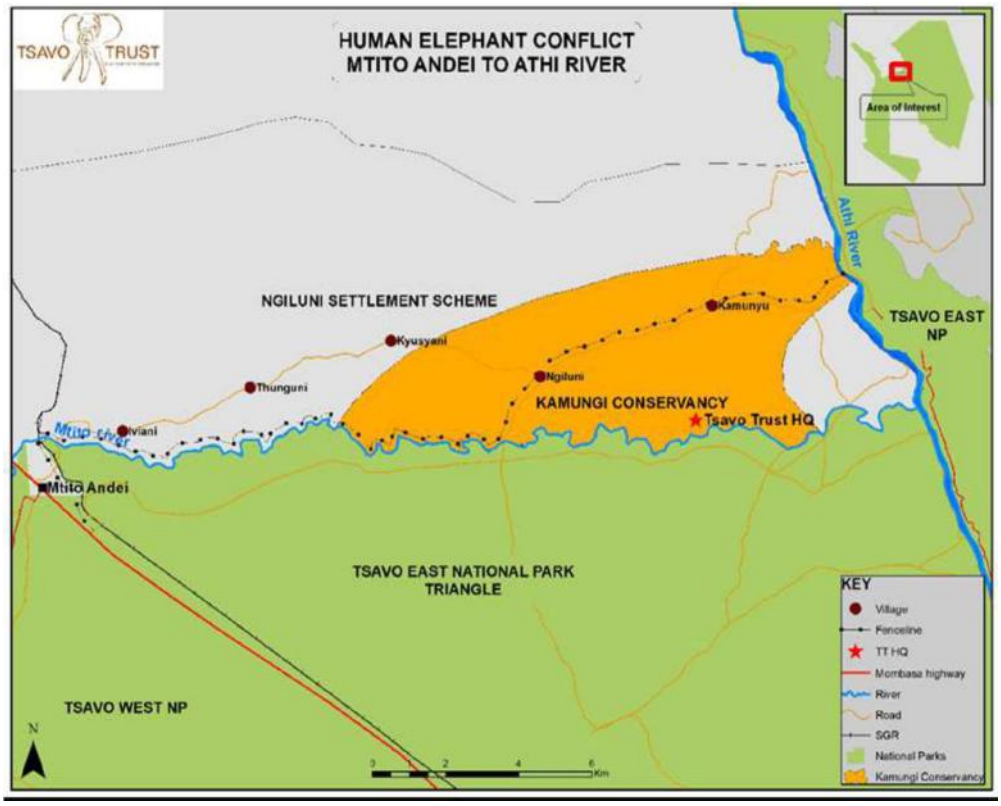
ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT
FOR
THE PROPOSED INSTALLATION OF ELECTRIC FENCE AT TSAVO EAST NATIONAL PARK, (KAMUNYU, KILALINDA, KAMBU RIVER, LUKENYA UNIVERSITY).

MAKUENI COUNTY



Co-ordinates: START OF ELECTRIC FENCE Latitude 2^0 38' 59'', Longitude 38^0 20' 02'' and END OF ELECTRIC FENCE Latitude 2^0 15' 32'', Longitude 38^0 04' 28'' .

Prepared by:	*For and on behalf of* PROPONENT:
Eng. Pius M. Kikuyu & Julius M. Musili (NEMA L/Expert Reg. No. 3074) Prodtech Engineers Ltd Quarry Road, Off Old Mombasa Road P.O. Box 4662 – 00506, Nairobi, Kenya Mobile : +254 722 743 267 / 710 495 542	COUNTY GOVERNMENT OF MAKUENI DEPARTMENT OF LANDS, URBAN DEVELOPMENT, ENVIRONMENT & CLIMATE CHANGE P.O. BOX 78-90300, MAKUENI, KENYA. TEL: 020-2477000 | 0795717885 | 0780717885 EMAIL: info@makueni.go.ke

SUBMISSION OF DOCUMENTATION

Eng. Pius M. Kikuyu and Julius M. Musili (Environmental Consultants), submit an Environmental and Social Impact Assessment Report for the proposed INSTALLATION OF AN ELECTRIC FENCE (60KM) AT TSAVO EAST NATIONAL PARK, (KAMUNYU, KILALINDA, KAMBU RIVER, LUKENYA UNIVERSITY), Makueni County, approximately 245 Kilometres from Nairobi. ccess to the site shall be through MTITO ANDEI TOWN. To my knowledge all the information contained in this report is accurate and a truthful representation of all findings as relating to the project.

Signed at Nairobi. on this 3rd day of April 2022

Signature .....

I Eng. Josphat M. Musyoki, on behalf of the COUNTY GOVERNMENT OF MAKUENI, DEPARTMENT OF ROADS, TRANSPORT, ENERGY AND PUBLIC WORKS, P.O. BOX 78-90300 MAKUENI, KENYA TEL: 020-2477000 / 0795717885/ 0780717885 (Proponent), submit an Environmental and Social Impact Assessment Report for the proposed **INSTALLATION OF ELECTRIC FENCE (60KM) AT TSAVO EAST NATIONAL PARK, (KAMUNYU, KILALINDA, KAMBU RIVER, LUKENYA UNIVERSITY)**, Makueni County, approximately 245 Kilometres from Nairobi. Access to the site shall be through MTITO ANDEI TOWN. To my knowledge, all information contained in this report is accurate and a truthful representation of all findings as relating to the project. The study has been carried out in accordance with the Environmental Management and Coordination Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Signed at Makueni County. On this 4th Day of April 2022

Signature & Stamp .....

Designation Chief Officer - Public Works & Energy

DEPARTMENT OF ROADS, TRANSPORT ENERGY & PUBLIC WORKS
C.O - PUBLIC WORKS & ENERGY
04 APR 2022
P.O Box 78-90300
MAKUENI

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ACRONYMS

ACC:	Assistant County Commissioner
AIDs:	Acquired Immune Deficiency Syndrome
BoQ:	Bill of Quantities
BOD:	Biological oxygen demand
CGoM:	County Government of Makueni
CSR:	Corporate Social Responsibility
EA	Environmental Audit
EFA:	Environmental Flow Analysis
EIA	Environmental Impact Assessment
ESIA:	Environment and Social Impact Assessment
EMCA	Environment Management and Coordination Act
EMP:	Environmental Management Plan
EMS:	Environmental Management System
ERS:	Economic Recovery Strategies
ESMP:	Environmental and Social Management Plan
EHS:	Environmental Health and Safety
HEC:	Human Elephant Conflict
HSE	Health,Safety and Environment
HWC:	Human Wildlife Conflict
KWS:	Kenya Wildlife Services
KPLC	Kenya Power Power & Lighting
MoH:	Ministry of Health
NEMA	National Environmental Management Authority
NAPEP:	National Poverty Eradication Plan
NLC:	National Land Commission
OSHA:	Occupation Safety and Health Act
OHS:	Occupation Health and Safety
PHO:	Public Health Officer
PPE:	Personal Protection Equipment
PAYE:	Pay As You Earn
PCC:	Public Complaint Committee
SACCO:	Savings And Credit Cooperative
TT:	Tsavo Trust
TOR:	Terms Of Reference
TENP:	Tsavo East National Park
WSSD:	World Summit for Sustainable Development
WRA:	Water Resources Authority
WHO	World Health Organisation
WTP:	Water Treatment Plant

EXECUTIVE SUMMARY

The Environmental and Social Impact Assessment (ESIA) findings presented in this report provide a critical examination of issues considered important in fulfilling the requirements of a clean, sustainable and healthy environment. This report is primarily aimed at establishing the environmental and social impacts of the proposed INSTALLATION OF AN ELECTRIC FENCE (60KM) AT TSAVO EAST NATIONAL PARK, (KAMUNYU, KILALINDA, KAMBU RIVER, LUKENYA UNIVERSITY), Makueni County. The proposed fence site is approximately 245 Kilometers from Nairobi City. Access to the site shall be through MTITO ANDEI Town.

The proposed fence routing will start at Kamunyu Primary school, then proceed through Sasum Home – Kamunyu Stream – Miisani Village – Kambu River – Somba Village – Makutano – Dan Marcos – Kalawa Village – Sabati and terminate at Lukenya University.

History of the proposed electric fence in summary:

- The park electric fence installation process started in 2017 at IVIANI, where the local community was rejecting the project because they were using the park to graze, firewood, hunting, etc.
- In 2018/2019 the County Government of Makueni allocated a supplementary budget of Kes. 500,000.00 (0.5m) and was approved by the County Assembly.
- In 2020, the County Government secured a NEMA Licence to erect the fence from Kambu River, spanning through some of the villages covered in this report.
- Before the time of the approval to erect the fence, some Conservationists settled within the animals friendly zone of the park to create conservancy zones and minimise the human-wildlife conflict, mainly along River Athi. These include Dan Marcos, Mary, Shadrick, Tsavo Trust, Jimmy, Nanu, Lukenya (farmers), Vistram, Subati, Masonga, etc.
- As the CGoM was awaiting budgetary allocation for the project, one of the Conservancies, Tsavo Trust, mobilised funds and the local communities, and proceeded to erect 33km of electric fence, as a subsidiary of the main project. This concluded section of the fence has shown the communities the value and benefits of the project to extend the fence to cover the main areas of wildlife migration into the villages/community land.
- The CGoM has now approved and allocated adequate funds to erect a further 60km of the electric fence, along the initially approved routing, starting from Kamunyu village, where the 33km funded by Tsavo Trust had terminated.
- The project shall be executed like any other Government project, e.g. for water, Road, etc.
- Currently, KWS is using Helicopters to chase/drive Elephats from the communities land back into the park. But there is a limitation because there are only two Helicopters at their disposal (One owned by KWS and a second private one, owned by one of the Conservationists). At times the helicopters are not available, leaving the local communities at the mercy of the elephants.
- The fence will be constructed mainly along riparian land along the river, which is min 6m and max 30m, and will be solar powered.
- The project scope incudes construction of a control and maintenance house after every 8km, to accommodate an attendant technician, solar panels, control panel and batteries.
- The main posts shall be spaced at ,10 metres and will have intermediate supports.

The Electric Fence

The electric fence will help minimise human beings - wildlife interaction, especially the elephants that are rampant in destroying community farm lands, structures, food stores, injury to human beings and killing of domestic animals. 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 areas where agricultural activities and high human population invariably lead people to encroachment into the wildlife territories.

Human-wildlife conflict is also a land-use problem, and occurs because of incompatibility of land use types and interests, sharing a common boundary such as State owned national reserve neighbouring crop producing private lands, despite all of them being legitimate undertakings. Conflicts also arise from differing behaviour, goals, value needs, expectations, and ideologies between parties (Omondi, 1994). Kelso (1962) notes that land use conflicts occur because land resources are limited while wants are limitless.

The increasing competition for use of scarce land has resulted in conflict management becoming a major issue. Effective conflict management requires adequate understanding of conflict history, causes and how it affects the parties involved. Human-elephant conflict epitomizes human-wildlife conflict, and is defined by the IUCN/SSC African Specialist Group as “any human-elephant interaction, which results in negative effects on human-social, economic or cultural life, on elephant conservation or on the environment”.

It is in this light that the County Government of Makueni, Department of Roads, Transport, Energy and Public works, through consultations with relevant stakeholders, proposed for the installation of an additional 60 Kilometres electric fence along the boundary between Tsavo East National Park and the neighbouring communities land. The fence will be electrified using solar power energy from power energizers which will be located after every 8 Kilometres (see attached design). Wooden posts will be used to support the 3 strands of power cables which will prevent the animals, specifically elephants, from crossing the river to the community’s farm lands. The fence will be put in a manner so as to allow the public access the water in the river, as well as their livestock with ease. The ESIA team made wide consultations, interviews and field visits to the project area and offices of relevant stakeholders. The views and concerns of all relevant stakeholders were noted and considered when writing this study report.

ESIA Study methodology

The following study methodology was adopted;

- Desktop studies;
- Physical inspection of the site and surrounding areas;
- Public participation via meetings, interviews and the filling of questionnaires;
- Discussions with the Proponent and the Project Engineer;
- Photography; and
- Consultation with the local administration.

Objectives of the ESIA study

The objective of the ESIA is to enhance project sustainability through appropriate intervention in project development. The specific aim of the project report is to identify all impacts, beneficial or detrimental, which can result from the project implementation and

operation, and provide mitigation measures in view of the Terms of Reference. The scope of the present study was to:

- Describe nature of the project, location and rationale;
- Describe the pertinent policies, legislation, regulations and standards governing environmental quality at national and international levels;
- Identify potential positive and/or negative environmental impacts and of the project;
- Propose environmental mitigation plan to minimize those negative impacts;
- Develop an environmental monitoring plan.

Terms of Reference (ToR) for the ESIA Process

The scope of the assessment covered excavation works, development works of the proposed development which include Topography Surveying, ground preparation, masonry, and erection of electric fence components, as well as other utilities required.

The consultant on behalf of the proponent conducted the study by incorporating the following terms of reference: -

- Review of the preliminary designs to assess any impact of installation and operation on the environment;
- Carry 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;
- A concise description of the national environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project;
- The objective of the project;
- The technology, procedures and processes to be used, in the implementation of the project;
- The materials to be used in the development and implementation of the project;
- The products, by-products and waste to be generated by the project;
- A description of the potentially affected environment;
- The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated;
- To recommend a specific environmentally sound and affordable waste management system.
- Analysis of alternatives including project site, design and technologies;
- An environmental management plan.

The output of this assessment is a comprehensive Environmental and Social Impact Assessment project report for the purposes of applying for NEMA approval and issuance of a license for the proposed development.

The study was carried out at desk level and also through a detailed and structured field study. The process included: collection of baseline data to describe the status of the project site before project implementation; data analysis and evaluation; public participation to identify the concerns of persons likely to be affected by the project; and preparation of an ESIA study report encompassing the details specified in the Legal Notice No. 101 of 13th June 2003 which deals with the Environmental Impact Assessment/Audit Regulations.

Policy, Legal and Regulatory Framework

The Environmental Management and Co-ordination Act (2015 Revised), is the legislation that governs ESIA studies in Kenya. This project falls under the Second Schedule of EMCA 2015, which lists the type of projects that are required to undergo ESIA studies. Other key national laws that govern the management of environmental resources in the country have been discussed in this report.

Project Main Project Components

The "Elephant exclusion zone" fencing is a very simple but effective way of keeping elephants out of specific areas, in this case community small scale farmland. There will be an inspection road 7m wide which will be separating the community and the electric fence. This type of cost-effective fence is basically two live wires separated by 1.5 feet and one earth wire that runs along the ground (dug underground or pegged in at intervals). The 2 live wires are nailed to posts being attached using an insulator to prevent shorting. The 2-strand fence is set approximately 5 to 6 foot off the ground and attached to fence posts.

This system is environmentally friendly and insignificant impact as the wire oxidizes and is not visible easily, and the fence is maintained and power upheld, and does work well as an elephant barrier. Livestock and people can easily move under the fence, hence their free movement is not impaired at all. It has been tried and tested in various conservation areas such as the adjoining Kamunyu Conservancy where the phase one 33km electric fence has been completed, Lewa Wildlife Conservancy and MT. Kenya Forest, to name just three examples.

Project Cost Kshs. 64.00 Million

Extract Summary form BoQ (PC Sums + priced BoQ items = 64 million)

Summary of Findings

A number of positive and negative anticipated impacts to the environmental and social wellbeing were identified.

Project Impacts

The project is geared towards enhancing social and economic benefits through Human-Elephant Conflict (HEC) Mitigation, Increased Resilience, and Capacity Building in the area between TSAVO EAST NATIONAL PARK and the Local Communities (KAMUNYU, KILALINDA, KAMBU RIVER, LUKENYA UNIVERSITY), in collaboration with the County Government of Makueni.

Potential Positive impact

The expected positive impacts from the project include:

1) Incorporation of environmental, health and safety concerns.
2) Generation of employment opportunities;
3) Reduced human-wildlife conflict specifically the elephants.
4) Knowledge transfer.
5) Increased conservation.
6) Contribution to Government Revenue.

7) Improvement of businesses within the area.
8) Increase in disposable income within the area and environs.
9) Increased productivity and food security.
10) Better watershed protection.
11) Climate change mitigation and adaptation.
12) Improved security.
13) Improved social order.
14) Reduced cases of pulmonary diseases.
15) Social-economic impacts: peace, less damage to property and infrastructure; better relations with the conservancy management.

Negative Project Impacts and Mitigation Measures (Biophysical and Socio-Economic)

Anticipated impact	Recommended mitigation measure
Loss of vegetation from clearing of vegetation and habitat destruction by animals	▪ Limiting clearing area, trees planting.
Soil erosion from loss of vegetation, compaction and machines/vehicles:	▪ Using manual labour as much as possible, drainage, and backfilling. ▪ Earthworks should be controlled so that land that is not required for the construction works is not disturbed. Wherever possible, earthworks should be carried out during the dry season to prevent soil from being washed away by the rain. ▪ Excavated materials and excess earth will be kept at appropriate sites approved by the supervising engineer and the earth dumping sites designed in such a manner as to facilitate natural water discharge; ▪ The Contractor shall protect areas susceptible to erosion by installing necessary temporary and permanent drainage works as soon as possible.
Solid wastes from vegetation clearing	▪ Pitting, materials used and human activity: Backfilling, proper wastes collection and disposal, community policing against dumping. ▪ Provide suitable and well labelled solid waste containers; ▪ Proper segregation of solid waste; ▪ Reduce generation of solid waste at the source; ▪ Reuse of top soil for landscaping of the site; ▪ Empty packaging materials like cartons and cement bags should be piled in a safe place and sold to waste paper recyclers; ▪ Other solid waste to be disposed of at designated sites; ▪ Install oil interceptors along the storm water drainage channels; ▪ Provision of sanitary facilities for use by workers; ▪ The use of the “3Rs” philosophy of reuse, recycle and reduce will be adopted.

Anticipated impact	Recommended mitigation measure
Restriction of wildlife movement	▪ Restriction of wildlife movement by fence resulting in trampling, habitat destruction, and overgrazing, increased populations: Securing migratory corridors.
Increased human activity	▪ Increased human activity near conservancy edge impacting on wildlife: Community education and mobilization.
Visual intrusion from artificial structure	▪ Using colours of poles and materials that blend well with the surrounding environment, use of trees as poles.
Air pollution from fumes and dust:	▪ Use of serviceable vehicles and equipment, and proper wastes disposal. ▪ Ensure strict enforcement of on-site speed limit regulations; ▪ Sprinkle water during excavation works; ▪ Sprinkle water on graded access roads when necessary to reduce dust generation by construction vehicles; ▪ Provide nose masks to be provided to employees and encourage them to use the masks.
Noise from vehicles, machines, man:	▪ Use of serviceable equipment, education, and not working at night. ▪ Noise levels shall be kept within acceptable limits by NEMA; ▪ Use of ear protectors by workers when performing noisy operations; ▪ Recondition engine exhaust systems; ▪ Engine tune-up; ▪ Establish inspection and maintenance program for equipment; ▪ Post appropriate notices to warn drivers against unnecessary hooting of vehicles; ▪ Switch off engines or reduce idling time when not in use; ▪ Confine activities between 8.00 am and 5.00 pm; ▪ Enclose the construction site with three metre high iron sheets especially along the road.
Human wastes	▪ Toilets (mobile and pit); liaison with adjacent communities
Increased accidents from electric fence:	▪ Community education and warning signs.
Offsite impacts	▪ Procuring materials from known sustainable sources.
Over-extraction of construction materials	▪ Construction materials shall be from approved sources: for example: hard-stone for building should be obtained from bonafide commercial quarries; ▪ Procure environmentally friendly and sustainable materials;

Anticipated impact	Recommended mitigation measure
	▪ Do not use the following materials for construction of the building: ▪ Asbestos in any form; ▪ Asbestos substitutes or any naturally occurring man-made mineral fibres ▪ Lead, Lead paint or other materials containing Lead which may be inhaled, ingested or absorbed; ▪ Vermiculite, unless it is established as being fibre-free; ▪ Any product containing Cadmium that are regarded as being deleterious building material which are not in accordance with statutory requirements or with current accepted good building practice at the time of specification or construction.
Liquid Wastes	▪ Carefully collect used oil in drums and dispose of by licensed refuse contractor; ▪ Adhere to wastewater management regulation of the legal Notice 121 and Water quality regulations of the Legal Notice 120; ▪ Conduct wastewater monitoring to check compliance and submit the results to NEMA; ▪ Document and train staff in the emergency spill response plan. ▪ Re-vegetation of open ground should be done to reduce run off hence reducing storm water drain.
Public health and occupational health and safety	▪ Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restrictions on site, frequency and personnel responsible for safety inspections and controls; ▪ Daily site inspections should be done to ensure safe work practises are adhered to; ▪ All workmen should be provided with personal protective equipment; ▪ The Conditions of Contract in the tender documents should stipulate health, safety and environment regulations and work procedures; ▪ The Contractor/ proponent must appoint a foreman with knowledge on health, safety and environment regulations; ▪ All injuries that occur on site must be recorded in the accident registers and corrective actions for their prevention be instigated as appropriate; ▪ Site personnel should be encouraged to report “near-miss incidents” in order to avoid potential problems and increase safety awareness; ▪ Ensure you have First Aid kit at the site all the time.
Energy Utilisation	▪ Develop an energy management plan;

Anticipated impact	Recommended mitigation measure
	▪ Construction machinery and vehicles should be maintained and used in accordance with manufacturer's specifications, to maximise efficiency and lower use of energy; ▪ Construction workers should be sensitised on the importance of energy management.
Water Utilisation	▪ The Contractor should monitor water consumption and utilisation; ▪ The Contractor should sensitise construction workers on the importance of proper water management.
Traffic Management	▪ The Contractor should plan and implement traffic management programme on daily basis; ▪ Comply with all applicable legislation and by-laws with regard to road safety and transport; ▪ Lane and junction design and signage to meet appropriate standards; ▪ Movement of construction vehicles timed to avoid peak periods; ▪ Ensure adequate entry and exit lane design and appropriate signage.
Diseases such as HIV	▪ Equip health centres with ARVs and protective devices to workers. ▪ Provide posters. ▪ Education to parents, schools, CBOs and FBOs. ▪ Counselling, civil education and instruction.

If the mitigation measures are implemented during the design, construction and operation of the proposed development, the potential negative environmental impacts will be managed and maintained to acceptable standards.

Mechanisms for implementation and monitoring have been recommended in an Environmental Management and Monitoring Plan presented in Chapter 10 of this report.

1 INTRODUCTION

1.1 Background

- The park electric fence installation process started in 2017 at IVIANI, where the local community was rejecting the project because they were using the park to graze, firewood, hunting, etc.
- In 2018/2019 the County Government of Makueni allocated a supplementary budget of Kes. 500,000.00 (0.5m) and was approved by the County Assembly.
- In 2020, the County Government secured a NEMA Licence to erect the fence from Kambu River, spanning through some of the villages covered in this report.
- Before the time of the approval to erect the fence, some Conservationists settled within the animals friendly zone of the park to create conservancy zones and minimise the human-wildlife conflict, mainly along River Athi. These include Dan Marcos, Mary, Shadrick, Tsavo Trust, Jimmy, Nanu, Lukenya (farmers), Vistram, Subati, Masonga, etc.
- As the CGoM was awaiting budgetary allocation for the project, one of the Conservancies, Tsavo Trust, mobilised funds and the local communities, and proceeded to erect 33km of electric fence, as a subsidiary of the main project. This concluded section of the fence has shown the communities the value and benefits of the project to extend the fence to cover the main areas of wildlife migration into the villages/community land.
- The CGoM has now approved and allocated adequate funds to erect a further 60km of the electric fence, along the initially approved routing, starting from Kamunyu village, where the 33km funded by Tsavo Trust had terminated.
- The project shall be executed like any other Government project, e.g. for water, Road, etc.
- Currently, KWS is using Helicopters to chase/drive Elephats from the communities land back into the park. But there is a limitation because there are only two Helicopters at their disposal (One owned by KWS and a second private one, owned by one of the Conservationists). At times the helicopters are not available, leaving the local communities at the mercy of the elephants.
- The fence will be constructed mainly along riparian land along the river, which is min 6m and max 30m, and will be solar powered.
- The project scope incudes construction of a control and maintenance house after every 8km, to accommodate an attendant technician, solar panels, control panel and batteries.
- The main posts shall be spaced at ,10 metres and will have intermediate supports.

The intended project involves activities with impacts to the ecological environment, culture and socio-economic set-up of the area. The proponent County Government of Makueni as a major stakeholder in environmental conservation needs to undertake the environmental management responsibilities through conducting an environmental and social impact assessment for the proposed project to assess and address the anticipated environmental concerns emanating from the project implementation, operation, and future decommissioning phases.

1.2 ESIA Project Team

The ESIA Project Team composed the following who are the lead Authors of the report.

No	Name	NEMA Reg No.
1	Pius Museka Kikuyu	1731
2	Julius Musyoka Musili	3074

1.3 Terms of Reference

The environmental consultants as stipulated under the Environmental Management and Coordination Act was commissioned by the proponent to undertake an environmental and social impact assessment for the proposed construction of an electric fence to assess the environmental and social impacts that may result from erecting a 60Km long two strand electric fence along TSAVO EAST NATIONAL PARK (KAMUNYU, KILALINDA, KAMBU RIVER, LUKENYA UNIVERSITY). Specific areas that the fence will cross are: Kamunyu Primary school then proceed through Sasum Home – Kamunyu Stream – Miisani Village – Kambu River – Somba Village – Makutano – Dan Marcos – Kalawa Village – Sabati – Lukenya University.

The ESIA report forms the baseline for objective evaluation of how activities and processes involved during implementation, operational and decommissioning phases will impact on the general social and natural environment and whether the activities will conform to the approved environmental management standards and sound environmental management practices with the main objective of promoting safe and healthy environment at all phases of the project. The Terms of Reference (ToR) within which the mandate of the experts is stipulated provide a basis upon which the eventual project report can be evaluated.

1.4 ESIA Guiding Principles

The guiding principles for Environmental and Social Impact Assessment are:

- It requires that all environmental concerns be accounted for in all development activities;
- It also encourages public participation in all stages of proposed project development. It increases the ownership and sustainability.
- It also recognizes the role of social and cultural principles traditionally used in the management of the environment and natural resources; International cooperation in the use and wise management of shared resources; Intra-generation and inter-generation equality; Polluter-pays principle; and the precautionary principle.

1.5 Scope

The scope of the ESIA is to assess all activities involved in the development of the proposed facilities, the subsequent operation and decommissioning processes; and the arising environmental impacts according to the requirements of the Environmental Management and Coordination Act 2015, and in accordance with the stipulations of Legal Notice No. 101, the Environmental

(Impact assessment and Audit) Regulations, 2003 and the Local Authority by-laws.

Development of the proposed facilities essentially requires an environmental management system. The responsibility to the environment, wildlife and the other projects and of the community in the area is tremendous. During the development phase, the project activities will generate temporary and/or permanent impacts, which include solid waste generation, air and noise pollution etc. During the operation phase, the project could generate several long-term impacts, either beneficial or detrimental e.g. interference with the cultural set-up of the area, improvement of the socio-economic set up of the area, development of essential infrastructure, etc.

ESIA is to enhance project sustainability through appropriate intervention in project development. The specific aim of the project report is to identify all impacts, beneficial or detrimental, which can result from the project implementation and operation, and provide mitigation measures in view of the Terms of Reference.

The project assessment investigates and analyzes the anticipated environmental impacts of the proposed project in line with the Environmental Impact Assessment and Audit 2003 regulations. Consequently, the report provides the following:

- *Nature of project;*
- *The location of the project including the physical area that may be affected by the project's activities;*
- *The activities that shall be undertaken during the project installation, operation and decommissioning of the project;*
- *The materials to be used, products and by-product including waste to be generated by the project and the methods of disposal;*
- *The potential environmental impacts of the project and mitigation measures to be taken during and after the implementation of the project;*
- *An action plan for prevention and management of possible accidents during the project cycle;*
- *A plan to ensure the health and safety of the workers and the neighbouring communities;*
- *The economic and social cultural impacts to local community and the nation in general. To achieve all this, a systematic approach was followed by the consultant that includes the general steps outlined below:*
- *Environmental screening;*
- *Environmental scoping which provided the key environmental issues;*
- *Desktop studies;*
- *Interviews with the Project Proponent;*
- *Physical inspection of the site and surrounding areas;*
- *EIA Public participation; and*
- *Reporting including the preparation of an Environmental Management Plan.*

All these aspects were considered accordingly. This report also seeks to ensure that all the potential environmental impacts are identified and that workable mitigation measures are adopted. The report also seeks to ensure compliance with the provision of the EMCA (Rev 2015), and Environmental (Impact Assessment and Audit) Regulations 2003 as well as other regulations. The

report emphasizes the duties of the proponent and contractor during the installation phase as well as the operation phase of this project.

1.5.1 Objectives of Environmental and Social Impact Assessment (ESIA)

The overall objective of carrying out an Environmental and Social Impact Assessment is to determine the likely impacts of a given project on the environment, propose possible mitigation measures and monitoring.
The Constitution of Kenya requires that environmental concerns are integrated in all economic Development which calls for environmental integration in the project life cycle in order to:

- Protect and manage the environment for sustainable development;
- Integration of environmental management and economic decisions at early planning stages;
- Predict the consequences of a proposed project in terms of environmental, social, economic and cultural settings and propose mitigation measures;
- Compare available alternatives for a particular project and determine the optimal mix of environmental and economic costs and benefits; and
- Involve public, proponents, private and government agencies in assessment and review of the proposed project in an open, transparent and participatory approach.

1.5.2 Approach Methodology used by consultant

The assessment team used both primary and secondary data collection. Primary data was collected through site visits and public consultations. While at the site, the consultant used key informant interviews, semi structured interviews, observations and focus group discussions. Secondary data was obtained through literature review.

a) Literature Review

Information obtained through literature review enabled us to know:

- Field information available;
- Social, environment, community and land ownership criteria likely to influence the sitting and operation of the project; and
- Relevant laws and regulations.

b) Site Visits

The project site was visited in order to:

- Develop a better understanding of the project area;
- Generate baseline information for the proposed site;
- Consult the local people about the proposed project and document their views;
- Assess project impacts;
- To provide a description of the proposed projects activities;
- To identify and evaluate the significant environmental impacts of the proposed project;

- Determine suitable mitigation measures for the negative impacts identified;
- To prepare environmental management plan for the project;
- To prepare a comprehensive ESIA Report for submission to the NEMA as required by law for informed decision-making.

c) Public Consultations

Public meetings were also undertaken as part of the ESIA in order to obtain the views of members of the immediate communities and interested and affected groups within the project's immediate area of influence. The consultations were done with randomly selected people in the neighbourhoods of the proposed project and involved use of a semi-structured interviews, public barazas and structured discussions with identified focus groups.

d) Fieldwork/ Assessment

This included a reconnaissance survey of the project area, assessment of existing occupational activities of the neighbours, existing type of land ownership, buildings, farmlands, schools, shopping centres, existing infrastructure, power and telephone lines, road network, emergency response facilities, and the general proponent's site set up. Alternatives to the various components of the project such as, design, route, relocation of the site and No-option alternative were assessed. Further, identification of mitigation measures and enhancement measures, assessment of the significant impacts and comparison with alternatives was carried out in detail.

e) Environmental Management Planning

Following identification of the nature and scale of potential impacts of the proposals, the ability of these impacts to be reduced or eliminated was considered. This involved the development of suitable mitigation measures which included recommendation of design and technology or additional protection measures. The preparation of an environmental plan to implement mitigation measures and monitoring recommendations has also been undertaken as part of the project report.

1.6 Structure of the Report

The structure of this report is as follows:

Chapter 0: Executive summary.

Chapter 1: Introduction: This chapter gives the background information relevant to the project and describes the objectives and requirements of the study.

Chapter 2: Project justification: To carry out a systematic examination of the baseline environmental situation within the project area in order to determine whether or not the proposed project requires the development and how it will impact on the environment.

Chapter 3: Policy, legal and regulatory framework: This chapter outlines Government policy on the environment, the relevant legislation

relating to natural resource management and environmental protection and the institutions that deal with various aspects of environmental management.

Chapter 4: Description of the existing environment: Provides a description of the existing environment to achieve an understanding of the bio-physical and social environmental setting.

Chapter 5: Project Description: Describes the Project design, project construction and operation.

Chapter 6: Project Alternative: The alternative consists of the proponent's final proposal with the inclusion of the NEMA guidelines and regulations and procedures. This is as stipulated in the Environmental Management and Co-ordination Act (EMCA) of 1999, which aims at reducing environmental impacts to the minimum extent practicable.

Chapter 7: Public Consultations: Describes the consultation process, views of stakeholders and the future consultations.

Chapter 8: Potential Environmental and Social impacts and mitigation measures: Identifies the potential impacts on the bio-physical and socio-economic environment, together with appropriate mitigation measures to minimise and manage the effects on the environment.

Chapter 9: Environmental and Social management plan: Describes the measures to be taken and the monitoring requirements and responsibilities for mitigating the potential negative impacts.

Chapter 10: Environmental Monitoring and Audit Program (EMAP): A comprehensive Environmental Monitoring and Audit Programme (EMAP) will be implemented to check effectiveness of the mitigation measures as proposed and environmental compliance with relevant statutory requirements.

Chapter 11: Conclusion and Recommendation: Provides a brief non-technical summary of the report findings and recommendations.

2 PROJECT JUSTIFICATION

The principle objective of the ESIA study was to carry out a systematic examination of the baseline environmental situation within the project area in order to determine whether or not the proposed project requires the development and how it will impact on the environment. The specific objectives of the proposed project include, but are not limited to, the following:

- To determine the compatibility of the proposed project with the neighbouring land uses and evaluate local environmental conditions.
- To identify and evaluate the significant environmental impacts of the proposed project.
- To assess the environmental and social impacts that may result from erecting a 60 Km long two strand electric fence along Kamunyu Primary school, Sasum Home, Kamunyu Stream, Miisani Village, Kambu river, Makutano, Dan Marcos, Kalawa Village, Sabati and Lukenya University in Kibwezi East Sub-county.
- To carry out extensive public and other stakeholders consultation on the proposed project.
- Assess risks and hazards associated with the project activities.
- To assess the alternative to designs, sources of energy and sources of materials.
- To provide an Environmental Social Monitoring & Management Plan and propose mitigation measures to any possible adverse environmental, ecological and social Impacts. For several years, small-scale agriculture has taken place east of Mtito Andei town and along the seasonal river also called the Mtito River. This river course is the boundary between Tsavo East.
- The proposed fence has a long history since 2017 when the communities, through elected leaders, started lobbying to have physical barriers erected to reduce Human Wildlife Conflict (HWC).

Communities that lie outside the Tsavo East National Park frequently experience Human - Elephant Conflict (HEC). There are many cases of Human Wildlife Conflict (HWC) and a negative perception towards wildlife as a whole. Other animals involved in this human animal conflict in the project area include Hippopotamus, Zebras, Baboons, Leopards, Hyenas, Lions, Crocodiles, Buffalo, Cheetahs and Jackal.

Elephant crop raiding has increased, anti-poaching patrols assistance by Tsavo Trust have availed employment, water projects and better healthcare to mention just a few that have, over time changed community perceptions and tolerance towards wildlife.

HWC remains one of the greatest challenges causing a constant fear of crop raiding as this occurs regularly, if not daily, and there is real urgent need to mitigate this conflict. Engaging with the affected communities in support of this HWC situation could be an excellent way to “bring them on board”.

It is therefore felt that if the HWC concerns of the adjoining communities is addressed with the development of a cost-effective fence to keep the elephants off and minimise crop raiding, their social-economic lives would improve significantly..

In regard to that, the County Government of Makueni is proposing to erect the two-strand electric fence to help keep away wildlife, specifically elephants, that are rampant in destructing community activities and destroying their farm lands. The fence will be electrified using solar power energy from two power energizers. Wooden posts will be used to support the power cables and utilities, which will prevent the animals from crossing the river to the people's farm lands. The fence will be put in a manner so as to allow the public access the water in the river as well as their livestock, with ease.

Below are some of the remarks made by stakeholders to support the project.

1	Elizabeth Maweu – Ward Admin	▪ Acknowledgement of elected/ Selected representatives. PMC members. ▪ The ESIA specialists are carrying out Research on our project through public consultations. ▪ Feel free to discuss all issues arising on the project. ▪ Elephants were many but have reduced due to the fence at Kamunyu (33km). ▪ Fence will protect us from elephants.
2	Edward Kiio – PMC Chairman	▪ Today is the start of our electric fence project dream. ▪ Public give us full support and we will chase away all the elephants.
3	Winfred Mwethya Village Admin Mtito Andei	▪ We have done all this kind of Baraza in our place and managed to put 33km electric fence. ▪ Development committee, chiefs were used to pick laborers from the area. ▪ We passed the fence peacefully. ▪ Nobody should talk negative about the proposed fence. ▪ Project has already been handed over to contractor. ▪ Dozer already on the ground. ▪ PMC liaise with the community to make the project a success. ▪ If you can get a place, please be someone to cook for the workers and you will get something from the project. ▪ Be assures you will get temporary and permanent jobs from the project.
4	Meshack Musyoki – Senior Chief	▪ Volunteer to fight for the rights. ▪ We are here to collaborate for good work. ▪ Main problem here is elephants. ▪ Once we get rid of human – world animals conflict we will do good farming. ▪ Thanks to County Government of Makueni work especially Hon. Kivutha kibwana.
5	Francis Mwania Sitting MCA	▪ Electric wire process started in 2017. ▪ Started at IVIANI where community was rejecting the project because they were using the park to graze, fire-hood, hunting etc.

		▪ You will show with the sign/ actions if you support the project. ▪ People along the river will be minimally affected by the project. ▪ In 2018/2019 there was a supplementary budget of Kes, 500,000.00 (Kes. 0.5 million) at the County Assembly. ▪ At Kambu River we have already been licenced by NEMA to put up the fence. ▪ Now in this area we need to get your opinion. ▪ Some White men have decided to stay in the animals friendly zone. Along Athi –(Dan Marcos, Mary, Shadrick, Tsavo Trust, Jimmy, Nanu, Lukenya (farmers), Vistram, Subati, Masonga). ▪ Before CGoM gave money, Tsavo Trust started meetings to source money to put 33km fence. It was financed and done. ▪ Now 60km has been approved and money provided by CGoM. Will start from Kamunyu. ▪ This project is like any other Government project of water and Road. ▪ Has you have noted one elephant when chased by KWS has objected to cross the electric fence. ▪ Currently KWS is using Helicopter to chase the elephats. But we have limitation because there only two Helicopters (One for Whiteman and the other for KWS and sometimes they are not there. ▪ Fence will be put along riparian land along the river which is min 6m – max 30m). ▪ Some people will be affected at Mwakila area. ▪ I believe no people at Likenya – Nanu (Mutua/Makau areas). ▪ There will be control house (House/ solar panels and battery) after every 8km. ▪ Post will be put every 10 metres. ▪ Rai is near and people need to do farming.
6	Kivindyo Nicodemus – Chairman Wildlife	▪ He deals with compensations and Government is using a lot of money to compensate vicitims. ▪ Had list of people who have not picked their money after being awarded compensation. ▪ Hon Governor has done good. ▪ Wildlife is National Government Not County. ▪ County Government has allocated 75million for this project. ▪ Only 3 electric wires will be installed to scare elephants. ▪ CGoM will not stop there, next year we will budget to put more wires to protect small animals. ▪ Lets stay with continuity by staying with elected leaders.

		▪ We pray there wire to continue up to Kibwezi – Kitui road
7	Bramwell Musyoka - Ass. Chief	▪ Cooperation in the project is paramount. ▪ Education to our Children is also important. During this holiday please check your children keenly. ▪ Once we arrest them loitering we will give them a lesson.
8	Dorcas Muthini Mutinda - Remarks	▪ Please accept the project. ▪ At my home there is always 3 elephants who come to destroy my Pawpaws. ▪ She used to have many but currently she has none. ▪ Mangoe trees have been destroyed. ▪ Maize harvested and placed in gallas has been eaten by elephants. ▪ Advised the attendants to be in contact with people who look for goods and bring them in the area. ▪ Be assured of security while implementing the project.
9.	FGD-2: Is there presence of human – Wildlife conflict along the project area? If yes, what damage been caused by wildlife invasion in the community?	▪ Yes. ▪ Damages to crops, water tanks, food in stores, Houses, People and animals injuries. Domestic Animals eaten.
10.	FGD-2: Are there cases of death reported from these invasions?	▪ Yes. ▪ Children injured by crocodiles when fetching water. Not in this area but 2021 someone was killed at Ngiluni far from here
11.	FGD-2: What type of Wildlife that commonly visit community/ farms?	▪ Elephants, Hippopotamus, Crocodiles, Buffalo, Lion, Hyenas, Cheetahs, Jackal and Leopards.
12	FGD-2: What are the human – wildlife conflicts hot spot areas?	Kwa Robert, Masila, Moodi Awori, Kioko Kilonzo, Sabati, Lukenya Uni versity and Peter Ivia. Crocodiles – Athiriver. Lions Roaming – Kwa Kilonzo.
13	FGD-1: Is there presence of human – Wildlife conflict along the project area? If yes, what damage been caused by wildlife	▪ Yes. ▪ Damages to crops, water tanks, food in stores, People and animals injuries. Domestic Animals eaten.

	invasion in the community?	
14	FGD-1: Are there cases of death reported from these invasions?	▪ Yes. ▪ 2021 someone was killed at Ngiluni.
15	FGD-1: What type of Wildlife that commonly visit community / farms?	▪ Elephants, Buffalo, Hyenas, Cheetahs, Jackal and Leopards.
16	FGD-1: What are the human – wildlife conflicts hot spot areas?	▪ Ngomano, Mcdonald,

3 POLICY LEGAL AND REGULATORY FRAMEWORK

3.1 Legal Framework

This chapter is a description of the national environmental legislative, policy, administrative and regulatory framework related to the project.

Kenya has numerous Laws that guide environmental management and conservation most of which are sector specific covering issues of 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.

ESIA is a tool for ensuring new projects and programmes incorporate appropriate measures to mitigate adverse impacts to the environment and peoples' health and safety as well as enhancing sustainable operations with respect to environmental resources and co-existence with other socioeconomic activities in their neighborhood. Necessary policies and legislation that ensures annual environmental audits (EA) are carried out on every running project, activity or programme and a report submitted to National Environmental Management Authority (NEMA) for approval and issuance of relevant certificates.

According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from industrial, economic and social development programmes that disregarded environmental sustainability. Following on this, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. The NEAP process introduced environmental assessments in the country with among the key stakeholders being industrialists, business community and local authorities. This culminated into the enactment of the Policy on Environment and Development under the Sessional Paper No. 6 of 2015.

Table 3-1: Legal Framework

Legislation	Relevant Section	Relevance to the project
Constitution of Kenya, 2010	Part (II) "Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.	The proponent/ contractor should put in place measures to prevent pollution during and after construction.

Legislation	Relevant Section	Relevance to the project
Environment (Impact Assessment and Audit) (Amendment) Regulations, 2016.	Legal Notice No. 150 The Environmental Management And Coordination Act (No. 8 Of 1999) Replacement Of The Second Schedule	This project falls under section 2. Medium Risk Projects. (1) Urban development (a) establishment of multi-dwelling project developments in not exceeding one hundred units.
Environmental Management and Coordination (Waste Management) Regulations, 2006, (Legal Notice No. 121)	The regulations are formed under sections 92 and 147 of the Environmental Management and Coordination Act, 2015. Under the regulations (Part I CAP 243), a waste generator is defined as any person whose activities produces waste while waste management is the administration or operation used in handling, packaging, treatment, conditioning, storage and disposal of waste. Part II of the regulations requires a waste generator to collect, segregate and dispose each category of waste in such manners and facilities as provided by relevant authorities. Part II section 9 states that, licensed persons shall operate transportation vehicles approved by NEMA and will collect waste from designated areas and deliver to designated disposal sites	This regulation puts specific obligation on the contractor to ensure that the waste generated (especially the bulk soils which will be generated during the excavation for the construction) is carefully handled and transported to a designated place offsite. Waste produced during construction should be disposed through a NEMA licensed waste collector. Reduce, re use, recycle and land filling are recommended.
Environmental Management and Co-ordination Conservation of Biodiversity, Access to Genetic Resources and Benefit Sharing Regulations 2006.	The Conservation of Biodiversity Act Sections 5-9 provides for the protection of endangered species, creation of an inventory, and monitoring of their status, protection of environmentally significant areas, provision of access permits, material transfer agreements and benefit sharing. Part II of Regulations, section 4 states that no person shall engage in any activity that may have adverse impacts on ecosystems, lead to introduction of exotic species or lead to unsustainable use of natural resources without an EIA license	The regulation puts in place measures to control and regulate access and utilization of biological diversity that include among others banning and restricting access to threatened species for regeneration purposes. It also provides for protection of land, sea, lake or river declared to be a protected natural environmental system in accordance

Legislation	Relevant Section	Relevance to the project
The Environment Impact (Assessment and Auditing) Regulations, 2003	Legal Notice No. 101 stipulates the ways in which environmental experts should conduct Environmental Impact Assessment and Audits in conformity with the stated requirements. It is concise in its report content requirements, processes of public participation, licensing procedures, inspections and any possible offences under the Act. Section 58 of the EMCA No.8 of 2015, second schedule 9 (I) and environmental (impact assessments and audits) regulation 203, stipulate that both new and old projects must undergo EIA and audits	This report has been done to meet the requirements of EMCA for the projects approval.
Conservancy Act	Development of programmes and facilities in collaboration with other interested parties for tourism, and for the recreational and ceremonial use of conservancy s, collaborate with other organizations and communities in the management and conservation of conservancy s and for the utilization of the biodiversity. Promote the empowerment of associations and communities in the control and management of conservancy. Enforcement of the conditions and regulations pertaining to logging, charcoal making and other conservancy utilization activities	The Conservancy Act provides for the establishment, development and sustainable management, including conservation and rational utilization of conservancy resources for the socio-economic development of the country
Employment Act	53. (1) Notwithstanding any provision of any written law, no person shall employ a child in any activity which constitutes worst form of child labour.	No underage individuals will be employed in the proposed project
The Wildlife (Conservation and Management) Act 2013 (Cap 376)	Part IX Section 62 to this Act provides for compensation for personal injury, death and loss of property by an animal. It states that any person who 'suffers any bodily injury from or is killed by any animal, or suffers any damage to or loss of crops or property or in the case of a deceased person, any person who was dependent upon him at the date of his death, may make application to a District Committee for the award of compensation for such injury or death or damage or loss'.	Wildlife Chairman is involved in this project.

Legislation	Relevant Section	Relevance to the project
Occupational Safety and Health Act, 2007	This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to: Secure the safety, health and welfare of persons at work; ▪ Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.	During the construction phase the proponent will have to register the site as a place of work with office of the Director of Occupational Health and Safety of the County.
Water Act, 2002	This Act of Parliament provides for the management, conservation, use and control of water resources and for the acquisition and regulation of rights to use water. The purpose of the 2016 Water Act is to align the water sector with the Constitution's primary objective of devolution. The act recognizes that water related functions are a shared responsibility between the national government and the county government	WRA will be consulted to provide the marking for the river.
Environmental Management and Co-ordination (Wetlands, Riverbanks, Lakeshores, and Seashores Management) Regulations 2009	The main purpose of this regulation is to provide for the conservation and sustainable use of wetlands and their resources in Kenya. Environmental Impact Assessment and Environmental Audit as required under the EMCA shall be mandatory for all activities likely to have adverse impact on the management of wetlands.	While this report serves as a compliance to the section 5(1)(b), the proponent and the contractor will be required to ensure that the project complies with all the relevant provisions of the act, especially those that have been cited above. This should be achieved in terms of project design, sitting and adherence to good engineering

Legislation	Relevant Section	Relevance to the project
		practices during development phase.

3.2 Policy Provisions

3.2.1 Constitution of Kenya 2010

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;

a) Equitable access to land.
b) Security of land rights.
c) Sustainable and productive management of land resources.
d) Transparent and cost effective administration of land
e) Sound conservation and protection of ecologically sensitive areas.

The provisions of the Kenyan Constitution therefore requires that wide consultations between the project proponent and key stakeholders (including the relevant institutions and the wider public, especially the affected persons) be held to ensure the right of Kenyans to enjoy a cleaner and sustainable environment versus the right to enjoy the potential benefits that the proposed development may bring are matched.

Table 3-2: Policy Framework and its relevance to the study

Policy	Relevant section	Relevance to the project
Kenya Vision 2030	Kenya Vision 2030 is the country's long term development blueprint guiding development in Kenya from 2008 to 2030.Its objective is to transform Kenya into a newly industrialising, ''middle income country providing a high quality life to all its citizens by the year 2030'' Section 5.4 on the Environment, the Vision 2030 in regards to the environment states that Kenya aims to be a nation living in a clean, secure and sustainable environment by 2030. It also states that Kenya will enhance disaster preparedness in all disaster-prone areas and improve the capacity for adaptation to global climatic change. In addition the country will also	Mitigation measures and the health and safety aspects that have been formulated for this project are relevant as they will ensure minimal interference with farmlands protecting the environment (Physical, Biological and Social).

Policy	Relevant section	Relevance to the project
	harmonize environment-related laws for better environmental planning and governance.	
National Environment Action Plan (NEAP)	According to the Kenya National Environment Action Plan (NEAP, 1994) the Government recognized the negative impacts on ecosystems emanating from economic and social development programs that disregarded environmental sustainability. In this regard, establishment of appropriate policies and legal guidelines as well as harmonization of the existing ones have been accomplished and/or are in the process of development. Under the NEAP process, EIA was introduced and among the key participants identified were the District Development Committees.	Mitigation measures for NEAP we have carried out the ESIA of the proposed project.
Millennium Development Goals (MDGs)	Goal 7: Ensure Environmental Sustainability-Target 9 Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources. The policy focuses on streamlining provision of water for domestic use, agriculture, livestock development and industrial utilization with a view to realizing the goals of the Millennium Development Goals (MDGs) as well as Vision 2030	Goal 7 demands Environmental Sustainability when interacting with the Environment. This report highlights the mitigation measures to be adopted for the project to ensure environmental sustainability such as preventing pollution that contributes to greenhouse gases emission.
National Policy on Water Resources Management and Development	The National Policy on Water Resources Management and Development (Sessional Paper No. 1 of 2015) was established with an objective to preserve, conserve and protect available water resources and allocate it in a sustainable rational and economic way. It also desires to supply water of good quality and in sufficient quantities to meet the various water needs while ensuring safe disposal of wastewater and environmental protection. To achieve these goals, water supply (through increased household connections and developing other sources) and improved sanitation is required in addition to interventions in capacity building and institutional reform. While the National Policy on Water Resources Management and Development (2015) enhances a	To mitigate, waste waste water will be handled as per EMCA 2006 guidelines. Appropriate sanitation systems to protect people's health and water resources from project pollution. The project has undergo comprehensive ESIA that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions.

Policy	Relevant section	Relevance to the project
	systematic development of water facilities in all sectors for promotion of the country's socioeconomic progress, it also recognizes the by-products of this process as waste water. It, therefore, calls for development of appropriate sanitation systems to protect people's health and water resources from institutional pollution. Development projects, therefore, should be accompanied by corresponding waste management systems to handle the waste water and other waste emanating there from. The same policy requires that such projects should also undergo comprehensive EIAs that will provide suitable measures to be taken to ensure environmental resources and people's health in the immediate neighbourhood and further downstream are not negatively impacted by the emissions. In addition, the policy provides for charging levies on waste water on quantity and quality (similar to polluter-pays-principle) in which case those contaminating water are required to meet the appropriate cost on remediation, though the necessary mechanisms for the implementation of this principle have not been fully established under the relevant Acts. However, the policy provides for establishment of standards to protect the water bodies receiving wastewater, a process that is ongoing.	
Sessional Paper No. 6 of 2015 on Environment and Sustainable Development	Among the key objectives of the Sessional Paper No. 6 of 2015 on Environment and Sustainable Development (1993) are; ➢ To ensure that from the onset, all development policies, programs and projects take environmental considerations into account, ➢ To ensure that an independent environmental impact assessment (EIA) report is prepared for any development before implementation, ➢ To ensure that effluent treatment standards will conform to acceptable health standards	The proposed project has undergone independent environmental impact assessment (EIA) report before implementation.

Policy	Relevant section	Relevance to the project
National Environment Policy 2013	The goal of this Policy is to Better quality of life for present and future generations through sustainable management and use of the environment and natural resources. Section 6.5 highlights on handling and disposal of hazardous substances.	The report has developed an ESMP for the study on how to handle and dispose wastes from the Development to ensure that the environment is not compromised by illegal dumping of wastes.
Land Policy	The National Land Policy in Chapter 3 under section 3.4, Environmental Management Principles, provides for the policy actions for addressing the environmental problems such as the degradation of natural resources, soil erosion, and pollution of air, water and land. The policy advocates for environmental assessment and audit as a land management tool to ensure environmental impact assessments and audits are carried out on all land developments that may degrade the environment and take appropriate actions to correct the situation. Public participation has also been indicated as key in the monitoring and protection of the environment. Section 3.4.3.3 prohibits discharge of untreated wastes into the environment.	To achieve an integrated approach to management of land based natural resources, all policies, regulations and laws dealing with these resources shall be harmonized with the framework established by the Environmental Management and Coordination Act(EMCA),99
The Agricultural Policy	In Kenya the agricultural policy revolves around key areas of policy concern including increasing agricultural productivity, especially for small-holder farmers, emphasis on irrigation, encourage diversification into non-traditional agriculture commodities, enhancing food security, encourage private sector-led development and ensure environmental sustainability. The policy observes that droughts and floods have increased in frequency and intensity in the past three decades resulting in high crop failure and livestock death. Increased land degradation has decreased land resilience thereby exacerbating the effects of drought and floods leading to devastating famine that has taken a toll on human and animal lives. Some of the famine experienced could have been avoided or their impacts significantly mitigated. Environmental degradation and rising poverty is of major concern for	The provision of electric fence will reduce wild animals and human conflict which will increase food production in the country.

Policy	Relevant section	Relevance to the project
	agricultural development. The continued scarcity of productive land and increasing poverty levels has led to an increase in agricultural practices that conflict with the environment particularly in the rural areas. Pressure on high potential areas is pushing people to migrate into ASAL lands where they practice inappropriate farming practices leading to environmental degradation and thereby creating a vicious cycle of environmental degradation and poverty.	

3.3 Legislative Framework

Table 3-3: Legislative Framework and its relevance to the study

Legislation	Relevant Section	Relevance to the project
Constitution of Kenya, 2010	Part II (Environment and Natural Resources), (I) the State clearly undertakes to carry out the following: • Ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources, and ensure the equitable sharing of the accruing benefits; • Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya; • Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities; • Encourage public participation in the management, protection and conservation of the environment; • 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.	The project should observe these conditions in as far as environmental protection is concerned throughout the project cycle.

Legislation	Relevant Section	Relevance to the project
	Part (II) "Every person has a duty to cooperate with State organs and other persons to protect and conserve the environment and ensure ecologically sustainable development and use of natural resources.	
Environment Management and Coordination (Amendment) Act, 2015	Section 58 of the Act makes it a mandatory requirement for an EIA study to be carried out by proponents intending to implement projects specified in the second schedule of the Act. Such projects have a potential of causing significant impacts on the environment. Section 68 of the Act specifies that accurate records should be maintained and annual reports submitted to NEMA as required.	The proposed establishment of a Electric fence development requires an ESIA report to be submitted to NEMA for licensing before the project is commences.
Environmental Impact Assessment and Audit Regulations 2003	Regulation 3 states that "the Regulations should apply to all policies, plans, programmes, projects and activities specified in Part IV, Part V and the Second Schedule of the Act. Part III of the Regulations indicates the procedures to be taken during preparation, submission and approval of the environmental study report. Part 4(1) of the Regulation further states that: *"…no Proponent shall implement a project:* *(a) Likely to have a negative environmental impact; or* *(b) For which an environmental impact assessment is required under the Act or these Regulations, unless an environmental impact assessment has been concluded and approved in accordance with these Regulations…"*	This project falls among the projects that have been listed in the second schedule of EMCA and therefore requires an ESIA study prior to its implementation.
Environmental Management and Co-ordination (Water Quality) Regulations, 2006)	It is an offence under Regulation No. 4 (2), for any person to throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution. Regulation No. 11 further	During implementation of the project the contractor's activities and during the operational phase, storm water from the Development may

Legislation	Relevant Section	Relevance to the project
	makes it an offence for any person to discharge or apply any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment.	contain traces of hazardous components. It is recommended that the above regulations be met with prior to the storm water run-off joining the environment.
Environmental Management and Co-ordination (Waste Management) Regulations, 2006	Regulation No. 4 (1) makes it an offence for any person to dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle. Regulation 5 (1) provides categories of cleaner production methods that should be adopted by waste generators in order to minimize the amount of waste generated and they include: **Improvement of production process through** • Conserving raw materials and energy; • Eliminating the use of toxic raw materials and wastes; • Reducing toxic emissions and wastes. **Monitoring the product cycle from beginning to end by** • Identifying and eliminating potential negative impacts of the product; • Enabling the recovery and re-use of the product where possible, • Reclamation and recycling and • Incorporating environmental concerns in the design and disposal of a product. Regulation 6 requires waste generators to segregate waste by separating hazardous waste from non-hazardous waste for appropriate disposal. Regulation 15 prohibits any industry from discharging or	The proposed project, during construction, operational and decommissioning phases will generate wastes which will need to be disposed as per the guidelines in the regulations.

Legislation	Relevant Section	Relevance to the project
	disposing of any untreated waste in any state into the environment. Regulation 17 (1) makes it an offence for any person to engage in any activity likely to generate any hazardous waste without a valid Environmental Impact Assessment license issued by NEMA.	
Environmental Management and Coordination Act (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009	According to regulation 3 (1), 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. Regulation 4 prohibits any person to (a) make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or (b) cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source. Regulation 5 further makes it an offence for any person to make, continue or cause to be made or continued any noise in excess of the noise levels set in the First Schedule to these Regulations, unless such noise is reasonably necessary to the preservation of life, health, safety or property. Regulation 12 (1) makes it an offence for any person to operate a motor vehicle which (a) produces any loud and unusual sound; and (b) exceeds 84 dB(A) when accelerating. According to sub-regulation 2 of this regulation, 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. Regulation 13 (1) provides that except for the purposes specified in sub-Regulation (2) there under, no person shall operate construction equipment (including but not limited to any pile driver, steam shovel, pneumatic hammer, derrick or steam or electric hoist) or	The contractor and project proponent will be required to ensure compliance with the above regulations in order to promote a healthy and safe working environment throughout the project cycle. This shall include regular inspection and maintenance of equipment and prohibition of unnecessary hooting of vehicles as well as scheduling work between 8.00am and 5.00pm.

Legislation	Relevant Section	Relevance to the project
	perform any outside construction or repair work so as to emit noise in excess of the permissible levels as set out in the Second Schedule to these Regulations. Regulation 19 (1) prohibits any person to carry out activities relating to fireworks, demolitions, firing ranges or specific heavy industry without a valid permit issued by the Authority. According to sub-regulation 4, such permit shall be valid for a period not exceeding three months.	
Environmental Management and Coordination (Fossil Fuel Emission Control Regulations 2006)	Section 4(1) of the Regulations states that "any internal combustion engine is subject to inspection under these regulations and shall, as a condition of compliance with the inspection, pass such tests as may be required to demonstrate that the internal combustion engine complies with any standards and requirements for the control of air pollution or contamination as may be prescribed. Section 5 states that "The authority may appoint such number of environmental inspectors as it may deem appropriate for purposes of carrying out emissions inspections under these Regulations and may ,without prejudice and may, to the foregoing, appoint any employee of a lead agency conducting inspection of internal combustion engines on behalf of the Government.	The proposed development should adhere to the stated regulations especially during the operational phase of the project.
Public Health Act (Cap. 242)	Section 115 of this act prohibits causing nuisance or other condition liable to be injurious or dangerous to health. Section 118 provides a list of nuisances which includes any noxious matter, or waste water, flowing or discharged from any premises, wherever situated, into any public street, or into the gutter or side channel of any watercourse, irrigation channel or bed thereof not approved for the reception of such discharge.	This Act is applicable to the project since the contractor will be required to construct toilets for use by workers and visitors to the site during the construction phase and operational phase of the proposed works.
Public Health (Drainage and Latrine) Rules	Rule 85 provides that every owner or occupier of every workshop, workplace or other premises where persons are employed shall provide	

Legislation	Relevant Section	Relevance to the project
	proper and sufficient latrines for use by employees. Rule 87 requires every contractor, builder or other person employing workmen for the demolition, construction, reconstruction or alteration of any building or other work in any way connected with building to provide in an approved position sufficient and convenient temporary latrines for use by such workmen. Rule 91 provides that no person shall construct a latrine in connection with a building other than a water closet or a urinal, where any part of the site of such building is within 200 feet of a sewer belonging to the local authority which is at a suitable level, and where there is sufficient water supply.	
Penal Code (Cap. 63)	Section 191 of the Penal Code makes it an offence for any person or institution that voluntarily corrupts, or foils water for public springs or reservoirs rendering it less fit for its ordinary use. Similarly, section 192 of the same act prohibits making the atmosphere in any place to make it noxious to health of persons/institution in dwellings or business premises in the neighbourhood or those passing along a public way.	The Contractor will be required to ensure strict adherence to the Environmental Management Plan throughout the project cycle in order to mitigate against any possible negative impact associated with dust, noise and effluent discharge.
Physical Planning Act	Section 36 states that if in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the application an environmental impact assessment report. Section 30(1) requires a developer in any local authority to be granted development permission by the respective local authority, failure to which heavy fines will ensue; and the land registrar shall decline to register such a document. No sub-division of private land shall take place within a local authority unless the sub-division	The proponent will be required to present its development plan to the Makueni County Planning office for approval before the project commences.

Legislation	Relevant Section	Relevance to the project
	is in accordance with the requirements of an approved local physical development plan.	
Employment Act	53. (1) Notwithstanding any provision of any written law, no person shall employ a child in any activity which constitutes worst form of child labour. 56:- (1) No person shall employ a child who has not attained the age of thirteen years whether gainfully or otherwise in any undertaking. (2) A child of between thirteen years of age and sixteen years of age may be employed to perform light work which is (a) Not likely to be harmful to the child's health or development; and (b) Not such as to prejudice the child's attendance at school, his participation in vocational orientation or training programmes approved by Minister or his capacity to benefit from the instructions received.	The project proponent and the contractor will need to understand the requirements of the Act during employment at construction stage and operation phases of the project
Traffic Act	This Act specifies that motor vehicles use proper fuel. The traffic Regulations promulgated under the Act specifies that every vehicle is required to be well constructed, maintained and used so as not to emit any smoke or visible vapour.	The contractor should ensure that all locomotives used throughout the project construction and operational phase for transportation comply with this Act.
Work Injury Benefits Act (WIBA)	It is an act of Parliament to provide for compensation to workmen for injuries suffered in the course of their employment. It outlines the following: • Employer's liability for compensation for death or incapacity resulting from accident; • Compensation in fatal cases; • Compensation in case of permanent partial incapacity; • Compensation in case of temporary incapacity;	The Contractor will need to abide by all the provisions of WIBA.

Legislation	Relevant Section	Relevance to the project
	• Persons entitled to compensation and methods of calculating the earnings; • No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury; • Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.	
Occupational Safety and Health Act, 2007	This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to: • Secure the safety, health and welfare of persons at work; • Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work. The Occupational Safety and Health Act 2007 (OSHA 2007) Kenya Gazette Supplement No. 111 (Acts No.15) dated October 26, 2007 revokes the Factories and Other Places of Work Cap.514. The scope of OSHA 2007 has been expanded to cover all workplaces including offices, schools, academic institutions, factories and plantations. It establishes codes of practices to be approved and issued by the Directorate of Occupational Safety and Health Services (DOSHS) for practical guidance of the various provisions of the Act.	The Contractor will be required to comply with all the provisions of the Act throughout the project cycle.

Legislation	Relevant Section	Relevance to the project
County Governments Act 2012	The local government act has been repealed after the final announcement of all the results of the first elections held under the Constitution as per the County Governments Act of 2012. Under section 134 subsection *(1), The Local Government Act is repealed upon the final announcement of all the results of the first elections held under the Constitution*. It further states in section 134, subsection (2) reads "*All issues that may arise as a consequence of the repeal under subsection (1) shall be dealt with and discharged by the body responsible for matters relating to transition".* Part VIII of the act on Citizen Participation (87) (b) emphasizes on the right of citizens to participate to any development projects prior to their implementation.	The project will have to abide by the requirements of the act applicable.
Work Injury and benefits Act (Chapter 236) Laws of Kenya	It is an act of Parliament to provide for compensation to workmen for injuries suffered in the course of their employment. It outlines the following: • Employer's liability for compensation for death or incapacity resulting from accident; • Compensation in fatal cases; • Compensation in case of permanent partial incapacity; • Compensation in case of temporary incapacity; • Persons entitled to compensation and methods of calculating the earnings; • No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury; • Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the labour officer of the area or District Commissioner.	The project must adhere to the Act throughout its life cycle.

(a) Occupational Safety and Health Act, 2007

This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes.

It applies to all workplaces where any person is at work, whether temporarily or permanently.
The purpose of this Act is to:

- Secure the safety, health and welfare of persons at work;
- Protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work.

The Occupational Safety and Health Act 2007 (OSHA 2007) Kenya Gazette Supplement No. 111 (Acts No.15) dated October 26, 2007 revokes the Factories and Other Places of Work Cap.514.

The scope of OSHA 2007 has been expanded to cover all workplaces including offices, schools, academic institutions, factories and plantations. It establishes codes of practices to be approved and issued by the Directorate of Occupational Safety and Health Services (DOHSS) for practical guidance of the various provisions of the Act.

Other parameters within the Act include:

- Duties of employers, owners or occupiers of workplace;
- Establishment of safety and health committees;
- Annual safety and health audit of workplaces;
- Safety and Health obligations for persons who may come to premises for work and are not employees of that particular workplace;
- Reporting of any accident, dangerous occurrence or occupational poisoning caused in the workplace to the area Occupational Health and Safety Office. These incidents should be entered in the General Register. In case of a fatal accident, information to the area Safety and Health Office should be within 24 hours and a written notice to the same within 7 days;
- The registration of all workplaces by the Director forming the basis of his work statistics;
- Machinery safety to include:
  - ✓ Safe use of machinery, plant and equipment;
  - ✓ Prime makers and transmission machines;
  - ✓ The maintenance, construction of fencing safeguards;
  - ✓ The statutory requirements of various machines, plants and equipment (hoists and lifts, chains and ropes, cranes, steam receivers and containers, air receivers, cylinders for compressed liquefied and dissolve gases and refrigeration plants).

- Chemical safety including:
  - ✓ Handling, transportation and disposal of chemicals and other hazardous substances;
  - ✓ Importance of Materials Safety Data Sheets (MSDS);

- ✓ Labelling and marking of chemical substances;
- ✓ Classification of hazardous chemicals and substances;
- ✓ Establishment and adoption of exposure limits on hazardous substances in a workplace;
- ✓ Control of air pollution, noise and vibrations;
- ✓ Redeployment on medical advice;

- Health, safety and welfare special provision including:
  - ✓ Permit to Work systems;
  - ✓ Work processes that are likely to harm persons below eighteen (18) years;
  - ✓ Supervision of apprentices and indentured learners;
  - ✓ Training and supervision of inexperienced workers;
  - ✓ Medical surveillance;

- Penalties, offences and legal proceedings including:
  - ✓ The upward adjustments of all fines imposed in the event of failure to comply with provisions of the Act;
  - ✓ The need to investigate and prosecute the real offender otherwise all those who fail to comply with any provisions of this Act that have been legally imposed on him/her shall be prosecuted.

Regulations under The Factories and Other Places of Work Act now deemed to be under The Occupational Health and Safety Act (OSHA) 2007 are:

- The Factories and Other Places of Work (Fire Risk Reduction) Rules 2007;
- The Factories and Other Places of Work (Hazardous Substances) Rules 2007.
- The Factories and Other Places of Work (Medical Examination) Rules 2005;
- The Factories and Other Places of Work (Noise Prevention and Control) Rules 2005;
- The Factories and Other Places of Work (Health & Safety Committees) Rules 2004;
- The Factories (Eye Protection) Rules 1978

(b) Fire Risk Reduction Rules (2007)

The following subsidiary regulations were made under the Factories and Other Places of Work Act, Legal notice No. 59 of the Kenya Gazette Supplement No. 46 of May 4, 2007.

The rules define classes of fires:

Class A fire: Fire involving ordinary combustible materials such as paper, wood cloth, rubber or plastic materials;
Class B fire: Fire involving flammable or combustible liquid, flammable gasses, greases or similar material, rubber or plastic material;
Class C fire: Fire involving energized electrical equipment where safety to the worker requires the use of electrically non-conductive extinguishers media;
Class D fire: Fire involving combustible metal such as magnesium, zirconium, sodium, lithium or potassium.

These rules outline standards on:

- Handling, storage and disposal of flammable substances and vapours;
- Provisions for preparedness, drills, training and procedures in the event of fire hazards, fire escape exits, control of spread of smoke, means of evacuation and formation of fire fighting team;
- Marking and labelling (English and Kiswahili) highly flammable substances storage areas and containers;
- Monitoring of flammable substances, First Aid, notices, colour coding of pipes, fire safety policy, and fire safety audit.

(c) Hazardous Substances Rules (2007)

These regulations cover specifications for factories and workplaces where hazardous substances are handled. Provisions are made for exposure limits, protection of workers and the environment, maintenance of equipment and future guidelines on hazardous substances.

(d) Medical Examination Rules (2005)

The Medical Examination Rules are described in Legal Notice No. 24 of the Kenya Gazette Supplement No. 22 of April 2005. These Rules apply to all those employees in employment or have been in employment in every workplace, to which the provisions of the Factories and Other Places of Work Act (Cap 514) apply. The Rules describe the following:

- Occupations requiring medical examination;
- Duties of employer and employees as to medical examination;
- Reports on examination;
- Certificate of redeployment;
- Certificate of fitness;
- Notification of occupational diseases;
- Offences and penalties.

(e) Noise Prevention and Control Rules (2005)

The Noise Prevention and Control Rules are described in Legal Notice No. 25 of the Kenya Gazette Supplement No. 22 of April 2005 and apply to every factory, premises, place, process and operations to which the provisions of the Factories and Other Places of Work Act (Cap 514) applies.
These Rules describe the following:

- Permissible noise levels;
- Noise prevention programme and measuring equipment;
- Noise hazard areas;
- Noise measurements and records;
- Information on noise and training of workers;
- Engineering controls;
- Installation and maintenance of machinery or plant;
- Means of communication;
- Hearing protection;

- Workers responsibility in noise hazard areas;
- Duties of the occupier;
- Medical examination and hearing tests;
- Compensation and notification of occupational hearing impairment;
- Noise programme review;
- Offences and penalties.

(f) Health and Safety Committee Rules (2004)

The Health and Safety Committee rules are described in Legal Notice No. 31 of the Kenya Gazette Supplement No. 25 of 14 May, 2004 and apply to all factories and other workplaces that regularly employ twenty or more employees. Among other items, the rules state that:

- The occupier of every factory or other workplace shall establish a Health & Safety committee;
- The Committee shall consist of safety representatives from the management and the workers;
- The factory occupier shall appoint a competent person from the management staff to be responsible for safety, health and welfare in the factory or workplace; and the person appointed shall be the secretary to the Committee;
- Every member of the Health & Safety Committee shall undertake a prescribed basic training course in occupational health and safety within a period of six months from the date of appointment or election, and thereafter further training from time to time;
- The occupier of every factory or workplace shall cause a health and safety audit of the workplace to be carried out at least once in every period of twelve months by a registered health and safety adviser.

The above legal notice also describes the functions and duties of the Health & Safety committees, meetings and minutes, and roles in the Committee. It further describes the duties of the occupier and those of the Health & Safety Adviser.

3.4 Institutional Framework

Table 3-4: Institutional Framework and its relevance to the study

Institution	Function /Relevant section	Relevance to the project
National Environmental Tribunal	The National Environment Tribunal (NET) is created under Section 125 of the Environmental Management and Coordination Act (EMCA) of 1999. Its functions are: • To hear and determine appeals from NEMA's decisions and other actions relating to issuance, revocation or denial of Environmental Impact Assessment (EIA) licences or amount of money to be paid under the Act and imposition of restoration orders;	Any disputes arising from issuance or denial of the project licence will be addressed by NET.

Institution	Function /Relevant section	Relevance to the project
	• To give direction to NEMA on any matter of complex nature referred to it by the Director General.	
Land and Environment Court	This is an Act of Parliament to give effect to Article 162(2) (b) of the Constitution; to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of, and title to, land, and to make provision for its jurisdiction functions and powers, and for connected purposes. The principal objective of this Act is to enable the Court to facilitate the just, expeditious, proportionate and accessible resolution of disputes governed by this Act. Section 13 (2) (b) of the Act outlines that in exercise of its jurisdiction under Article 162 (2) (b) of the Constitution, the Court shall have power to hear and determine disputes relating to environment and land.	Any land or/and environmental cases arising from the project will be handled in accordance with the provisions of this act.
National Environment Council	The National Environmental Council is responsible for policy formulation and directions for the purposes of the EMCA 1999 Act. The Council also sets national goals and objectives, and determines policies and priorities for the protection of the environment.	The proponent should ensure that the project abides by the set goals and objectives of the council.
National Environment Management Authority (NEMA) Committees	The National Environmental Council is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives, and determines policies and priorities for the protection of the environment. **Standards and Enforcement Review Committee (SERC)** EMCA provides for the establishment and enforcement of environmental quality standards to be set by a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC). **Public Complaints Committee** EMCA has also established a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The Committee has the mandate to investigate complaints relating to environmental damage and degradation. The members of the Public Complaints Committee include	The Proponent should address all issues arising from the project in accordance with the said committees.

Institution	Function /Relevant section	Relevance to the project
	representatives from the Law Society of Kenya, NGOs and the business community.	
Physical Planning Department	Physical Planning Act	Governs land change of user in zoning and Categorizes development plan as commercial, industrial and other purposes.
Kenya Bureau of Standards	• All fused switchgear and isolators whether mounted on machinery, walls or industrial panels shall conform to the requirements of KS 04 – 226 PART: 1: 1985. • All contacts are to be fully shrouded and are to have a breaking capacity on manual operations as required by KS 04 – 182: 1980. • Fuse links for fused switches are to be of high rupturing capacity cartridge type, conforming to KS 04 – 183: 1978. • All conduits shall be black rigid super high impact heavy gauge class „A" PVC in accordance with KS 04 – 179: 1988 and IEE Regulations. No conduit less than 20mm in diameter shall be used anywhere in this installation. • All conduit outlets and junction boxes are to be either malleable iron and of standard circular pattern of the appropriate type to suit saddles being used or super high impact PVC manufactured to KS 04 – 179 : 1983. • P.V.C. Insulated Cables and Flexible Cords --- Ks 04-192:1988. P.V.C Insulated Armoured Cables - Ks 04-194:1990 • Armouring of Electric cables --- Ks 04-290:1987. • Shall be 600/1000 volt grade manufactured to Ks 04-194:1988 and Ks 04-187/188 with copper stranded conductors. • SOCKETS AND SWITCHED SOCKETS - "M.K. Electrical Co. Ltd.", or other approved equal to KS 04 – 246: 1987. • FUSED SPUR BOXES - "M. K. Electrical Company Ltd", or other approved equal. KS 04 – 247: 1988. • COOKER OUTLETS - "M.K. Electrical Company Ltd", or other approved equal KS 04 – 247: 1988. • Tungsten filament lamps shall be manufactured in accordance with KS 04 – 112:1978 for general service lamps	The contractor and the proponent will comply with the KS conditions.

Institution	Function /Relevant section	Relevance to the project
	and KS 04 – 307:1985 for lamps other than general services. Tubular fluorescent lamps shall comply with KS 04 – 464:1982	
Energy Regulatory Commission	ERC is a single sector regulatory agency, with responsibility for economic and technical regulation of electric power, renewable energy, and downstream petroleum sub-sectors, including tariff setting and review, licensing, enforcement, dispute settlement and approval of power purchase and network service contracts.	Project proponent should acquire all necessary permits.
County Government	It constitutes various developmental approvals departments such as the planning department.	The project proponent should present the project drawings and plans to the department for approval prior to the project implementation.

3.5 Licenses and Permits

Table 3-5 summarises the legislation, requirements and regulatory bodies relevant to the proposed Development.

Table 3-5: Licences and permits

Legislation	Requirement (Licences / Permits)	Regulator
Public Health Act (rev. 1996)	• Inspections on cleanliness and prevention of nuisances.	Makueni County.
	• To inspect and approve adequate protection of water supplies. • Approval of plans for new buildings from the Council.	
Occupational Health and Safety Regulations 2007 (OSHA), Part (V), Section 44.	• Registration certificate.	Ministry of Labour.
	• Display Abstract of Factories and other places of Work / OSHA.	
Local Government Act (rev. 1998) Cap 265	Trade / Business Licence (Single Business Permit).	Makueni County.
Trade Licensing Act	Trade Licence.	Ministry of Trade & Industry
Physical Planning Act (1996)	• Development application to be made for any new buildings.	Makueni County.
	• Development permission for any new units.	

Legislation	Requirement (Licences / Permits)	Regulator
Environmental Management & Co-ordination Act (1999)	• Emissions licences; • Effluent discharge licence; • Noise; • Noxious smells.	National Environment Management Authority.
Building Code (1997)	Local Council approval required for plans for any building	Makueni County.
Local Government Act (rev. 1998).	Trade / Business Licence.	Trade / Business Licence.

3.5.1 Key Regulatory Agencies

The regulatory agencies of relevance to the proposed activities are shown in Table 3-6 below.

Table 3-6 Regulatory Agencies

Regulatory Agency	Responsible Ministry	Requirements
National Environment Management Authority (NEMA)	Ministry of Environment and Mineral Resources.	Submission of EIA, Environmental Audit and Monitoring Reports pursuant to Sections 68 and 69 of the Act.
National Environment Management Authority (NEMA)	Ministry of Environment and Mineral Resources.	Effluent Standards Compliance.
Department of Occupational Health and Safety:	Ministry of Labour.	Responsible for the implementation of the Factories and Other Places of Work Act and OSHA.

3.6 International Conventions and Treaties

Kenya is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. Some of the relevant International treaties and conventions include:

Vienna Convention for the Protection of the Ozone Layer:

Inter-governmental negotiations for an international agreement to phase out ozone depleting substances concluded in March 1985 with the adoption of this Convention to encourage inter-governmental co-operation on research, systematic observation of the ozone layer, monitoring of CFC production and the exchange of information.

Montreal Protocol on Substances that Deplete the Ozone Layer:

Adopted in September 1987 and intended to allow the revision of phase out schedules on the basis of periodic scientific and technological assessments, the Protocol was adjusted to accelerate the phase out schedules and has since been amended to introduce other kinds of control measures and to add new controlled substances to the list.

Kyoto Protocol:

Drawn up in 1997, pursuant to the objectives of the UN Framework Convention on Climate Change, in which the developed nations agreed to limit their greenhouse gas emissions, relative to the levels emitted in 1990.

The Basel Convention:

Sets an ultimate objective of stabilizing greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic (human-induced) interference with the climate system;

Convention on Biological Diversity (CBD, 1992):

This Convention entered into force on 29 December 1993, and its objectives are to: conserve biological diversity; use biological diversity in a sustainable fashion and share the benefits of biological diversity fairly and equitably. This Convention governs Kenya's international obligations regarding biological diversity;

UNESCO Convention for the protection of the World Cultural and Natural Heritage (World Heritage Convention, 1972):

This Convention aims to encourage the identification, protection, and preservation of Earth's cultural and natural heritage.

Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention):

The Convention was signed in Iran in 1971 and came into force in 1975. It represents the first attempt to establish a legal instrument providing comprehensive protection for a particular type of ecosystem. The Ramsar parties agree to implement their planning so as to promote conservation of the wetlands included in the list.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):

This convention seeks to control the trade in species of wild animals and plants that are, or may be, threatened with extinction as a result of International trade. CITES is an important line of defence against the threat posed to diversity by invasive species.

African Convention on Conservation of Nature and Natural Resources (1968):

This Convention of the African Union is ratified by 40 African countries, including Kenya. The fundamental principle requires contracting states to adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and fauna resources in accordance with scientific principles and with due regard to the best interests of the people.

4 DESCRIPTION OF THE EXISTING ENVIRONMENT

This chapter describes the biophysical and social economic environment of the project area. This would form the basis for future appraisals. The information in this chapter is mainly derived from literature review by the ESIA study team.

4.1 Background Information on the Project Area

Makueni County covers an area of 8,034.7 square kilometers within the former Eastern Province of Kenya, one of three predominantly inhabited by the Akamba peoples of Kenya. The County capital, Wote, is 130km east of Kenya's capital, Nairobi. The County lies between 259m and 2138m above sea level in four distinct forms: the undulating and very steep uplands of Kilungu, Kilome and Mbooni to the northwest, vast open gently-inclined plains stretching south-east from Kilome's foothills, the bottomlands of Kibwezi and enclosed by the Chyulu Hills mountain range at the southwest and the Yatta linear plateau to the northeast.

Makueni County is spatially structured by both geo-physical and man-made components. The geophysical elements that have structured the county's territorial space include the landforms, the county drainage and ecological systems. A variety of activities associated with the peopling and habituation of this landscape by humans that have also structured Makueni spatially include transport, settlement, land use and spatial practices.

4.2 Population

The current population of Makueni County is estimated to be 1,002,979 people (in 2018), growing at a rate of 1.4% annually. 51% of the population is women while an estimated 7% are vulnerable persons aged above 75 years or living with disability. The population pyramid of the County is bottom-heavy, with 44% of all persons being children below 15 years of age. 34% of the County residents are categorized as absolutely poor.

4.3 Agriculture

Agriculture is the predominant economic activity in the County contributing 78% of the total county Gross Domestic Product. Dairy farming and the production of coffee, avocadoes, passion, horticulture, maize and vegetables is predominant in the uplands. The production of green grams, pigeon peas, cow peas, mangoes, citrus fruits, paw paws, melons, cotton and sisal is predominant in the plains in the middle zone of the County. Poultry production, bee keeping, pasture development, fruit farming (mangoes, water melons, paw paw), green grams, sorghum, millet, pigeon peas, cow peas, cassava, sweet potatoes among others is practiced in the lowlands. Value-addition however remains inadequate in the agricultural sector, although facilities such as the Makueni Fruit Processing plant in Kalamba and the Kikima Milk processing plant have revitalized their specific sectors.

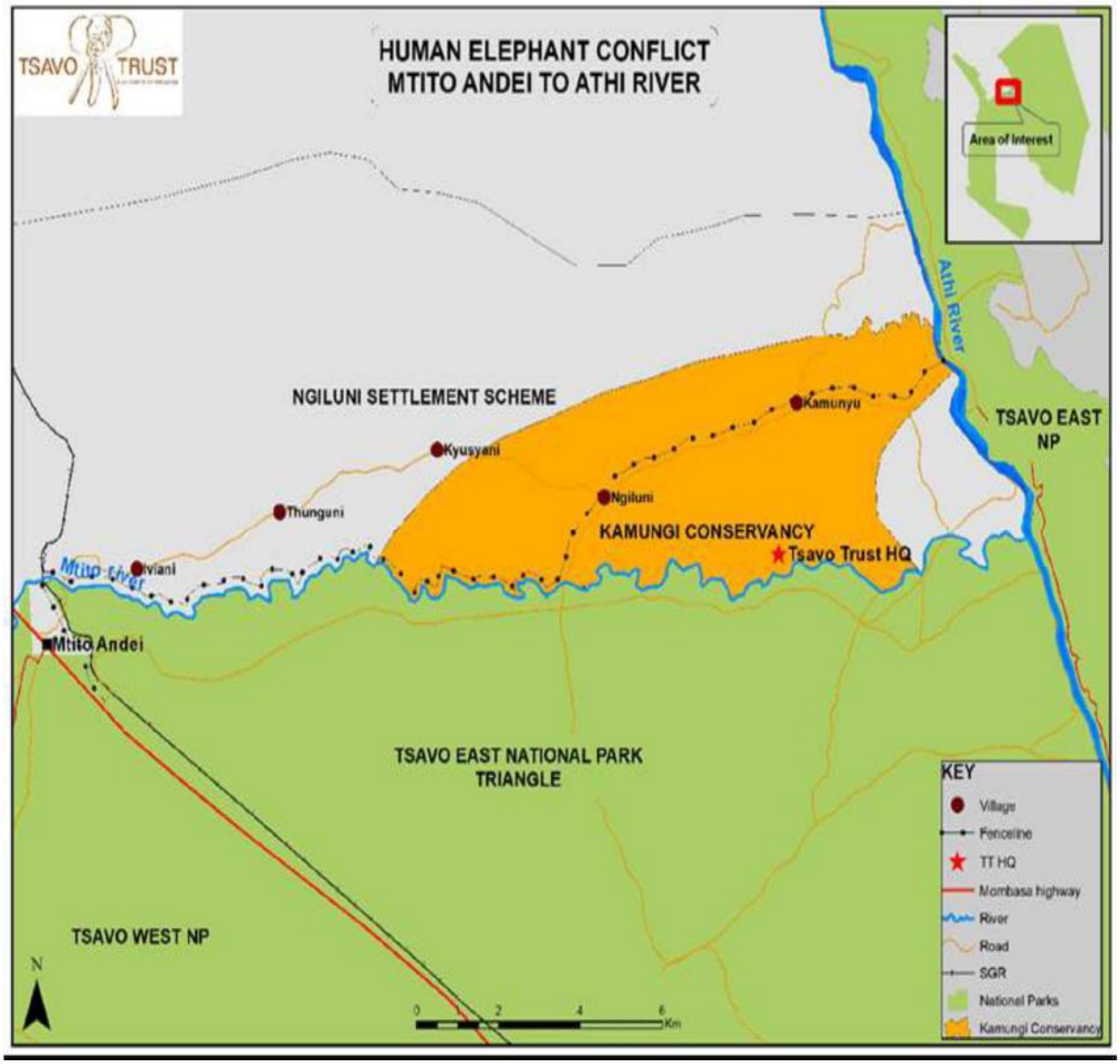
4.4 Trade, Commerce and Minerals

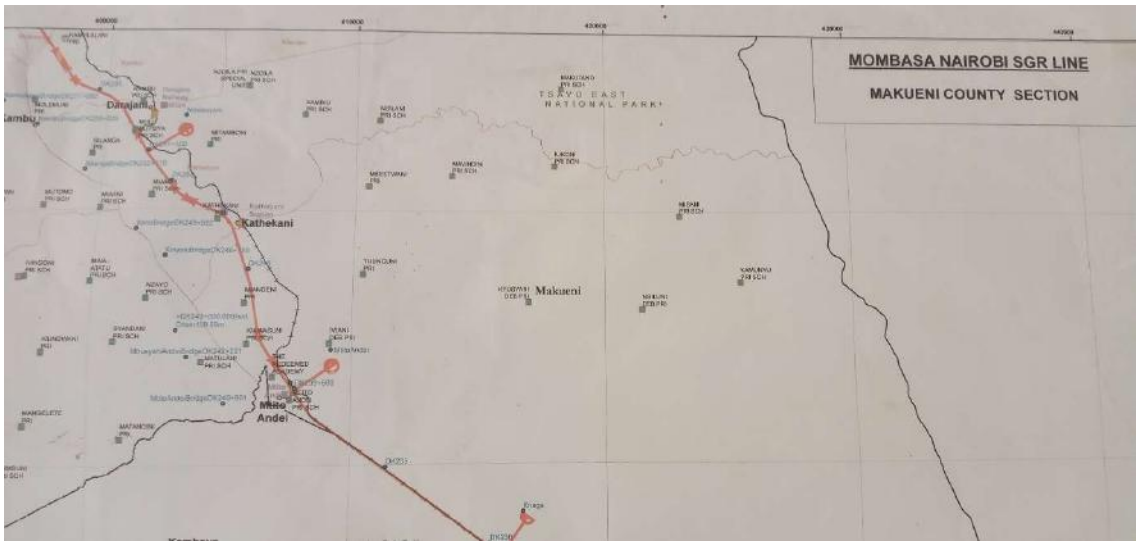
Trade and commerce are a vibrant occupation in Makueni County, with the informal sector growing at an annual rate of 3%. The mining sector mainly

involves the extraction of sand, soil, granite, stone and ballast. While there are deposits of Kaolin, limestone, volcanic rocks, marble, salt, granite (green and red), quartz, gypsum, vermiculite, mica, copper, dolomite, iron ore, basalts, gemstones in Kibwezi West Sub County, their commercial viability has not been established. The County shares part of the famous Tsavo National park with Taita Taveta and Kitui Counties.

4.5 Project Location

The map below shows Tsavo East National Park possible alignment of a HEC 2 strand electric fence line. Co-ordinates: START OF ELECTRIC FENCE Latitude 2^0 38' 59'', Longitude 38^0 20' 02'' and END OF ELECTRIC FENCE Latitude 2^0 15' 32'', Longitude 38^0 04' 28'' .





Map showing proposed area

4.6 Physical Environment

4.6.1 Climate and Temperature

Climate change has been a major challenge in Makueni County, with 12 climatic disasters having been recorded in the County since 1980. The result has been erratic rainfall, frequent droughts and shortage of water to sustain agricultural development. This has also further constrained water sources replenishment and thus the frequent drying up of perennial rivers and water pans. Environmental challenges in the County are mainly depletion of water catchment areas, destruction of reserve s, and invasion of wet areas, unabated sand harvesting and poor agricultural practices such as cultivation along riverbanks.

4.6.2 Rainfall Pattern

The County has three relief and climate-differentiated zones, namely; arid (Mtito Andei, Tsavo), semi-arid (Masongaleni, Kibwezi, Kathonzweni, Makueni) and sub-humid (Mboono, Kilungu). Precipitation is higher in the highlands of Tulimani, Mbooni, Kilungu and Matiliku which receive 800-1200mm of rainfall per annum. The and middle altitude zones of Kalawa, Kasikeu, Mbitini, Chyulu hills, Kibwezi and Makindu record a mean seasonal rainfall of 350-450mm. The lowlands of Kilome, western sides of Kasikeu, Nguu and Kathonzweni receive significantly lower rainfall averaging between 200 and 350mm.

4.6.3 Hydrology and Water resources

The contoured undulated uplands host a dense rivulet network of tributaries that flow downstream, successively merging into larger rivers, including, Thwake, Kaiti, Kikuu, Muooni, Kiboko, Kambu, Tsavo, Mtito Andei, Kambu and Kiboko. The latter eventually channel their waters into the giant Indian Ocean-bound Athi River, which meanders southwards across the County's bottomlands.

4.6.4 Physical and Topographic Features

The County's positioning within Kenya's marginal southeast, coupled with the fragilities associated with its varied and topographically challenging landscape, unpredictable and often harsh climate, has often served to limit the ability of Makueni peoples to derive maximum potential from their land resource. There therefore needs to be sensitive to the intrinsic, unique and often fragile qualities of the land and environment. The challenging topography of the County's northwest, as characterized by undulation and steepness of hills, and this, coupled with the fact of the area's watershed properties. The areas were identified as undergoing degradation, both of the land, and of the watershed, inflicted by the land use practices of an expanding local population.

4.6.5 Soils and Geology

The undulating uplands which have their origin in the tectonic movements responsible for the Great Rift Valley's formation, host a substratum of erosion resistant metamorphic granitoid, folded into very steep hills, topped with a moderate layering of rich volcanic soils. The rocks have undergone significant weathering and fracturing making it possible for them to play an important role in the workings of the hydrological system, particularly as a mechanism for groundwater recharge, thereby making them highly aquiferous. This latter quality is the reason for their christening as crying hills.

On their part, the lowlands' pre-cambrian metamorphic sub-strata, equally composed of weathered and fractured gneisses and schists, is overlain by a thin profile of sandy clays with low dry-season water retention properties, although the sandy rivers host substantive aquifers. The County's soil distribution pattern is a direct consequence of its geology. Soil types range from clayey black cottons over the Konza steppe, dark sandy loams atop uplands of the northwest, to red sandy soils alongside the Yatta plateau, and sand clays upon the Kibwezi plain.

4.7 Biological and Ecological Environment

4.7.1 Vegetation within the Study Area (Flora)

The County's land cover profile ecosystem structure is greatly influenced by variation in altitude, climatic patterns and distribution of soils. The County is generally dry and precipitation significantly low compared to other areas in Kenya. It is largely arid and semi-arid and usually prone to frequent droughts. Consequently, moderate rainfall in the uplands support a vibrant vegetation cover while depressed rains in the lower parts only allow for stunted vegetation and which likewise influence the land cover profile.

Sandy loams, which are localized in the highlands, are generally high in fertility, and together with high precipitation, allow a dense vegetative conservancy covers to flourish. Black cotton clays of the Konza steppe, as well as sandy clays of the Kibwezi plain, are generally low in fertility, and given the interceding dry climate, host vast stretches of savannah grasslands, scattered acacia trees and other shrubbery. Approximately 40% of the county is covered by vegetation. Of this, 90% is natural indigenous vegetation.

4.7.2 Wildlife Variety (Fauna)

The County has varied wildlife species, most of which are localized at the Tsavo National park which lies in the southern part of the County. There is also a great variety of bird life both within and outside the Tsavo and in Kiboko sanctuary.

a) Elephants

The elephants of Tsavo are known around the world for their distinctive red colouring and this region is also home to some of the last great tuskers of Africa. The title “Red Elephants” of Tsavo doesn’t mean that the elephants were born that way. The name is more of a nickname. Tsavo East National Park soil is somewhat red and when the elephants wallow in the mud they look that shade of red. Tsavo has always been a special place for elephants and this vast expanse is currently home to Kenya’s largest elephant population numbering around 14,000. Tuskers (Tusker term used to describe bull elephants) are now incredibly rare with possibly as few as 20-30 left on the entire African continent. The greater Tsavo ecosystem containing Tsavo East, Tsavo West and Chyulu Hills National Parks is home to possibly the largest population of tuskers left in all of Africa.

Elephants

b) Hyena

Hyenas or hyaenas (from Ancient Greek ὕαινα, hýaina are feliform carnivoran mammals of the family .With only four extant species (in three genera), it is the fifth-smallest biological family in the Carnivora, and one of the smallest in the class Mammalia. Despite their low diversity, hyenas are unique and vital components of most African ecosystems.

Hyena

c) Lion

The lion is a species in the family Felidae; it is a muscular, deep-chested cat with a short, rounded head, a reduced neck and round ears, and a hairy tuft at the end of its tail. It is sexually dimorphic; adult male lions have a prominent mane, which is the most recognizable feature of the species.

Lion

d) Zebra

Zebras are several species of African equids united by their distinctive black-and-white striped coats. Their stripes come in different patterns, unique to each individual. They are generally social animals that live in small harems to large herds. Habitat loss due to human encroachment, agricultural practices, and livestock grazing remains an issue in the ongoing conservation of this species. These problems seem to be especially prevalent in the southern half of their range and account for much of recent population decline.

Zebra

e) Cattle egret

The Cattle Egret is a small heron. Only half the size of a Great Egret, the Cattle Egret's size is a useful field mark. Juveniles and adults in non-breeding plumage are pure white with dark legs. Adults have yellow bills. Adults in breeding plumage are unmistakable, with buff-colored plumes creating patches on the back, breast, and crest. Breeding adults also have orange bills and reddish orange legs.

The Cattle Egret eats mainly insects, especially grasshoppers, and in some parts of the world, parasitic flies. An adaptable species, they have been known to eat nestling birds and eggs, and to scavenge in dumps. Cattle Egrets typically first breed at two years old. Both parents incubate the 3-4 eggs for about 24 days.


Cattle egret

f) Horn bill

This hornbill is a common, widespread resident of the dry thorn fields and broad-leafed woodlands. Frequently they can be sighted along roads. They feed mainly on the ground, where they forage for seeds, small insects, spiders and scorpions. Termites and ants are a preferred food source in the dry season.


Horn bill

g) Salts Dick-dick

The dik-dik is a tiny antelope, standing only around 35cm at the shoulder. It is a reddish-brown colour on the back, with lighter flanks and white belly. Size is usually the easiest way to identify a dik-dik, but other marks are the almost total lack of a tail and the tuft of dark hair on the forehead. Horns (found on the males only) are so short (around six cm) that they are often lost in the hair tuft. Dik-diks are usually seen singly or in pairs and are in found in the bushes. They are mainly nocturnal but can be seen grazing in acacia scrub in the early morning and late afternoon; like so many animals they rest in the heat of the day.


Salts Dick dick

4.8 Land use

An estimated 63% of all county land is considered arable, with an ability to support meaningful crop production. Conservancy s account for 17% of the total land cover in Makueni, bushlands cover 48% of the county, grasslands 5%, croplands 6%, barren lands 16% and 8% is under intensive settlement. While majority of residents are land owners (of an average of 1.58 Ha), land adjudication remains incomplete with only 35% of people having title deeds. The land sector faces challenges of uncontrolled land fragmentation, landlessness and the existence of squatters conditions.

4.9 Power generation

Makueni County has a high potential for solar power generation with an average County-wide insolation of 4.2-4.4kwh/kwp. Wind energy equally remains unexploited despite the existence of wind speeds of up to 15.4kmph on the hills. While there are currently no hydropower plants in the county, completion of the Thwake multi-purpose dam is anticipated to generate 17.6 megawatts of hydro power per day.

4.10 Transportation

There is potential this sector holds has largely been under-tapped in Makueni County such as from the Standard Gauge railway line and stations, gazette conservancy s and scenic views in the uplands. Makueni County is strategically anchored within and connected to its context through an elaborate and hierarchical network of international rail and road trunks, national and regional highways. This includes the 140 kilometers of the Standard Gauge railway line, the A109 highway, Makindu airstrip, a national pipeline and other highways connecting the County to Moshi, Kitui, Machakos, Voi and Mwatate. Numerous other feeder roads further penetrate the County's interior. Of the 3,203.5 km^2 of the County's road coverage, 69% are earth roads and only 14% are tarmacked.

4.11 Education

There is Lukenya University located within the project area. Also there are several other schools as shown below

Schools	Mtito Subward	Kambu Subward
ECDEs	16 + 7 Feeders	18 + 9 Feeders
Primary	16 + 11 (Private)	18
Secondary	6	8
CTTIS	-	1
University	1	1

4.12 Health

Health Facilities	Mtito Subward	Kambu Subward
Subcounty Hospitals	2	0
Dispensaries	3	3
Health Centre	0	

5 PROJECT DESCRIPTION

5.1 Electric Fencing

During the study scoping stage, electric fencing was identified as the most effective barrier to manage problem animals in the area especially the elephants. The “Elephant exclusion zone” fencing is a very simple but effective way of keeping elephant out of specific areas, in this case community small scale farmland. This type of cost-effective fence is basically initially designed as follows fir future purpose:

- *The electric fence shall consist of Three (3) strands. There shall be provision for seven live wires and three earth wires. The bottom earth wire will be looped to the upper earth wires and subsequently at 100m interval, the fence return wire shall be attached to a 2m earth peg with a joint clamp.*
- *All live wires shall be attached to strain insulators at strainer assemblies and tied by joint clamps and looped across king post to the next wire tied in the same way. Galvanized staples shall be used to attached earth wires and insulators to the posts. All wires shall be strained to a tension of 150kg. Standard galvanized joint clamps shall be used to join the wire along the main fence line and at corners where looping shall be necessary.*
- *All joints shall be tight and of a figure 8 configuration. The electric fence will be fully integrated with the CCTV system at all energisers locations to provide real time footage for safety of equipment cabinets. The electric fence zones and CCTV will be monitored in real time from one command center software in the centralized control room. The power supply to the system shall be via solar*

During this phase of the project, two live wires separated by 1.5 feet and one earth wire that runs along the ground (dug underground or pegged in at intervals) will be constructed.

The 2 live wires will be attached to posts using a W-insulator to stop shorting. The 2-strand fence is set approximately 5 to 6 foot off the ground and attached to fence posts. This system is environmentally friendly and insignificant impact, the wire soon oxidizes and is not visible easily, and provided the fence is maintained and power upheld it does work well as an elephant barrier. Livestock and people can easily move under the fence so free movement is not impaired at all. It has been tried and tested in various conservation areas especially the earlier 33km electric fence within the same area where it has worked.

5.2 Planning

This has already started and includes the undertaking of this Environmental and social Impact Assessment. Already, a scoping exercise has been undertaken and it involved extensive consultations with the CGoM, adjacent communities and key stakeholders. The ESIA process also involved various meetings and discussions that were held to try and identify the best wildlife barriers to mitigate human-wildlife conflicts, and it is from this process that the electric fence, its design and alignment were chosen.

In choosing the design of the electric fence, the key problem animals were considered with respect to their sizes, intelligence. In our case, the elephants were the Key interest. 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 scooping exercise and other initial meetings (Athi Kamunyu and Athi Makutano) were held between communities and established that the wildlife barriers were actually required and indeed requested adjacent communities as the best way to mitigate human wildlife conflicts. The scooping exercise determined that the electric fence was indeed the preferred barrier as the lasting solution.

The electric fencing initiative is thus community driven, and the proposed project will involve the community in the implementation and maintenance (operation) phases. Already, most communities have established and operationalized fence committees in their respective covered zones.

The project sustainability is also guaranteed due to the high socio-economic benefits that will accrue to the communities adjacent to the National Park. Key will be poverty alleviation through minimization of crops and infrastructure destruction by animals. The fences will also restore social order and improve small holder agriculture production, food security, and general security, reduced incidences of pulmonary diseases, and improved incomes and livelihoods. Additionally, the sustainability is assured due to the commitment of the communities to maintain the fences.

5.3 Development Phase

This will be the main phase of the project and will include the actual erection of the fence. The design of this fence is such that it will comprise of two strands of wire. The fence is designed to allow ingress of larger wildlife from the settlement side by breaking the W- insulators, but to prevent egress of wildlife from the rangeland. Key activities will include:-

5.3.1 Clearing of the fence alignment

This will start with the surveying of the alignment by the contractor. The fence alignment will be on the boundary between the National Park and the community. The clearing will thus be on the community side. The contractor together with the County Government of Makueni will determine how the cleared vegetation will be disposed.

5.3.2 Pitting and erecting fence posts

This type of cost-effective fence is basically two live wires separated by 1.5 feet and one earth wire that runs along the ground (dug underground or pegged in at intervals). The 2 live wires are nailed to posts using a W-insulator to stop shorting. The 2-strand fence is set approximately 5 to 6 foot off the ground and attached to fence posts.

This system is environmentally friendly and insignificant impact as the wire soon oxidizes and is not visible easily, and the provided fence is maintained and

power upheld it does work well as an elephant barrier. Livestock and people can easily move under the fence so free movement is not impaired at all.
All posts will be well tamped prior to the attachment of insulators and wires.

5.3.3 Straight and angle-strainer assemblies

Straight-line strainer assemblies will be installed at a maximum distance of 200 metres or at any point where there is a rise and fall in the fence line. Angle strainer assemblies will be installed at every point where the fence alignment changes.

5.3.4 Electrics

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 and galvanized wires and connected between the fence and the earth.
Earthing: The earthling system for both the energizer and the lightening diverter will be installed. Two 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 of 12001400N. 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.
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 live wire at a spacing of approximately 90 meters.

5.3.5 Gates

These will be constructed at any point where access to the area is required. This will generally vary with different areas but gates will normally occur to allow human access for firewood, water and other conservancy products (wood and non-wood). The actual gate locations and distances between them will be discussed with the CGoM, adjacent communities, KWS and each gate will need to be justifies as they should be as few as possible. It is proposed that due to pressure from elephants the gates are equipped with live droppers.

5.3.6 Energizer house

There is one energizer house already installed that serves some established areas. It is anticipated that the solar panel, the energizer and battery banks will be housed at the houses which will be constructed at 8Km intervals they will be safe from theft because they will be manned 24 hours, and the fence line itself

will follow the Mtito River and Athi River profiles. The fence will follow the boundary road around the National Park. This way people and community livestock will still have access to the Mtito River. This plan has been discussed with the community and they are very happy to help and participate in this project.

This fence configuration has been used extensively, with success, to mitigate HEC on National and Private Protected Areas especially in northern Kenya. They 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 of 8 Kilometres.

5.3.7 Access roads

The fence will have a service or access road which is fairly motorable road 7 metres wide, and which will be well maintained for proper monitoring of the fence.

5.3.8 Materials and equipment

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

DESCRIPTION	SPECIFICATIONS
Posts	All posts to be used shall be treated in creosote or copper tanalith or equivalent chemical wattle or blue gum variety. The treatment shall be as per KEBS specification for preservation of Timber (KS 02 – 94 – 1985)
Line Posts	All line posts shall have a minimum diameter of 125-150mm and height of 3050mm and shall be spaced at 5000mm. They shall have a smooth and cylindrical surface free of knots and cracks. The posts shall be set in holes 450mm wide by 950mm in depth in such a manner that 2100mm will be above the ground. The posts shall be embedded all round in 1.3.6 concrete with a cover of 150mm.
Strainer Posts	Strainer shall be built where there is change in the fence alignment (corner) and at every 200m on a straight line. The strainer assembly consists of the King posts, 2No. Strainer posts and two struts. They shall all be 175 – 200mm diameter 3300mm in height. The posts shall all be embedded all round in 1.3.3 concrete in a pre-dug hole measuring 525mm diameter and 1300mm in depth. They shall be set in such a way that 2100mm is above ground level. A minimum of 4days will be allowed for the curing of the concrete during which period no external forces shall be exerted on the posts. The strainer posts shall be connected to the King posts by a 3000mm long 150mm diameter strut(side arms).The side arms/struts are to be tightly mortised into the straining post and the bracing posts.

DESCRIPTION	SPECIFICATIONS
Live wire	Plain wire to be used for live wire shall be High Tensile Steel wire 2.5mm diameter heavily galvanized to a zinc coating of not less than 280gm/m^2 and of steel class BS 1044 or BS 1065 and tensile strength of between 1200 and 1400N. The wire shall be strained on each end on polycarbonate strain insulator and run through W-plastic insulators nailed to posts by use of deep sunk heavily galvanized 2" u-nails. ▪ Shall be High Tensile Steel wire b) Nominal diameter of 2.5mm subject to a tolerance of 2.5% c). ▪ Shall be heavily galvanized with a continuous zinc coating free from lumps, black spots and at least 280gm/m2 d). ▪ The metallic zinc used in coating bath shall have a purity of not less than 98% e). ▪ The zinc coating and adherence on wire shall as per Kenya Bureau of Standards Specifications KS-06-24-1987.
Earth Wire	The earth wires shall be as the live wires above.
Electrification (Power Source) and CCTV	Source of power shall be Solar/inverter/battery system. There shall be 8No. energizer points. Each energizer point shall have 2No. Energizer of at least 16 joules stored energy,4No. Network IP cameras,1No Data switch, Media converters and solar power systems located 8km apart along the fence line. 2NO. Weatherproof mounting cabinets shall be used to install solar and network equipments. Each Energizer to power a 8Km fence line The 60KM fence line shall have 8No. monitored zones.
Double Insulated Lead wires	Lead Wire (Under gate cable) in PVC pipe will carry power from the energizer house to the fence and the same to be used where there is any crossing like across gates, roads, grids, bridges over pass, under pass. At every passage, there will be a cut out switch. The lead out cable shall be of 2.5mm diameter, double insulated in heavy duty polyethylene UV protected PVC material, put through a 25mm heavy gauge PVC pipe and laid 500mm below ground level. U-bends shall be constructed using bends, elbows and unions at points where the lead out wire goes into or comes out of the ground for the bend to face downwards.
Lightning Diverter	At every energizer installation, there will be a set of Lightening diverter installation for protection of the electrics. The diverter shall have a well constructed loop and choke assembly complete with PVC or insultimber supporter.
Earthing for Energizer	This shall be identical to earthing for the fence but shall be provided separately using 12No. earth pegs set at 2m spacing. At the same area there will be earthing for the lightening arrester which will consist of 6No. pegs also at interval of 2m.

DESCRIPTION	SPECIFICATIONS
Crossing Gorges/lagers/riverbed	In Areas with gorges and dry river beds, there shall be a strainer assembly on either side at a height of 6m above the highest water level. The overhead fence across the valley shall be of the 14 electrified wires. In deep gorges and valleys fence chain danglers will be suspended under the fence to stop people/ big wild game from crossing. The number and length of the danglers will be determined by the shape and depth of the valley. A flood gate controller will be installed at every river, gorge or valley crossing.
Gates	Gates shall be constructed at strategic points to be determined on site.
Clearing of The Fence Alignment	Within a corridor of 7m width along the eased section of the land for the fence on either side of the proposed fence will be the fence alignment to be cleared of all vegetation and top soil up to a depth of 200mm cut The ground within the corridor shall be levelled by grading, set so as to leave a 3m width of the corridor to either side of fence to serve as fire break and service road and sloped as is most suitable according to terrain so as to allow for surface drainage.
Drainage and Earthworks	Where necessary, catch water, cut-off and side/mitre drains shall be cut with an earth moving equipment or human labour to deviate run off from the service road. Simple drainage structures (culverts or drifts) shall be constructed where identified by the supervisor. Where necessary forming the appropriate cross sections shall involve cutting and filling and in such cases the fill shall be compacted in layers to 95% MDD ASHTO T99 in accordance with the Standard Specification for road and Bridge Construction.
Mesh Wire(if applicable)	▪ The Tight lock shall be galvanized to a weight of 350gm/m2 where proof is by KEBS test certificate ▪ Tensile strength of 1200 – 1400N where proof is by KEBS test certificate. ▪ The mesh shall have a width of 1500mm. ▪ The mesh shall be 100m roll. ▪ The nominal diameter of wire forming the mesh shall be 2.5mm with a tolerance of (+or– 0.02mm). ▪ There should be 10line wires equally spread at 150mm. The droppers (vertical wire) to be a continuous length of wire at 150mm centers. ▪ The knot tying the longitudinal wires to droppers shall be of Tight lock, (no weld mesh shall be allowed). ▪ The tight lock will be attached to the bottom wire earth wire of the electric fence using ring fasteners at an interval of 200mm.
Warning Signs	▪ Shall be made of UV protected PVC plate. ▪ Size 200mm×100mm. ▪ Color shall be bright yellow. ▪ Inscription written in black ELECTRIC FENCE.

DESCRIPTION	SPECIFICATIONS
	▪ Eligible with lettering not less than 25mm in height. ▪ A legal requirement for all electric installations.
Control Room	The control room shall have: ▪ 40 inch LED HD monitor. ▪ Keyboard and mouse. ▪ 8 hours backup power supply. ▪ Server with the following minimum specification.
Live Fence Indicator t	The Live Fence Indicator to be place along fence. The indicator to blink as long as the fence line has sufficient power. ▪ Visible from 3000M. ▪ Will not flash if the fence voltage is too low. ▪ Water and UV resistant. ▪ Low voltage cut off.
Lightning Diverter/ arrester	At all places where energizers are installed there shall be a lightning diverter ▪ Standard Lightening diverter is completed with spiral wire earthing system connection. ▪ Not less than 30amps.
Solar Power at Energizer	▪ 2 x370 Watt Solar Panel as LG or approved equivalent Connector Cable. ▪ 1 x Unlock Key H4 connectors (locknuts, Solar Combiner Box, Din Rail Mount circuit Breakers, 80 MPPT Charge Controller Solar Surge Protection Device). ▪ 1000W 12V Inverter. ▪ Solar DC Disconnect. ▪ 50mV DC Shunt for Current Monitoring Meters ▪ Solar DC Ground Fault Protector, 63A. ▪ DC Din Rail Mount Breaker. ▪ Solar Surge Protection Device. ▪ 2x12v, 2000AH lithium battery.
370W Monocrystalline Solar Panel	▪ Monocrysta lline / N-type Cell Configuration 60 Cells (6 x 10).
Solar Top Post Mounting	To consist of 2No. parallel RHS galvanized steel post ,750mm apart and being 6 metres above ground. RHS to be 150mm minimum diameter made of Hot dip galvanized round hollow steel (RHS)(Minimum coating 80- micron).
Line Insulators	▪ W-Insulators. ▪ Polyethylene material. ▪ Open-face for good drainage. ▪ With holes for anchoring staples. ▪ Made of UV protected PVC material.
Strain end Insulators	▪ Bull nose type. ▪ Porcelain material. ▪ Fire resistant. ▪ Long tracking distance. ▪ High quality glaze finish.

DESCRIPTION	SPECIFICATIONS
Corner and Line Insulators	▪ Reel round Insulator. ▪ Porcelain material. ▪ Fire resistant. ▪ High quality glaze finish.
Battery	Solar battery 12 volts 100 AH deep cycle cells
Joint clamps	Fence clamp
Staples	2.5 cm x 2.5 cm fencing nails
Nails	Staples (U-nails) shall be: ▪ Heavily galvanized wire nails. ▪ Long shank. ▪ 2 inch. ▪ Hot dipped.
Earth pegs	15 cm x 180 cm G.I tube
Lightening arrestor	Lightening diverter
PVC pipe	Plastic 2.5 mm diameter
Cement	Ordinary 50 kg bag
Ballast	2.5 cm x 2.5 cm machine crush
Sand	River sand

Storage of materials

Construction materials will be stored on site. Bulky materials such as rough stones, ballast, sand, posts, blocks and wires will be carefully piled on site. To avoid piling large quantities of material on site, the contractor will order bulky materials such as sand, gravel and stones in quotas. Materials such as cement, paint and glass among others will be stored in temporary storage structures to be built for this purpose.

5.4 Operations 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 earthlings.
- No disconnected lead-out wires.
- No wires are in contact with vegetation or other objects.

To ensure proper monitoring and maintenance, the community members who will be employed 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. At a time when the human encroachment on wildlife habitat has reached untenable heights where HEC occurrences are regular, every measure possible should be looked at. This mitigating project could be a “win, win” venture to halt crop raiding elephant and at the same time halt illegal activities in the Protected Area, especially elephant poaching.

5.5 Decommissioning Phase

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, the 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.

5.5.1 General Notes on Structural Works

- All measurements are shown in millimetres. DO NOT SCALE off this drawing.
- All levels and dimensions to be checked on site before any building work commences.
- All sections should be read as per the floor plan and all drawings must be read in concert with each other. Any discrepancies to be reported to the office of the consultant.
- All work to be strictly in accordance to with the standard specifications and notes.
- The drawing is to be read in conjunction with specifications and all other relevant drawings.
- Walls below 200mm thick to be reinforced with hoop iron at every alternate course.
- Depth of foundation to be determined on site to SE approval.
- PV denotes permanent air vents over doors and windows as shown on drawings.
- Damp proof course must be provided under all external walls at grade. DPC to be minimum 150mm above ground level.
- Drain pipes passing under tarmac, driveways, and buildings to be encased in 150mm thick concrete surround.
- All reinforced concrete work to Structural Engineer's drawings.
- All sanitary works to the entire satisfaction of Mechanical Engineer.
- All roads, storm water drainage and foul sewerage to Civil Engineer's drawings.
- All electrical works to the entire satisfaction of Electrical Engineer.
- All soils under slab and around external foundation to be treated for termite control.

5.6 Roofing works

Roof pitch @ 25 0 Box Profile roofing sheets on 50x50 purlins, 100x 50 timber truss &rafters, 100x50 struts & ties & 100x 50tie beam and wall plate to Eng. Details.

5.6.1 Electrical works

Electrical work during construction of the premises will include installation of electrical gadgets and appliances including electrical cables, lighting apparatus, sockets etc. In addition, there will be other activities involving the use of electricity such as welding and metal cutting.

5.7 Description of the project decommissioning activities

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the top soil and re-vegetation using indigenous plant species. The proponent has developed a comprehensive landscaping plan. The site will be landscaped using plant species available locally. This will include, tree planting, establishment of flower gardens and grass lawns to improve the visual quality of the site.

5.7.1 Demolition works

Upon decommissioning, the project components including the electric wire removals and associated facilities, building, pavements and drainage systems, will be demolished. This will produce a lot of solid waste, which will be reused for other construction works or disposed of appropriately by a licensed waste disposal company as per the directive of the lead agencies including Council and NEMA.

5.8 Material inputs, products, by-products and waste

5.8.1 Tools and Machinery

The following tools and machinery are to be used:

- Hammers and mattocks;
- Wheelbarrows;
- Spades, trowels and other masonry tools;
- Concrete mixer (diesel-operated);
- Poker vibrator (for removing air bubbles and excess water from concrete).

5.9 Waste and by-products during construction

The waste and by-products arising from this project during construction include the following:

- Construction debris (from concrete and broken stones);
- Excavated/ dug soil and rock;
- Wooden pieces, timber cut-offs and left-over timber;
- Waste water;
- Sanitary waste.

These wastes will be disposed of by the contractor under the supervision of Proponent Site Representative who will follow the *Waste Management Regulations, Legal Notice 121 of September 2006*.

6 PROJECT ALTERNATIVES

6.1 The Proposed Development Alternative

This ESIA Report will be presented to the National Environmental Management Authority. This will help in evaluating and examining the effects of the project on the environment. After the evaluation of the proposed development alternative an Environmental Impact Assessment License would be issued. This way, NEMA would approve for the implementation of the project. However, the development has to ensure that all environmental measures are complied with during the construction and operation period.

The alternative consists of the proponent's final proposal with the inclusion of the NEMA guidelines and regulations and procedures. This is as stipulated in the Environmental Management and Co-ordination Act (EMCA) of 1999, which aims at reducing environmental impacts to minimum extent practicable.

This section analyses the project alternatives in terms of technology scale and waste management options.

6.1.1 Scaring of problematic animals

This is the main method used by 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 which include:

- Shouting /screaming.
- Beating of empty tins.
- Using dogs to scare.
- Using whistles.
- Lighting fires, torches and smoke.
- Burning of tyres to produce foul smelling smoke.

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.

6.1.2 Moats

This is the second method used to control human-wildlife conflicts and has had a good measure of success. Conservancies has successfully used moats in the past especially with regard to establishing conservancy plantations.

Moats are essentially trenches dug to stop wildlife from entering community land. Moats are expensive to build and maintain. Though low in terms of material inputs, they require a lot of manpower in development and maintenance, and most have indeed failed due to lack of the latter. Several moats of different sizes and lengths exists in the proposed project area though some are no longer

working due to lack of maintenance with subsequent filling up through erosion. Elephants have also learnt how to fill moats up with soil and cave in the sides.

Moats are also unsuitable in swampy and rocky soils, and along river valleys which wildlife use to gain access to community land. Moats are also un-environmentally friendly with regards to vegetation clearance, soil erosion, interruption of drainage systems, and are liable to siltation and refilling through erosion and by the elephants. They may also become health hazards when filled with stagnant waters.

Thus, though moats have shown some success rate, they are an expensive option as a long-term solution. Further, the terrain is unfriendly and maintenance a major problem with regard to their sustainability.

6.1.3 Live Fences

This is the most environmentally friendly option though its capacity to mitigate human-wildlife conflicts may be limited especially considering that elephants are the main problem.

Live fences mainly consist of 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.

A cactus species Opuntia exultata has been tried in some parts of Laikipia and Narok but is slow growth process and potential to spread are a major limitation. The sharp prickly thorns of the plant inflict intensive pains on the elephants, thus deterring them. Mauritius thorn (Caesalphinia decapetala) was effectively used to control virtually all animals (including primates) along the Salient of Aberdare national park before the electric fence was introduced in 1989. There is however differing opinion on whether it is an invasive species or not.

6.1.4 Barbed Wire

This is also feasible but would have more or less similar impacts of development as an electric fence with regards to pitting and posts. It would however require little clearing and maintenance would also be low. It would also be cheaper to construct and maintain.

The fence would however be ineffective in terms of control of the problem animals in the area, namely, elephants. It would be destroyed severally and would not offer long-term protection.

6.1.5 Chain Link

The effectiveness of a chain link would be like that of a barbed wire, though it is stronger. It would be able to control all small animals but be ineffective in controlling larger ones. A chain link would also be destroyed severally and maintenance would be very high.

Impacts of pitting and pole erection would be similar to that of the barbed wire and electric fence. Its installation costs are higher than the barbed wire and it would require minimal clearing of vegetation.

6.1.6 Stone Wall

This would be an effective but expensive method in terms of both development 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.

6.1.7 Control Shooting

KWS uses the Problem Animal Control (PAC) method to scare, kill or drive away problem animals from community areas. This method may at times lead to loss of wildlife and human deaths.

The method is basically a reactive measure rather than a preventive measure and only serves short term remedies after damage has occurred. PAC can only be undertaken by KWS and is thus limited by scarce manpower, fuel, time, and maintenance costs for vehicles and planes. It is thus ineffective where human-wildlife conflicts abound, and in areas as large as all athi areas where this conflict is spread. In terms of conservation, the method is also unsustainable.

6.1.8 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.

The fence however has high initial costs of establishment and also require regular monitoring. Where fences have been erected, human-wildlife conflict has drastically reduced and livelihoods improved, social order has been maintained and even academic performance improved. People have also appreciated wildlife better in these communities and they generally relate better with KWS staff.

There are various fence designs with different efficacy in terms of mitigating human-wildlife conflicts. There are two-strand fences which only control elephants while allowing all other animals to pass through; four strand; 6 strand and eight strand fences, a two-strand fence has been recommended, as it will easily control the large animals without limiting movement of humans and domestic animals. The two-strand electric fence has also very minimal disruption to the environment.

6.1.9 Bee keeping.

The idea explores the use of Beehive Fences as a natural elephant deterrent, helping protect farmers and farmland. It is based on an innovative study using elephants' fear of African honeybees to help reduce crop-damage and minimize other human-elephant conflict incidences. A win-win addition to a toolbox of deterrent methods, beehive fences help create a social and economic boost to farmers through pollination services and the harvesting of 'Elephant-friendly honey'

6.2 Analysis of Power Sources

Even if the two-strand electric fence option is chosen, the question of how the fence will be powered comes in and there are a few alternatives to choose from.

Power from the national grid:

This is a possible and reliable source of power for the proposed fence. However, operation costs in terms of power bills may be unsustainable. The option would also require getting the necessary licenses and working agreements with the Kenya Power.

Thermal power:

This option would require use of a generator to power the fence. Though easy to undertake, the option would be expensive in the long run due to fuel costs. There would also be negative impacts from noise and exhaust fumes, oil and fuel spillage, and others like dust and noise associated with vehicular movement.

Wind power:

This is an attractive option but may be difficult to implement due to high initial cost.

Solar power:

This is the best option and the option that the project design intends to use. It is fairly easy and cheaper in the long run. It has also been tried and seen to work within the conservancy and elsewhere. Its main handicap is vandalism and theft of panels and batteries.

6.3 Alternatives of Fencing Poles

Different fencing poles can be used in the erection of barriers. These include plastic poles, cement poles, live trees, and timber poles. Plastic poles have in the past been used successfully in the Aberdares and have the distinct advantage of being malleable and easy to work with. They are also light and longer lasting as pests do not attack them. They have in the recent past become very expensive.

Cement posts are also longer lasting but are heavy and also very expensive. Transport costs due to weight and carrying them by hand through rough terrain would also prove fairly difficult.

The project intends to use both live trees and timber poles to cater for areas where alignment of trees will be difficult

6.4 No project Option and its Associated Impacts

This aims at maintaining the status quo of the situation. This will mean there will be no fence as proposed and therefore, all the efforts by the community and other institutions will be rendered useless. This will make the local people continue suffering from wildlife destroying their crops, property and endangering

their lives. This makes the 'no project option' expensive and unacceptable to the community.

a) Continued Destruction of Crops

The communities settled next to the National Park are smallholder farmers who grow a wide range of crops. All these crops are subjected to severe damage by the elephants and constitute a major economic loss to the farmers.

b) Food insecurity

The destruction of food crops means the settlement communities do not harvest adequate amounts of food and sometimes rely on relief food. Being agriculturists, they also hope to have some surplus food to sell. They thus need to buy food they would ordinarily grow.

c) Impacts of human health

Community members' long stays outside their shelters to scare the elephants at night will continue to expose them to health hazards like pneumonia, flu and common colds. They thus become a weaker community and will have to incur medical expenses which are difficult to get compensation for. With increased conflict, people will also be injured or killed by the wildlife leading to further medical and funeral bills impacting negatively on the living standards of the community and individual families affected.

d) Disruption of social order

The human wildlife conflicts disturb social order with people being awake at night and sleeping during the day. The most annoying thing was that the whole neighbourhood has to remain awake including children.

e) Loss of Productivity

The disruption of social order results in reduced community productivity especially with regard to agriculture which the main economic activity. This is compounded by illnesses associated with their being out at night. Productivity also includes children performance in schools as they either miss school due to fatigue from lack of sleep, or because of insecurity as the elephants may still be in the surroundings.

f) Insecurity

This is both real and perceived insecurity as animals like elephants have injured and claimed several lives in their communities. They (people) also disclosed that it is scary for them to walk at night for fear of being attacked by wild animals including elephants, hyenas and wild pigs. After a night of terror from the elephants, children are afraid of going to school early in the morning, meaning they get to school late and their leaning is negatively affected.

g) Destruction of infrastructure

Elephants also cause infrastructure damage to water pipes, water tanks and even to schools. Water supply and learning are thus affected, with children

having to stay home or learning from outside as repairs are being undertaken. Communities also have to pay for such repairs.

h) Poverty

All the negative impacts associated with human-wildlife conflicts affect the living standards of the communities. They make the communities poor and perpetuate them in poverty. With increased conflict, the poverty situation will get worse as communities become unable to send their children to school.

i) Poaching and snaring

These are bound to rise with increase of human-wildlife conflicts and poverty levels. The wildlife barriers, though meant to control animal movement, also restrict human access to selected areas which are easy to monitor. The no intervention approach will thus leave the whole boundary open for illegal human activities like poaching. Other illegal activities like charcoal burning may increase with the uncontrolled access in and out of the park. Other environmental crimes like theft of biodiversity may also occur.

j) Community relationship with wildlife and KWS:

Communities, especially where barriers do not exist, are already tired of the human-wildlife conflict menace. Their view towards wildlife is that of a nuisance other than a resource. Their tolerance towards wildlife is changing to hostility and this is bound to increase with the no intervention approach, making conservation of fauna and even flora difficult. With the no intervention approach, the relationship between the settlement communities and KWS will continue to be lukewarm. The communities are of the opinion that KWS is more concerned with wildlife than the people: “They rush in when they hear a wild animal is killed in an area but take time when a person is killed by their animals”.

7 PUBLIC CONSULTATION

7.1 Background

Public participation is enshrined in the constitution of Kenya 2010 and EMCA Cap 387. This process serves to disclose the proposed project to stakeholders, neighbours and interested parties. Further, the consultation enables the community to present concerns that they deem to be associated with a proposed project and provide suggestions on how to mitigate/ enhance the impacts. The Environmental Expert contacted the local administration specifically Location Chief and the village elders. A meeting was held at the proposed site during the public consultation exercise.

Public consultation in the EIA process is undertaken during the project design, implementation and initial operation. The aim is to disseminate information to interested and affected parties (stakeholders), solicit their views and consult on sensitive issues.

7.2 The Consultation process

Community participation is encouraged during the implementation of development projects.

Section 35-2 of The Environmental Impact Assessment and Audit Regulations 2003, requires that an EA should *"examine and seek views on environment, health and safety issues from the local community and other potentially affected* communities*"*.

The objectives of the public consultation process are as follows:

- To gather information on likely impacts of the project as perceived by stakeholders
- Disclosure to the public of planned activities of the proposed project and impacts identified through the Environmental and Social Impact Assessment;
- Identification of concerns and grievances from interested and affected people by asking local residents about problems they anticipate with the proposed project and how these can be mitigated;
- Harnessing of local expertise, needs and knowledge from interested and affected people;
- Response to grievances and enquiries of affected people.

7.2.1 The consultant carried out the public consultation as follows:

- Through interviews to neighbours and stakeholders;
- Public notices.

The mapping was done as follows:

- Those who will be adversely affected by potential environmental and social impacts.
- The most vulnerable stakeholders.

- At what stage of the project development is which stakeholder to be engaged.
- What are the various interests of the project stakeholders and what might influence them?
- Which stakeholders might help to enhance the project design.
- Which stakeholders can best assist with early scoping of issues and impacts.
- Who opposes or supports the project, its changes and impacts.
- Whose opposition could be detrimental to the success of the project.
- Which departments of government are relevant to the project.
- Who is critical to engage with first and why.
- What is the optimal sequence of engagement?

7.2.2 Public participation was guided by a number of objectives namely to:

- Improve transparency and increase public confidence in ESIA Study.
- Identify the social, bio-physical, economic and environmental concerns as perceived by the public.
- Identify the positive and negative impacts that the project should consider.
- Identify and record contentious issues that could later bring conflict.
- Obtain local input into the design of the project, alternatives and mitigation measures of negative impacts of any nature.

7.3 Objectives of Stakeholder Engagement during the ESIA

The objectives of the stakeholder engagement during the Environmental Social Impact Assessment phase, taking into consideration regulatory requirements and good practice guidelines are to provide sufficient and accessible information to stakeholders during the:

i. **Screening Phase;** - Receive and disseminate initial information about the proposed project; - Contribute to the design of the stakeholder engagement process; - Provide initial comments and responses to the proposed project; and - Contribute local information and knowledge

ii. **The Scoping Phase;** - Raise issues of concern and suggestions for enhanced benefits sharing

Verify the following:-

- that the community issues are always recorded.
- Community is engaged in identifying reasonable alternatives for siting various site specific activities and projects elements.
- Contribution of relevant local information and traditional knowledge to the environment assessment.

iii. **The Impact Assessment Phase** - Dialogue impacts with the local community - Ensure contribution of relevant information and local and traditional knowledge to the environmental assessment; - Verify that their issues have been considered in the environmental investigations; - Comments on the findings of the social and environmental assessments. - Discuss the reports and provide consent as to their project issues

iv. **Mitigation Management Plans** - Verify and dialogue how the impacts have been managed; - Contribute relevant information and knowledge to management plans; - Comments on the proposed management plans; and - Commit to monitoring and grievance mechanism defined; - Discuss the management plan proposed

The consultant employed various forums to ensure public consultation. They included; focus group discussions, administration of key Stakeholder questionnaires.

7.4 Stakeholder Engagement during Development and Operation Phase

Stakeholder engagements during the development and operations phases of the project are determined both by various activity schedules that the project demands and the commitments defined within the specific requirements including the following:

- Considering the commitments to continuous reporting to the stakeholders throughout the life of the project;
- The need for local community based engagement and dissemination of information about the project; Given the detailed and comprehensive information demands that this commitment implies;
- Identifying the need to keep the community ready and engaged on the project

7.5 Pre-Development Phase

At the pre-development stage the following stakeholder engagement process details are on-going and in preparation for the development stage:

- Following up on commitments made and subjected to the environmental permit acquired from the regulatory authorities.
- Following up on the commitments made to the community in relation to the reporting on various activities as key stakeholders in the process.
- Clear communications including tendering stages, survey works and the investment due diligence requirements of various potential and actual investors of the project.
- Coordinate community meeting to enable new opportunities including the CDM to engage with the community with clear explanations to the community about their benefits to these or any additional opportunities, brought about by the project.
- Preparing the community for the up-coming development phase and the challenges expected as delineated in the potential impacts assessment through sensitization meetings and information;
- Continuing with process engagements that are incomplete even as the ESIA draft report is submitted including: Completion of detailed in-depth engagement, deliberations and drafting of the Community Trust documents.
- Completion of the ESIA for the associated institutions.
- Setting up detailed structures, plans and resources for management of the identified potential mitigation measures.
- The development and dissemination of a grievance mechanism to manage the pre and development and operations phase of the project.

7.6 Grievance mechanism:

Development Stage:

Management of community issues associated with the project. Locally accessible community liaison officers able and willing to manage grievances within outlined procedures will be engaged. Clear and transparent non-judicial process of management of grievances with the help of local traditional structures including elders has been discussed and agreed as the mechanism by which grievances will be handled. A well-functioning grievance mechanism is designed and proposed by the community during the meetings is necessary and will include the following aspects:

- Be predictable, transparent and credible process to all the parties in any grievance but more so to the local community members.
- The outcomes should be fair, and effective and lasting as would also be judged by the elders who participated in considering the grievance as was reported.
- Should build trust as an integral component of broader community relations activities.
- Should enable systematic identification of emerging issues and trends, and in general meetings facilitate awareness of these trends and facilitate correction and pre-emptive engagement.

7.7 During construction, the site manager will be responsible for handling the grievances

- There should be a grievance desk in the community.
- All grievances and complaints solution mechanism should be devolved to the lowest possible unit so that different project actors can lodge their concerns easily and effectively.
- The person dealing with the complaints should avoid bribery and distortion of the complaint from the community. The grievance officer should be a member of the community with the community interests at heart; have effective ways to avoid changes of the complaint through corruption.
- Provide ways in which the complaint can be forwarded in local language and effectively translated into official languages.
- Ensure an effective data management system (storage, retrieval of complaints).
- Have a prescribed way of managing a complaint from beginning to end.
- Have an elders represented in the first level of mediation.
- Second level of mediation should include local administration like the chief.
- Third level should include elders, local administration and legal representatives.
- Community participation and ownership is important.
- Ensure an effective community reporting on how the grievances were resolved.
- Continuous, efficient monitoring and evaluation of the effectiveness of the whole grievance mechanism should be adopted.

7.8 Community Awareness and Information

7.8.1 Project Management Communications

The project should maintain engagement throughout the life of the project. The communication given should be consistent to the information needs provided in the plan. This includes communication about meeting of the community relevant activities. These include but not limited to:

- **Project Activity Plans**: during development and operations to enable effective participation and review. There should equally be adequate information disclosure about the activities as has always happened during the ESIA and the feasibility stages.
- **Community Trust Communications:** the activities of the trust should be communicated in an effective and participatory manner so that to enable continuous engagement and the feeling that the community is part and parcel of the establishment and management of the community trust.
- **Accessible Methods of Project Communications:** the local meetings are an effective way of providing information that is general as opposed to information targeting individual land owners or residents community members. The site office should have communications about development activities in a clear and ongoing manner. Community liaison officers should be accessible and fair. Grievances should be clearly recorded and fairly reviewed with the interests of the local community prioritized.
- **Project Report Communications:** reports produced will be in simple formats and will be discussed in open meetings. A summary in the local language will be given to allow and involve the least literate members of the community participate and understand the contents of the meeting proceedings. The reports will be periodically produced and shared with the community.
- These communications will be guided by operational phase plan scheduled.

7.9 Community Trust

The establishment, function, control and responsibilities of the Community Trust are as to be formed in line with intentions expressed by the developers of the fence (County Government of Makueni): -

7.9.1 Objectives of the Trust

These are continuous further engagement of the wider community to ensure the objective meet the wider community for its benefit. A project website will provide detailed information on the project. While other reports and news will be provided through the county media, county submitted reports, flyers etc. The broad areas of support, subject to full consultation and engagement, will be:-

- To preservation of the locals' culture and language for the specific betterment of the community.
- To development of infrastructure within the project area to benefit the indigenous community.

- To promote and sustain formal education (including schools and other facilities).
- To promote and sustain adult education and awareness into economic matters, including financial and legal services to understand the implications of the increased resources in the community.
- To promote health services (including clinics and other facilities) focusing on community based healthcare, primary health care, education and prevention on sexually transmitted diseases including HIV/Aids, education and awareness to avoid substance abuse and general management of good hygiene and good health;
- To manage natural resource including provision and preservation of water;
- To ensure that there is equality in representation of all focus groups:- women/widow, orphaned children and youth groups and that their interests are protected;
- Generally, ensure equitable distribution, management and use of wealth. This way no one section of the community is disadvantaged in deployment of resources that are available to the Trust;
- A central team or teams to be appointed from the various groups of the Community to ensure their interests are added to the formal establishment of the Trust.

7.10 Benefits of the proposed project

1) Incorporation of environmental, health and safety concerns.
2) Generation of employment opportunities;
3) Reduced human-wildlife conflict specifically the elephants.
4) Knowledge transfer.
5) Increased conservation.
6) Contribution to Government Revenue.
7) Improvement of businesses within the area.
8) Increase in disposable income within the area and environs.
9) Increased productivity and food security.
10) Better watershed protection.
11) Climate change mitigation and adaptation.
12) Improved security.
13) Improved social order.
14) Reduced cases of pulmonary diseases.
15) Social-economic impacts: peace, less damage to property and infrastructure; better relations with the national park management.
16) Public consultation and awareness for gathering environmental data, understanding likely impacts, determining community/ individual preferences, designing viable and sustainable mitigation plans.

7.11 Problems and concerns cited on the proposed development

- Possibility of pollution / contamination of surface and groundwater resources;
- Monitoring waste water to ascertain impact from spilled petroleum products;
- Health and safety policy and familiarisation with it;
- Noise management;
- Waste management;

- Minimization of water use;
- Minimization of energy use;
- Fire outbreak protection;
- Security.

7.12 Views of the Public Concerning the Project

Based on the study, the types of probable social reactions, arising from the implementation of the project was surveyed and recorded.

In line with the ESIA regulations, face to face interviews with local people were accomplished. A wide range of people were selected to consult on the project that included county government of Makueni representatives, national government administration representatives, farmers, business people, health workers, youth, women, etc. Their views are assumed to represent those of the entire community that will be affected by the project.

A summary of the suggestions and issues discussed by the beneficiaries are listed below:

Affected persons raised some pertinent issues of concern which are hereby summarized.

Attendant	Issues / concern	Response
Mr Peter Kamukwa	Once the electric fence has been put, we have been told it will bring positive and negative impacts. Will there be Gates to access water left?	There will be gates left but with hanging life wires to protect elephants from leaving the park. Also the wires will leave a space from the ground where human beings and cows/goats/ donkeys can pass.
Mr Charles Kyule	How will the riparian land be determined?	Surveyors will align the fence with the help of local community
Mr Patrick Mule	Misuuni area elephants have issues plus water scarcity? Elephant issues let it be a lasting solution.	Answer: For now, the electric fence is the lasting solution. Monitoring is easy because of the road. Government also compensates but snake is no longer being compensated since 2018when it bites human being, but is compensated when it bites domestic animals.
Mr Mumo Mbindyo – Kivwauni area	WE have problems with elephants. When we call officers from Kamungi Conservacy, Dan marcos they come only to beat us.	Wildlife Officer will address this issues in a separate meeting. Foe now lets discuss the project.
Mr Hillary Mutuku James –	Farmers at Athi River at Reparian land will they get any compensation	No compensation. This is your project to separate you from the wild animals. Riparian land is

Attendant	Issues / concern	Response
Makutano area	during project implementation?	Government owned. The Government will put the fence along its wayleave. So whoever is there is on Government land.
Eng Patrick Mule – MCA aspiring	What is the immediate action because we are in fear?	Contractor will try and finish the work within two months instead of 3 months. Elephants are many but we shall try to do our best.
Pastor Jeremiah Kyalo	What assurance as you leave here work will be done?	Contractor has already been given the project by County Government. The Dozer is already on the ground making the road. Elephant that were at the 33km fence have moved this area. We assure you all will be separated from you once the fence is done.
Joseph Wambua – Athi Makutano	When taking our domestic animals, they might enter to neighbors farms?	Solution lies with you. Please protect your farms by erecting fence.
Domiana Musyoka	How will the payment to workers be done?	The CGoM has informed the contractor to pay good rates. How the payments will be done it will be between the workers and contractor representative.
Vincent King'ele – Ndovoini area	We fetch water at the river, is there danger of our children being electrocuted? If I planted trees, will there be any compensation?	Along the road/ electric fence there will be sign of danger/ Hatari. People will be educated through Baraza, Schools, Churches etc. No compensation on trees. If they will be enclosed in the park you can acess through underpass. There will be gates left open but with live hanging wires to protect elephants. There will be employed personnel by the CGoM to man the gates, power houses.
Mrs Christine Luvasi	How many metres from the river will be taken or left? If you put more wires how will we fetch water?	Answer: Riparian land is measured from the centre of the river. Take your palm centre and assume that is the centre of river. Measure to the edge and assume that is the water level when river flows maximum. Take the same width and map it on the land. That is riparian land. It measures minimum of 6m and maximum of 30m. So the surveyor is coming to mark the area that will be taken. Please work with surveyor to help taking the minimum land. More wires will be at later stage. Access gates will be left for use. Will

Attendant	Issues / concern	Response
		be manned by you as employees of CGoM.
Mr Luka Mutavi - Utuluni	Can the contractor uplift the road at the areas where they join small roads?	This will be done.
Mr Joel Muya wa Sefu - Iviani	River is not straight; will the contactor straighten the road?	Answer: The road will follow the contour that goes zigzag.
Mrs Beatrace Maingi - Iviani	What will happen to my crops within Riparian land?	The crops will be lost, that land does not belong to you. The Government has let you free to use it. Once it wants it back, it can be taken anytime.
Mr Japeth Kavithi - Kithayooni	The electric fence will only protect Elephants, what about Hippos?	True the 3 wires will protect the Elephants only. For now, let's protect the big animals first. They have been our main problem.
Mrs Christine Luvasi	Will Solar panels power run all through to protect elephants knowing the area sometimes the area is cloudy?	Yes. it will be able. The design will support the project. There will be 24 hours surveillance
Mrs Winrose Mulei	Hippos are too much and nuisance?	Lets first deal with the big animals. Lets chase the hippos the way you have doing it before. Some area electric fence can protect them. Low areas we will put an extra wire to protect.
Mr Jeremiah Suza – Iaani Village	The river might wash the wire after sometime?	With your help let's put the electric fence away from the flooding area
Mr Justus Kioko – Iaani Village	How will the casuals be employed?	Please go and seek employment at the project site. Liaise with local authority to get employed.
Mr Luka Muindi - Ndovoini	Comment: At every 8km there will be workers, we don't want to meet new faces who are not from the area.	Locals will be given the first priority by the County Government of Makueni
Mr Raphael Wambua – Athi Kamunyuni Village	If I farm 1 Acre of land, the 7m road can take all the land?	The road will be along the riparian land. You might lose your farm but not all.
Mr Robert Masila - Kithayooni	The riparian land can raise water and wash away the electric fence hence electrocution?	Locals please help surveyors to put the fence at a safe area. Educate children and community not to touch the fence either standing or lying.

Attendant	Issues / concern	Response
Mr Paul Kasesi - Mukomane	Sustainability of the fence, water can wash them away?	Locals please help surveyors to put the fence at a safe area. Employees will patrol the fence 24 hours.
Attendants		▪ Immediate action on the elephants is needed within our area. ▪ Contractor is first finishing the 8km which was among the done 33kms. ▪ 1.5million has been set aside to be used for surveillance of the fence. ▪ All attendants agreed with show of hand they support the project.
Josphat Kimindu - Mavindini	Informed the meeting there is draught.	Comment: Ward admin informed the rain is coming and we shall encourage community to do farming because Elephants will be put away from community.
Stephen Ngelu – Former Speaker (aspiring MP seat)	Remarks: Informed how he has helped to bring development in the area including roads and current electric fence project.	-
Mr. Meshak Musyoki	Remarks: He informed he is one of the happy people when seeing the community accepting the project.	-

7.13 Future Consultations

The initial consultations during the preliminary design phase should be followed by more consultations as follows:

- Prior to commencement of construction;
- Construction phase;
- Operation phases.

Selected photos of Stakeholder's and public consultation Meetings in the area.








8 POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

8.1 General

The purpose of the environmental & social impact assessment (ESIA) of the proposed development is to improve decision making and to ensure that the project progresses in a sustainable approach. The ESIA identifies ways of improving the project environmentally and socially by preventing, minimising, mitigating, or compensating for adverse impacts. These measures will help to avoid potentially costly remedial measures.

The potential impacts are derived from the project activities and baseline information in addition to issues that emerged during scoping.

The potential environmental impacts predicted from the proposed project are varied and are expected to be both positive and negative. Some impacts will occur only during certain phases of the project life cycle while some will persist all through. Impacts are also expected to be of different severity irrespective their longevity, and as such, though some may be long-term, their severity might be low and vice versa. Some negative environmental impacts already exist in the area and are bound to occur even without the proposed project taking off.

The potential impacts of the proposed project have been listed in Table 8-1 below and analysed into different categories based on the perceptions and the consultant's previous experience in undertaking similar projects ESIAs and experiences gained from construction projects.

Table 8-1 Summary of potential impacts

Environmental and social impact	Positive/ negative	Direct / indirect	Temporary/ permanent	Major / Minor	Occurrence	
					Design and Construction	operation
Increased employment opportunities.	Positive	Direct	Permanent	Major	✓	✓
Knowledge transfer	Positive	Direct	Permanent	Major	✓	✓
Over extraction of construction materials	Negative	Direct	Temporary	Major	✓	-
Improved Government revenue	Positive	Indirect	Permanent	Minor	✓	✓
Improved local socio-economy	Positive	Direct	Permanent	Major	✓	✓
Utility consumption	Negative	Direct	Temporary	Minor	✓	✓
Fire and accident	Negative	Direct	Permanent	Major	✓	✓

Environmental and social impact	Positive/ negative	Direct / indirect	Temporary/ permanent	Major / Minor	Occurrence	
					Design and Construction	operation
Vegetation Disturbance	Negative	Direct	Permanent	Major	✓	✓
Soil erosion.	Negative	Direct	Temporary	Major	✓	-
Traffic Management	Negative	Direct	Temporary	Minor	✓	✓
Reduced air quality.	Negative	Direct	Permanent	Major	✓	✓
Noise pollution.	Negative	Direct	Permanent	Major	✓	-
Solid waste generation and disposal	Negative	Indirect	Temporary	Major	✓	✓
Public health and occupational health and safety	Negative	Direct	Permanent	Major	✓	✓
Contamination of soil and ground water sources incase of accidental spillages	Negative	Direct	Permanent	Major		✓

The following impacts are predicted as well as their mitigation measures throughout the life cycle of the project.

8.2 Positive Impacts

8.2.1 Generation of employment opportunities

There will be job opportunities for both skilled and unskilled labour during the construction phase. The contractor will be employing some amount of local manpower for the project execution.

8.2.2 Market for construction materials

The project will buy material from local hardware(s) and suppliers.

8.2.3 Knowledge transfer

The project will entail a lot of professional tasks such as in installation of the fuel storage tanks and connection to the dispensers. The locals will have an opportunity to learn from some of the specialised skills that are going to be employed while putting up the tanks.

8.2.4 Revenue Generation

Revenue generation; the County Government and the National Government will obtain various fees for licenses, permits and approvals required for the project.

8.2.5 Controlled human-wildlife conflicts

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

8.2.6 Food security and better yields

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. Farmers who might have abandoned their farms may also will start farming since the problematic animals will be contained within the protected area.

8.2.7 Sustainable conservation

Fencing of the ecosystem will enhance conservation activities in National park. Illegal activities such as poaching or subsistence hunting will be minimized, as access to the conservancy will be done through legal access routes. The involvement of communities in project will also ensure that perpetrators of such illegal activities are apprehended through community policing.

Other activities such as illegal logging and exploitation of conservancy vegetation will also be reduced. People will only use conservancy resources for specific purposes and in a non-degrading manner such as firewood collection and collection of fruits and tubes and other available food sources. Access to conservancy will only be at specific times of the day and through legal access gates.
Fencing will enable conservancy restoration of the already degraded conservancy sections by incompatible land use activities such as cultivation.

8.2.8 Improvement in environmental, health and safety issues

The proponent has incorporated environmental, health and safety concerns at the project planning stage. This will ensure a positive impact to the environment, as any adverse impacts have a mitigation plan in place.

8.2.9 Water catchment protection

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

8.2.10 Improved security

The electric fencing project will certainly have positive impacts to local communities who live adjacent to the conservancy. It is envisaged that community members will no longer be living in fear of potential raids and attacks by animals.

8.2.11 Mitigation of climate

Park restoration will lead to improved carbon sequestration; thereby help reduce the accumulation of CO2 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.

8.2.12 Improved social aspects

Communities living adjacent to Park have complained about lack of sleep especially during cold seasons when animals come from the conservancy, and harvest seasons when they raid their farms. Members of communities where there are no fences have to form vigilante groups to keep away animals especially elephants. This in essence disrupts their social order as they sleep during the day when they are supposed to work. Children also go to school late due to fear of encountering animals on the road or sleep in class as they keep vigil at night.
Hence setting up a fence along will restrict animal movement and ensure that they can sleep.

8.2.13 Reduced cases of pulmonary diseases

Keeping vigil at night to prevent animals from raiding farms predisposes community members to cold related diseases such as pneumonia. Hence erecting a fence will ensure that farmers can stay in their houses at night.

8.2.14 Social-economic impacts

One of the benefits of erecting up a fence is that it will ensure that families live in peace and harmony with wildlife. Members will be able to have time to socialize especially in the evening and bond in all that pertains to a normal family set up.

Losses incurred due to property damages, livestock injuries, will be reduced. This means that community members can have utilize their resources in other development activities rather than repairing or replacing damaged properties.

Farming activities will be intensified in areas where farmers had abandoned farming due to crop destruction by wild animals. Land will be fully utilized for farming which will lead to food security and increased income in households.

Other social economic impacts will include: employment opportunities during the development and maintenance of the fence; improved relations between the National Park and community members, which is currently unwholesome; and improved relations between communities and wildlife as they will co-exist.

8.3 Potential Negative Impacts from Electric Fencing

8.3.1 Some degree of vegetation loss

Clearing of vegetation during erection of the fence will destroy some biodiversity and also reduce wildlife habitat. The vegetation affected also forms part of the overall life supporting resources for animals, and an important component of the reserve ’s ecological services role which will be lost with the clearing. Loss of vegetation will also result in soil erosion and loss of soil moisture.

The fence will retain the animals within the park, as they will not be able to move in their former dispersal areas. This may result in range deterioration due to reduced habitat and resultant overgrazing and trampling. Degradation may also arise as the animals try to get ways to move into their former dispersal areas for food, water, saltlicks which may be fenced off. This will mainly be along the fence line where some destruction of vegetation may arise especially from elephants.

Mitigation measures:

The alignment of the fence will generally pass along the reserve boundary. Some existing fences however pass between the natural and plantation reserves. The fence will invariably lead to the clearing of vegetation. As part of the mitigation measures, the clearing will be limited to the fence alignment section only. Further, vegetation destroyed will be compensated through trees planting in the rehabilitation of degraded areas and agro-reserve components of the larger programme. Proper surveying and disposal of the cleared vegetation through sale or auction will be undertaken as past experiences have shown that large areas may be cleared of the fence's alignment with the aim of illegal logging.

8.3.2 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 development of energizer houses and other infrastructure associated with the electric fence.

Soil erosion will also arise due to vehicular movement during surveys and transportation of materials. Vehicles and machinery will also contribute to soil compaction, and even potential soil pollution through oil spillage.

Mitigation measures:

The proponent will ensure that digging of holes will be done manually and only in surveyed areas. Considerations on slopes and general terrain will also be put in place while erecting the fence. Proper drains will also be set up, constructed along erosion prone sections. The workers will also undertake backfilling of excavated sights. On the whole, heavy machinery will be used only where necessary and vehicles used will be serviceable.

8.3.3 Solid waste

Solid waste will be generated from development of facilities, and from left over development materials used in the erection of the fence. Other solid wastes will be generated by development workers in form of waste food, papers, packaging materials etc. Solid waste may also result from dumping along the fence by communities living adjacent to the conservancy.

Solid wastes may result to subsequent soil pollution, foul smells, and if allowed to pile up or spread, to an eyesore. Solid wastes especially food, also have the potential for affecting some wildlife behaviour as some become dependent on human foods. Littered waste bags in the park may be swallowed by animals leading to death.

Mitigation measures:

All solid wastes resulting from cuttings, materials used, and food stuff will be placed in bins and taken out of the conservancy for proper disposal in a sanitary land fill. Community members will be sensitized on the need to keep environment clean, and how to avoid inducing behavioral change in animals through food. Dumping along the fence will be mitigated through enforcement of existing laws and by-laws with the help of community policing.

- Provide suitable and well labelled solid waste containers;
- Proper segregation of solid waste;
- Reduce generation of solid waste at the source;
- Reuse of top soil for landscaping of the site;
- Empty packaging materials like cartons and cement bags should be piled in a safe place and sold to waste paper recyclers;
- Other solid waste to be disposed of at designated sites;
- Install oil interceptors along the storm water drainage channels;
- Provision of sanitary facilities for use by workers;
- The use of the "3Rs" philosophy of reuse, recycle and reduce will be adopted.

8.3.4 Movement of wildlife restrictions

The National Park is already virtually isolated from neighbouring wildlife habitats by intense small scale agriculture. However, the fence will have the effect of curtailing some animal movement outside the conservancy. The fence will reduce their habitat and access to any resources like water and salt licks which may be fenced off. The fence will also prevent wildlife from accessing farm lands which they frequently invade to feed on crops. The development of sections of the fence might also lead to wildlife seeking alternative routes, which might create conflicts in other areas.

The reduced access to any resources that animals currently use may result in overgrazing and trampling of vegetation leading to environmental degradation, changes in breeding patterns and behavior. The fence will also any current or previously existing block migratory corridors for wildlife especially elephants.

Mitigation measures:

It is envisaged that erecting fences will ensure that wild animals are confined within the park (some). In order to mitigate against cases of trampling of vegetation along fence, habitat destruction and destruction of reserve s, the ecological corridors and migration routes will be secured and left open.

8.3.5 Increased human activity close to Park edge

Stoppage of wildlife incursions outside the conservancy will encourage intensification of cultivation and settlement right up to the edge of the reserve. This could lead to increased pressure of the reserve 's resources (such as firewood and constructions materials), and an increase in the incidence of undesirable activities such as the setting up of fires and spraying of chemicals, which will impact negatively on wildlife.

Mitigation measures:

Human activity next to the National Park edge will be mitigated through community education and the need to reduce human-wildlife conflict even with the fence in place. Communities will thus be mobilized and educated on the importance of considering wildlife in their daily activities in order to co-exist.

8.3.6 Air pollution

This will arise from dust and exhaust fumes from vehicles and machinery during the transportation and erection and maintenance of the fence. Air pollution may result from development activities such as mixing of ballast and other development materials.

Mitigation measures:

This will be mitigated by giving dust masks and protective kits. Watering will also be undertaken where necessary and vehicles used will be serviceable. Foul smells will be dealt with by proper solid and liquid wastes disposal

8.3.7 Noise

This will arise from vehicular movement and development machinery. It may also arise from the development workers. Noise will impact on animals especially their movement and sourcing for food.

Mitigation measures:

Movement of materials and development vehicles at night will be restricted and so will any use of machinery at night and early morning. Machinery and vehicles used will also be well maintained.

8.3.8 Human wastes

This will arise from the development workers and will be dependent on how they will be accommodated during the development phase. If no proper facilities are availed, development workers might end up relieving themselves along the fence line with resultant impacts on health and hygiene, and pollution.

Mitigation measures:

Mobile toilets will be provided during development or where feasible, arrangements made with neighbours for use of their toilet facilities.

8.3.9 Increased accidents

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. Accidents may also occur due to exposure of community members to animals in the park during development leading to death or injuries. Other accidents are likely to occur during transport and development phase as people handle different machines, tools and vehicles. People and livestock may be injured as a result uncovered holes.

Mitigation measures:

Prevention of accidents will be of high priority to the proponent. Workers will be encouraged to take extra care in using equipment, on avoiding incidences of snake-bites, and animal attacks. The electric fence will also be fitted with warning signs in order to ensure people are not exposed to electric shock.

8.3.10 Oil spills

This will arise from the various vehicles and machinery used during the fences erection. Spills will also arise from the development camps set up during the fences construction.

Mitigation measures:

The proponent will ensure that no vehicles or machinery will be serviced on site to avoid instances of oil spillages. All servicing operations should be done in compliant garages or petrol stations

8.3.11 Over extraction of construction materials

During the construction phase, the contractor will outsource construction materials from various sources. Cases of over extracting these materials from one use may arise beyond their regenerative capacity.

Mitigation measures:

- Construction materials shall be from approved sources: for example: hardstone for building should be obtained from bonafide commercial quarries;
- Procure environmentally friendly and sustainable materials;
- Do not use the following materials for construction of the building:
  i. Asbestos in any form;
  ii. Asbestos substitutes or any naturally occurring man-made mineral fibres
  iii. Lead, Lead paint or other materials containing Lead which may be inhaled, ingested or absorbed;
  iv. Vermiculite, unless it is established as being fibre-free;
  v. Any product containing Cadmium that are regarded as being deleterious building material which are not in accordance with statutory requirements or with current accepted good building practice at the time of specification or construction.

8.3.12 Energy utilisation:

Mitigation measures:

- Develop an energy management plan;
- Construction machinery and vehicles should be maintained and used in accordance with manufacturer's specifications, to maximise efficiency and lower use of energy;
- Construction workers should be sensitised on the importance of energy management.

8.3.13 Traffic Management

The Development compound is expected to experience increase in the volume of traffic by vehicle flow to and from the facility.

Mitigation measures:

- The Contractor should plan and implement traffic management programme on daily basis;
- Comply with all applicable legislation and by-laws with regard to road safety and transport;
- Lane and junction design and signage to meet appropriate standards;
- Movement of construction vehicles timed to avoid peak periods;
- Ensure adequate entry and exit lane design and appropriate signage.

8.4 Potential Negative Environmental impacts during Decommissioning phase

8.4.1 Disposal of scrap metal an equipment

During the demolition works scrap metal and equipment will be part of solid wastes that require proper disposal.

Mitigation measures:

- Use a licensed waste collector to dispose the scrap metal and equipment.

8.4.2 Air/dust Pollution

Dust emissions are expected to result from demolishing of the development.

Mitigation measures:

- Practice dust management techniques, including watering down the site;
- Set up dust barriers/ screens at strategic locations;
- Provide and enforce the appropriate use of PPE against dust such as nose masks.

8.4.3 Solid Waste generation

Solid waste material such as metals arising from demolition activities during the decommissioning phase is expected.

Mitigation measures:

- Disposal of solid waste in compliance with EMCA 2006 Waste Management Regulations;
- Segregation of waste to encourage reuse and recycling, where feasible;
- Ensuring that the contracted waste collector is registered with NEMA to collect and dispose wastes.

If the mitigation measures are implemented during the design, construction and operation of the proposed Development, the potential negative environmental impacts will be managed and maintained to acceptable standards. Mechanisms

for implementation and monitoring have been recommended in an *Environmental Management and Monitoring Plan*.

8.4.4 Increased incidence/ HIV/AIDs

Increased diseases is expected because of influx and interaction with the local community.

Mitigation measures:

- Equip health centres with ARVs and protective devices to workers.
- Provide posters.
- Education to parents, schools, CBOs and FBOs.
- Counselling, civil education and instruction.

9 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

9.1 Introduction

The *Environmental and Social Management Plan* (ESMP) is a synthesis of all identified impacts and proposed mitigation measures, and assigns responsibility for implementation of these measures. The EMP is a working document, which provides direction and assistance in the following:

- Construction activity planning and procedures to protect the environment;
- Environmental mitigation during operations;
- Environmental emergency response planning and procedures.

The ESMP is prepared to show how site specific concerns and mitigation measures are addressed through the design, pre-construction, development and post-development / operation phase of a project might require amending. This is therefore a working document, which should be used as a basis for formulating more site specific Environmental Action Plans.

9.2 Objectives of the ESMP

The objectives of the ESMP are:

- To bring the project into compliance with applicable national environmental and social legal requirements, social policies and procedures;
- To outline the mitigating/enhancing, monitoring, consultative and institutional measures required to prevent, minimise, mitigate or compensate for adverse environmental and social impacts, or to enhance the project beneficial impacts.
- To address capacity building requirements within the relevant ministries if necessary.

9.3 Responsibilities

In order to ensure the sound development and effective implementation of the EMP, it will be necessary to identify and define the responsibilities and authority of the various persons and organisations that will be involved in the project.

The following entities will be involved on the implementation of this ESMP:

- County Government of Makueni;
- Independent Consultant;
- Supervising Engineer/ Architect;
- Contractor;
- National Environmental Management Authority (NEMA).

The Supervising Engineer/ Architect must be registered to supervise all activities related to construction works.

For effective environmental management and monitoring, it is proposed that County Government of Makueni acts as the responsible institution but supported

by an Independent Consultant and an Environmental Monitoring Unit to be constituted by technically competent people from key institutions. It is suggested that the TOR for the Contractor should include a resident Environment Manager who is to implement all the mitigation actions proposed in the ESIA.

9.3.1 Institutional Responsibilities

It is proposed that the institutional responsibilities for implementing the Environmental Management Plan shall involve:

- The Contractor, which shall include an Environmental Manager (EM);
- Contractor, in addition to his/her own internal capacity, shall contract a Supervising Engineer (SE) with one or more qualified environmental specialists; and
- An Independent Consultant Firm contracted by County Government to support in implementation and capacity development.
- The environmental Monitoring Unit, which shall consist of specialist organizations such as the Kenya Marine and Fisheries Research Institute, Kenya Medical Research Institute, Kenya Agricultural Research Institute, National Museums of Kenya, etc.
- The National Environment Management Authority (NEMA) and the representatives of the affected County.

9.3.2 Responsibilities of the County Government of Makueni

As the project proponent Makueni County Government shall bear the greatest responsibility and will undertake the following tasks:

- Oversee the development and implementation of the Final ESMP by the Environmental Management Unit (EMU) of the National Park and coordinated by the Independent Consultant.
- Oversee and facilitate the implementation of all time-bound (non-recurrent) environmental management measures in the Final EMP by the Independent Consultant.
- Make Park staff available for environmental training, including working collaboratively with the Independent Consultant's personnel to implement particular environmental management measures.
- For environmental management measures specified in the final EMP that are recurrent – such as biota and water quality monitoring - provide the qualified staff to carry out these recurrent tasks, or ensure that they are carried out through operating agreements or contracts with other entities.
- Oversee the work of the Supervising Engineer and the Civil Works Contractor and associated subcontractors; facilitate adaptive responses that shall have been formulated by the EMU to any unforeseen environmental problems that arise during project construction; and apply all appropriate financial penalties in case of non-performance or serious non-compliance with the Final EMP or other environmental legal requirements.

9.3.3 Responsibilities of the Independent Consultant

The Independent Consultant will be an internationally professional firm contracted to:

- Assist in developing those plans envisaged under the Environmental Management Plan during Year 1 of project implementation, before bidding begins on the civil works. In developing these plans, the Independent Consultant shall coordinate with the EMU.
- On behalf of and in close collaboration with County Government of Makueni, assist in the development and the timely implementation of all plans and tasks, except for those tasks specifically assigned to other entities such as the Civil Works Contractor or Supervising Engineer.

9.3.4 Responsibilities of the Contractor

The main Civil Works Contractor shall be responsible for full compliance with the ESMP provisions, as well as health and safety measures specified in the development. The Management Plan that will comprise part of the Final ESMP. The Civil Works Contractor-and all associated Sub-Contractors shall also ensure compliance with all Kenyan environmental laws and regulations, as well as international conventions.

The Civil Works Contractor shall appoint a Workplace Environment Manager (EM) and additional environmental specialists and staff as needed. The EM's expected to have at least 5 years relevant working experience regarding environmental management of infrastructure development projects, and should be familiar with Kenya's environmental legislatives requirements. The Contractor will be responsible for ensuring that all sub-contractors and workers are adequately informed and trained to comply fully with the letter and spirit of all environmental requirements specified in the Final EMP, the Environmental License(s) granted by NEMA and other Kenyan and international legal requirements.

9.3.5 Responsibilities of the Supervising Engineer

The Supervising Engineer will be a firm contracted by County Government of Makueni to supervise closely the daily work carried out by the Civil Works Contractor and relevant sub-contractors, including the environmental, health, and safety aspects. The environment-related staff of the Supervising Engineer will include (at a minimum) an Environmental Supervisor, who will lead the supervision of the environmental aspects of civil works, in accordance with the Development and Workers Camp Management Plan that comprises part of the Final ESMP.

The responsibilities of the Supervising Engineer include the following:

- Carry out regular environmental site surveillance to investigate the Contractors' site practice, equipment, and work methodologies with respect to pollution control and adequacy of environmental mitigation implemented, and to ensure that the Development and Workers Camp Management Plan is complied with.
- Monitor regularly the implementation of environmental mitigation measures and the Contractor' compliance with environmental protection, pollution prevention and control measures, and contractual requirements; advice to

the Contractor and associated subcontractors on environment improvement, awareness, proactive pollution prevention measures.

- Specify remedial mitigation measures that the Contractor must carry out, in the case of non-compliance with any part of the Final ESMP or other environmental legal requirements. Oversee the implementation of remedial measures to reduce environmental damage.
- In conjunction with the supervising engineer, calculate the financial penalties that the Contractor will suffer for particular types and length of environmental non-compliance.
- Ensure that environmental, health and safety issues are prominently mentioned in the Supervising Engineer's periodic progress reports to NIB.

9.4 The Project Management Unit (PMU)

This unit will be the national body that will oversee implementation of all project activities including environmental mitigation measures. The unit will be established at least 1 month before the start of the Project and will operate as follows: 1 year for pre-construction, throughout the development period and 3 – 5 years to monitor post impoundment impacts and take action where necessary. The operational costs of the unit will be factored into the project cost.

Specifically, the roles of the PMU are:

9.4.1 Management Plan Principles

The project is geared towards enhancing social and economic benefits through sustainable animals and human conflict. Development of the electric fence project would be expected to comply with the environmental conservation requirements in accordance with the established Kenyan laws and regulations. To realize these goals, acceptability by a majority of the stakeholders and minimal effects to the physical environment will require to be ensured through participation in the project and continuous consultations, evaluations and review of the design aspects throughout project implementation cycles.

It is also recommended that the environmental management guiding principles specific to this project improvement and water resources management be established to allow integration of environmental management considerations during development and operations. Among the factors that need to be considered in this particular project implementation will include;

- Ensure control of soil erosion and siltation of the water sources (rivers and the streams), Incorporation of electric fence safety provisions and the associated components.
- Enhancing integration of environmental, social and economic functions in the project implementation.
- Compensation of any land or property that may be affected by the project in accordance to the laid down regulations.

The contractors and other players in the project activities be prevailed upon to implement the EMP through a sustained supervision and continuous consultations.

9.4.2 Management Responsibilities

In order to implement the management plan, it is recommended that an expert be identified to oversee the environmental and social management aspects including the electric fence conservation, soil erosion control, re-vegetation whenever appropriate, water conservation and equity in distribution, enhanced sanitation and hygiene measures throughout project area. The expert would also be required to coordinate and monitor environmental management activities during development and post monitoring audits. Other recommended participants include;

- Water Service providers, in this case County Government of Makueni who have the responsibility to enforce water quality monitoring and efficient maintenance systems, procedures to minimize interruptions to water supply and ensure accessibility by all consumers.
- National Environmental Management authority (NEMA) through the county Director's Office shall be responsible of surveillance of environmental and social aspects of the project implementation.

9.5 Environmental Management Guidelines

The guidelines will include among other areas environmental management programmes, standard operation procedures, compliance monitoring schedules and environmental audit schedules as required by the law. Social harmony of the conservancy and associated component will be achieved through the collaborations with the stakeholders or community management committees introduced at various water consumption points.

9.6 Environmental Education and Awareness Rising

The beneficiaries need to understand the basic environmental principles. In this regard therefore the following steps may be considered;

- Creation of liaisons on all matters related to environment, health and safety.
- Encourage contribution of improvement ideas on specific issues related to the management of the facilities.
- Establish initiatives that would instil a sense of ownership of the facilities and related components to all beneficiaries.

9.7 HIV/AIDS Issues

The contractor would be expected to incorporate HIV/AIDS programmes during development phase. Awareness, prevention and training on HIV/AIDS and other social diseases is important during project development and operation phase. The awareness creation should be improved through putting up of banners, posters and training should be facilitated within the project area to the development workers and the community.

9.8 The Management Plan Matrix

Complying with the national laws and regulations, the ESMP will include;

- The monitoring plan.

- The institutional and managerial arrangement for implementation of the full ESMP.
- The cost of the implementation programme during pre-construction, development and post development if applicable.

In the final ESMP, It is proposed to analyze any measure present in the ESMP according to the following element;

- Justification and expected results.
- Conditions of eligibility.
- Main technical characteristics of the measure.
- Activities to carry out to implement the measure.
- Operating arrangements to implement the measure.
- Cost of the measure.
- Arrangements for monitoring and evaluation of implementation and impacts of the measure.

An Environmental and Social Management Plan (ESMP) is generally a tool for an organization to keep aware of the interactions that its activities have with the environment, and to achieve and continuously improve a desired level of environmental performance. It is designed to continuously identify and reduce the environmental harm (impacts) created by the activities of a project. This Environmental Management Plan details strategies to be implemented in the various stages of the project.

Training and human resource development is an important link to achieve sustainable operation of the project and environmental management. Staff and community members will be informed of their responsibilities for successful operation of various environmental management plan items concerning the electric fence.

Apart from having an ESMP, there will be a permanent staff charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring. This will ensure

- Implementation of the environmental management plan.
- Compliance with all relevant rules and regulations.
- Initiation of environmental monitoring as per approved schedule.
- Maintenance of documentation and records.
- Coordination with regulatory agencies and communities.
- Maintenance of record of public concerns, community welfare and the related responses.

9.9 Environmental Monitoring Plan

This ESIA proposes a Monitoring Plan that will be closely tied to the Environmental Management Plan (EMP). While the EMP will focus primarily on mitigating all adverse environmental impacts, the monitoring plan will look at the progress on the project's implementation and how it impacts on the community, the ecosystem, and on the performance of the fence itself. The monitoring plan will thus give room to identify and address any aspects that may not have been adequately captured

in the ESIA and by extension not included in the EMP. Thus it will allow for changes to ensure all impacts are adequately mitigated.

The monitoring plan will focus on the following three areas: -

- **Socio-economic impacts:** This will cover both qualitative and quantitative impacts on the fence especially with regard to human-wildlife conflicts. Quantitative impacts will include benefits and losses in terms of food production, crop damage, monies raised in the local economic activities, conservancy coverage, park destruction, school enrolment and performance, and other quantifiable aspect. Others will include any social hardships associated with the fence e.g. lack of firewood and water, long distances covered for the same, or lack of access to park goods and services. These will be measured based on data from government sources and field surveys specifically undertaken for this purpose. Qualitative impacts will include change in attitude towards conservation and wildlife, better relations among communities and KWS/TT, community well-being, human security, and better health.

- **Ecological monitoring:** This will include monitoring whether the ecosystem's function and structure is impacted upon by the fence erected. This will include habitat changes – improvements or destruction in overall vegetation cover and biodiversity composition. Others will include the fence impacts on anthropogenic activity in the conservancy including illegal logging, charcoal making, and snaring/poaching. Animal monitoring will include impacts on the fence on animal numbers and their distribution. This is more so in terms of increased large animal populations due to inability to move, or their congregating in key areas. Impacts will also include those on animal behaviour and on their breeding. In regard to the latter, issues of lack of access to breeding areas, and inbreeding will be closely monitored.

- **Fence monitoring:** This will be with regard to the operations and maintenance of the fence. This will be done on a daily basis with regards to measuring voltage, monitoring fence for any vegetation touching on the fence, monitoring for broken or fallen posts and wires, disconnected earthings, and also ensuring that the fence is not vandalized especially with regards to energizers, solar panels and batteries. Other monitoring activities will include communication with patrol teams and training of the same group on a regular basis on fence operations and maintenance.

Table 9-1 Monitoring and Evaluation Matrix

Aspects	*Responsibility/ Information sources*	*Frequency*	*Verifiable indicators*
Social Economic aspects			
Incidences of human-wildlife KWS conflict	KWS	Day to Day	PAC reports; crops destroyed, infrastructure destroyed, human/anima hurt or killed
Food production	Ministry of Agriculture	Annual Bi annual	Crop production reports in conservancy adjacent district
Economic Activities	Kenya National Bureau of statistics	Annual	District Development Reports
Conservancy cover/ Damage	TT, DRSRS	Annual	Conservancy cover reports; incidences of damage, aerial photos/satellite imagery
School enrolment and performance	Sub-County Education offices	Annual	School enrolment and performance in schools
Access to reserve products	TT/ KWS surveys	Annual	Reports from surveys
Attitude changes	KWS surveys Community wardens and KWS office	Annual/through normal interaction	Reports of KWS community officers and district wardens.
Ecological Monitoring			
Vegetation cover	TT\DRSRS	Annual	TT reports, DRSRS aerial photos and satellite imagery.
Anthropogenic activities	TT\KWS	Monthly	Arrest reports, kilns destroyed, illegal logging arrests.
Animal monitoring	KWS	Annual	Animal counts – direct and indirect; changes in animal behaviour and breeding.
Genetic monitoring	KWS	Ten years	Genetic analysis; incidences of diseases
Fence Monitoring			
Voltage measuring	Field teams/KWS	Daily	Daily records
Clearing of fence alignment	Field teams/KWS	Daily	Daily records
Fence monitoring breakages/ vandalism	for Field teams/KWS	Daily	Daily records
Communication with field teams	KWS	Daily	Daily records

10 ENVIRONMENTAL MONITORING AND AUDIT PROGRAM (EMAP)

A comprehensive Environmental Monitoring and Audit Programme (EMAP) will be implemented to check effectiveness of the mitigation measures as proposed and environmental compliance with relevant statutory requirements. The proposed key EMAP requirements include:-

- Monitoring health and safety measures.
- Noise monitoring at designated monitoring stations during development phase.
- Dust monitoring at designated monitoring stations during development phase.
- Regular site inspections at the works areas as part of the EMAP procedures to ensure the recommended mitigation measures are properly implemented.
- The proponent through periodical audits will know how to monitor the project affected community during implementation and operations phase.

10.1 Health and Safety Measures

10.1.1 Safety First

The client will ensure that safety is given a priority before electric fencing and the associated civil works commence. This will take the workers through applicable safety measures. Key areas that will require extra measures to ensure safety of all working in the fencing project will include:

- Ensuring that workers erecting the fence take extra precaution to avoid accidents and injuries.
- The client will ensure that workers are accompanied by rangers to prevent cases human-wildlife conflicts during construction.
- Safety and health will also include awareness creation and capacity building in terms of enhancing a sense of appreciation of a clean environment and its positive impacts on both the environment, and the workers/ communities welfare.
- Community members will also be sensitized on fire hazards and prevention mechanism in protected areas. The incorporation of community members in fire management will ensure that they are involved in firefighting during outbreaks.
- The electric fences will also have warning signs indicating “hatari” or “danger”, to ensure that people are not electrocuted, or shocked

10.2 Prevention and Management of Possible Accidents

- **Setting of minimum standards of construction:** The project will ensure that all buildings and civil works are done in conformity with conditions of contract for civil engineering development including obligations and workmanship standards. The development phase will also ensure that legal Notice No. 40 - The Factories (Building Operation and Work of Engineering Construction) Rules, 1984 is observed.

- **Scaffolds and zoning:** During construction, the development area will be fenced off, scaffolds put up, and well-placed and clear warnings put up to alert people against falling objects.
- **Setting clear emergency routes:** This will be put in place to facilitate rapid responses in case of emergencies and accidents. An emergency exit route should be established within the working area.
- **Protective attire**: Development workers will be given helmets and overalls, and in some areas gloves for their protection and to minimize any adverse impacts should they occur.
- **Having all workers insured:** The proposed project will ensure that the contractor has a workmen's compensation for all development workers as a contingency measure in case of any accidents.
- **Insurance:** The building will also be insured for fire and other accidents and tenants advised to take insurance of their property.
- **Capacity building and training:** The staff will be trained on safety and minimum safety standards set for their observance. Signs on safety and a clean environment will also be put within the working area.
- **Observation of Kenya's Factory and Places of Work Act:** The project will observe to the letter this act as a way of minimizing and mitigating accidents especially during construction.
- **Feedback:** Feedback from staff on accidents and near-accident cases should be solicited and adequately received so that accidents prevention can be stepped up in areas with high risks.

10.3 Emergency Response Plan

10.3.1 Relevance of an Emergency Response Plan

An Emergency Response Plan (ERP) is an essential tool in any project especially in protected areas. It is therefore crucial that a proponent puts in place an emergency response plan that will take into account disaster prevention through good design, operation, maintenance and inspection to reduce the probability of occurrence and consequential effect of such eventualities.

It is not possible to totally eliminate such eventualities and random failures of equipment or human errors, omissions and unsafe acts cannot be ruled out. An essential part of major hazard control has therefore, to be concerned with mitigating the effects of such emergency and restoration of normalcy at the earliest possible time. It is therefore imperative that as part of an emergency response, an Emergency Response Team will be formed incorporating KWS and community members.

The ERP has therefore to be related to the identification of sources from which hazards can arise and the maximum credible loss scenario that can take place in the concerned area. The plan takes into account the maximum credible loss scenario - actions that can successfully mitigate the effects of losses

The overall objective of an emergency response plan (ERP) is to make use of the combined resources at the site and outside services to achieve the following:

- To localize the emergency and if possible eliminate it.
- To minimize the effects of the accident on people and property.

- Effect the rescue and medical treatment of casualties.
- Safeguard other people.
- Informing and collaborating with statutory authorities.
- Initially contain and ultimately bring the incident under control.
- Preserve relevant records and equipment for the subsequent enquiry into the cause and circumstances of the emergency.
- Investigating and taking steps to prevent reoccurrence.

10.3.2 Response procedure for emergency team

- Using the public address system, inform community members and other stakeholders.
- Inform the necessary authorities for aid by calling 999 or 911.
- Ensure that the first aid ambulance and fire tender vehicles are summoned if necessary.
- Inform the nearby hospitals if there are any injuries.

10.3.3 Response in case of fire

- Required response during in the event of a fire should be described in signs located in strategic areas such as gates.
- On sighting a fire, it should be immediately reported to the park warden and community representatives giving the exact location and type of fire in detail.
- Initiate the Emergency Response Team for fires.
- If the fire is small, engage in extinguishing the fire using the nearest available means.
- The Emergency Response Team should immediately inform the nearest dispensary and security force. If required a fire tender should be summoned.

The response team should immediately move to the point of fire and take all necessary steps to stop the fire. If the fire is not controllable and spreads then the in charge should inform the County authorities and call for external help.

Table 10-1: Environmental Management and Monitoring Plan for the proposed Electric Fence

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
1. Project Design Phase						
Planning, Surveying, EIA study, Alignment	Trampling on vegetation, animal disturbance, lack of consensus towards the project between stakeholders	Avoid vegetation destruction, use available tracks, maintain modicum of silence, intensified consultations	Senior Warden KWS,	Throughout project design stage, throughout the project cycle	N/A, as per the contract	Vegetation destroyed/animals affected, project acceptability
2. Development Phase						
Clearing	Throughout project design stage, throughout the project cycle	N/A, as per the contract	Vegetation destroyed/animals affected, project acceptability	All through development period	As per the project cost	Incidences of haphazard vegetation clearing, lack of backfilling in excavated areas.
Traffic Management	Accidents	• The Contractor should plan and implement traffic management programme on daily basis; • Comply with all applicable legislation and by-laws with regard to road safety and transport; • Lane and junction design and signage to meet appropriate standards;	Contractor Workers	All through development period	NA	Accidents

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
		• Movement of construction vehicles timed to avoid peak periods Ensure adequate entry and exit lane design and appropriate signage.				
Liquid wastes	Pollution to surface water	• Carefully collect used oil in drums and dispose of by licensed refuse contractor; • Adhere to wastewater management regulation of the legal Notice 121 and Water quality regulations of the Legal Notice 120; • Construct Interceptor and conduct wastewater monitoring to check compliance and submit the results to NEMA; • Document and train staff in the emergency spill response plan. • Revegetation of open ground should be done to reduce run off hence reducing storm water drain.	Contractor Workers	All through development period	NA	Water pollution
Constraining animals within the park.	Obstruction of wildlife migration routes, habitat destruction	Provision of wildlife migration corridor and ecological sites, translocation	KWS	Throughout the project cycle	In project contingency budget	Evidence of animal stress

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
Transportation of materials	Noise, trampling of vegetation.	Maintain modicum of silence, use designated tracks, avoid using noise prone vehicles such as old tractors	KWS/ TT/ Communities/ Stakeholders.	Development period	N/A	Number of vegetation destroyed, increase in animal stress
Digging holes	Soil erosion, solid wastes	Backfilling of excavated areas, solid waste put in bins are transported outside the park.	KWS/TT/ Communities/ Stakeholders	Development period	As per the project budget	Evidence of exposed soil, and solid waste in the project area
Fencing	Locking out animals outside, /Spill over of conflicts elsewhere/ continued human wildlife conflict.	Due diligence ensuring animals are not locked out Strategic wildlife management	KWS	At planning, construction and operation stages	In project budget; separate budget for translocation	N/A.
Air pollution and dust generation	Public safety risks, vegetation and animals due due to pollution	• Sprinkling all active construction sites with water; • Control of speed and movements of all automobiles within the construction site; • Use of low-sulphur diesel for diesel-operated construction machinery; • Provide dust musk to workers; • Install an eco-efficient back-up generator fitted with scrubs and silencer.	Project Proponent; Contractor; Drivers.	At development & operation stages	N/A	Evidence of dust at the area.

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
Over-extraction of construction materials		• Construction materials shall be from approved sources: for example: hardstone for building should be obtained from bonafide commercial quarries; • Procure environmentally friendly and sustainable materials; • Do not use the following materials for construction of the building: a. Asbestos in any form; b. Asbestos substitutes or any naturally occurring man-made mineral fibres c. Lead, Lead paint or other materials containing Lead which may be inhaled, ingested or absorbed; d. Vermiculite, unless it is established as being fibre-free; e. Any product containing Cadmium that are regarded as being deleterious building material which are not in accordance with statutory requirements or with current accepted good building practice at the time of specification or construction.	• Project Proponent • Contractor	At development & operation stages	N/A	Materials should be from approved sources

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
3. Operation Phase						
Live fence.	Public safety risks due to solar fence (electric shock)/ injuries to wild animals.	Install warning signs on the live wire, allow for migration corridors and safe gates in designated areas, monitoring of voltage.	KWS/TT/ Communities/ Stakeholders	At development & operation stages	In project budget	Incidences of electric shocks reported, number of attendants enlisted.
Limited access to the reserve.	Shortage of firewood, no grazing of animals and access to other products, sour relation between communities and KWS.	Allow for access routes in designated areas, provide for utilization of reserve products.	KWS/TT/ Communities/ Stakeholders	Throughout project cycle	N/A	Number of access routes installed, enhanced community ownership of the project, harmonization of TT/KWS policy on utilization of reserve products.
Access to the reserve	Loss of life/injuries inside the fenced areas, introduction of invasive species	Community members should indemnify KWS/TT, Access at owner's risk, awareness creation on possible exposure to danger.	KWS/ TT/ Communities/ Stakeholders	During operation stage	N/A	No of accidents/ incidences reported, cases of invasive species.
Maintenance.	Clearing of vegetation along the fence.	Minimum impact.	KWS/TT/ Communities/ Stakeholders.	During operation stage.	As per the budget.	Continued functioning of the fence, project sustainability.

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
Spillage of oil to soil and underground water sources	Soil contamination	• Have sorbent materials available on site; • If a spill or leak occurs, stop it from flowing at the source; • Develop a spill response action plan and display it in a strategic place; • Most of the open grounds should be cemented to prevent spills from leaking into underground water and soils; • Do not discharge petroleum products to sewers, drainage ditches, septic tanks, or streams; • Do not dispose of petroleum products in landfills or mix them with wastes that will be disposed of in landfills; • Ensure that all drainages are fitted with oil interceptors to retain any oils that will find their ways into the drainages; • Monitor quality of water draining from the site; • Monitor quality of underground water and soils for potential contamination, if necessary remediate the sites.	Contractor and workers	Throughout project cycle	NA	Soil contamination

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
4. Occupational Health and Safety Risks						
Accidents	Loss of life due to animal attacks, injuries due cuts, snake bites, falling	Adherence to safety requirements and standards, awareness creation on possible accidents, training of technicians on maintenance of the fence, installing warning signs.	KWS	Throughout project cycle	As per budget	Number of accidents/ incidences recorded, number of technicians trained, number of warning signs installed and their intervals.
Fire	Loss of vegetation, death of animals, destruction of habitat.	Install warning and preventive signs along access routes, engage stakeholders in fire management.	KWS/TT.	Throughout the project cycle.	As per budget.	Incidences of fire occurrence.
Public Health and Occupational Health and safety	Injuries, death of animals and human beings,	• Develop a site safety action plan detailing safety equipment to be used, emergency procedures, restrictions on site, frequency and personnel responsible for safety inspections and controls; • Daily site inspections should be done to ensure safe work practises are adhered to; • All workmen should be provided with personal protective equipment (PPE);	KWS and CGoM	Throughout the project cycle.	As per budget.	Incidences of Incident and accident

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
		• The Conditions of Contract in the tender documents should stipulate health, safety and environment regulations and work procedures; • The Contractor must appoint a foreman with knowledge on health, safety and environment regulations; • All injuries that occur on site must be recorded in the accident registers and corrective actions for their prevention be instigated as appropriate; • Site personnel should be encouraged to report "near-miss incidents" in order to avoid potential problems and increase safety awareness.				
5. Decommissioning Phase						
Poles.	Increase in solid.	Sold as firewood.	KWS.	Once at the end of the project life.	N/A.	Income derived from the sale.
Loss of Jobs	Loss of Jobs	• Notify the employees in advance on the project closure date and adequately compensate them; • Dismissal procedures to be compliant with Employment Act, 2007 and	CGoM	Once at the end of the project life.	N/A.	Lack of jobs

Activity	Possible Negative Impacts	Suggested Mitigation Measures	Responsibility	Frequency/ Timing	Cost	Verifiable Indicators
		Provide counselling & alternative skills for alternative activities.				
Electric wires.	Used as snares for trapping animals	Sold for recycling	KWS.	At end of project life.	N/A.	Income derived from the sale.
Other materials.	Increase in solid wastes.	Solar panels and energizers can be sold to willing buyers, other material dumped in designated sites.	KWS.	At end of project life.	N/A.	Income derived from the sale.
No fence.	Renewed human wildlife conflicts.	Constant maintenance of the fence, establish a revolving fund for project sustainability.	KWS/TT/ Communities/ Stakeholders.	Throughout the project cycle	N/A	Funds available for maintenance.

11 RECOMMENDATIONS AND CONCLUSION

11.1 Recommendation

This ESIA Report has been prepared to provide sufficient and relevant information on the proposed project to establish whether the activities of the project are likely to have significant adverse environmental impacts.

This Report documents the findings of an assessment and study of the proposed development construction, operations and neighbour's concerns. Mitigation measures have been proposed for identified impacts and an environmental management plan for the implementation of the proposed measures has been presented.

Current strategies to manage human-elephant conflict largely focus on either physical separation, or mitigating the problem by domesticating, fencing. Trans-locating, or culling problematic elephants and/or compensating farmers. While these tools remain important conflict management strategies, the majority appear to be driven by short-term, site-specific factors that often transfer the problems of human-elephant conflict from one place to another.

We proposed a conceptual model that recognizes the competition for water, land, and plant resources between these species, and seeks to identify conflict hotspots and alternative resource access options for effective land management now and in the future. We have highlighted the application of ecological, anthropological, and geographical knowledge and tools for developing long-term sustainable solutions to this complex problem, and hope our conceptual model provides guidance for future research focus.

The diverse data needed to build out our conceptual model require interdisciplinary cooperation to synthesize multiple historic, contemporary, and projected datasets from the biophysical and social sciences. While biophysical data may already be in a form that readily lends itself to landscape level modelling and planning, integration of ethnographic information will likely involve more effort including extensive social science fieldwork in conflict-prone communities.

The understandings of how people living in or near conflict prone areas use natural resources, and how they make decisions about current and future resource use, remains key to addressing the underlying drivers of human-elephant conflict and their spatial variation. Without this knowledge, the task of resolving human-elephant conflict and finding a means for these species to coexist in the Anthropogene is Sisyphean. Several measures have been suggested to prevent or minimize the negative environmental impacts and to maximize the positive ones using a comprehensive environmental management plan.

- **Fence Alignment:** The fence alignment should be on the conservancy boundary because it is primarily meant for mitigating human-wildlife conflicts.
- **Fence design:** We recommend that the electric fence put up should be a two-strand fence which will be able to control the movement of

only large animals especially elephants from the adjacent community lands. 2-strand fences have limitations in that they only keep off larger animals, while the smaller animals are still able to get access to community farms.

- **Putting up a secondary fence for reserve plantations:** This fence will keep off elephants which are the main problem animals as regards plantation, while at the same time allowing animal movement between the natural conservancy area and plantations. This fence will also give secondary protection for the reserve adjacent communities.
- **Incentives for Fence Maintenance:** The effectiveness of electric fence is closely tied to its maintenance. The reserve adjacent communities have given their commitment that they will maintain the fence especially if the alignment is between them and the Tsavo National Park (if it is near them).
- **Community Involvement and ownership:** Communities have been involved in the planning process ad this involvement must continue in the implementation and maintenance phases for the project sustainability or be assured. In this way, they will feel a sense of ownership and thus be able to protect the fence from being vandalized. Community contribution in the barrier's installation will also bring a sense of ownership.

11.2 Conclusion

Human wildlife conflict remains rife in the Tsavo area adversely impacting livelihoods of reserve adjacent communities and actually threatening their very survival. The public consultation with communities in the course of the ESIA study identified the electric fence as the optimum wildlife barrier to reduce human – wildlife conflicts around Tsavo Park area. The fence also has high socio-economic impacts for the adjacent communities especially with regard to poverty alleviation and general human security. Other benefits include improved health, improved agriculture production, improved incomes, and general improved living standards. The fence will also contribute to improved conservation of both flora and fauna in the park eco-system.

The ESIA study has also identified some minimal negative environmental impact and come up with workable mitigation measures. The ESIA study has also come up with an Environment Management and Monitoring Plan, which the County Government of Makueni and communities have committed themselves to follow. Both parties have also committed themselves to follow the recommendations arising from this study.

The study team has considered the various environmental impacts as they are at the present. However, ecosystems remain dynamic and thus the need for monitoring and constant evaluation of the EMP. In this regard, the other phases of the fencing project will need to be reviewed in light of lessons learnt from the first phase of this project. Consequently, the EMP may take a few alterations during the implementation of these phases.

The Proponent shall be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of this project. It is recommended that in addition to this commitment, the Proponent shall focus on implementing the measures

outlined in the EMP as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects.

It is also recommended that the positive impacts that emanate from such activities shall be enhanced as much as possible. It is expected that these measures will go a long way in ensuring the best possible environmental management and compliance with relevant legislations and standards.

The consultant (Lead Expert) recommends approval of the proposed activities subject to the project proponent adhering to all the proposed mitigation measures in this Report and the conditions that will be attached to the Compliance license.

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APPENDICES

Appendix 1	Location Map
Appendix 2	Project Fence Design and specifications
Appendix 3	County Government of Makueni Documents
Appendix 4	Lead expert NEMA Certificate 2021/2022
Appendix 5	Attendance list/ Minutes/ Public participation questionnaire forms
Appendix 6	Photographs

Appendix 1: Site Plan

Appendix 2 Project Fence Design and specifications

Appendix 3 County Government of Makueni Documents

Appendix 4: Lead expert NEMA Certificate 2021/2022


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THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT
ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE
License No : NEMA/EIA/ERPL/13976
Application Reference No: NEMA/EIA/EL/18577
M/S JULIUS MUSYOKA MUSILI
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is licensed to practice in the
capacity of a (Lead Expert/Associate Expert/Firm of Experts) Lead Expert
registration number 3074
in accordance with the provision of the Environmental Management and Coordination Act Cap 387.
Issued Date: 2/10/2021
Expiry Date: 12/31/2021
Signature.....
(Seal)
Director General
The National Environment Management Authority
P.T.O.
ISO 9001: 2008 Certified

FORM 7 (r.15(2))

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NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/16718

Application Reference No: NEMA/EIA/EL/21618

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registration number **1731**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **3/7/2022** Expiry Date: **12/31/2022**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001: 2015 Certified

Appendix 5: Public participation questionnaire forms

Appendix 6: Photographs

Photo Log

Description	Photograph
Public attending meeting at Athi Makutano area	
Lead Expert in Reflector and Stakeholders conducting public meeting at Athi Makutano.	
Chief of the area attending awareness meeting.	

Description	Photograph
County Environmentalist addressing a meeting.	
Public meeting	
Attendant asking a question.	

Description	Photograph
Ward admin addressing the public meeting.	
Attendants showing with sign of hand they have accepted the project.	
Attendant seeking a clarification.	

Description	Photograph
Public meeting at Kamunyuni.	
Public meeting at Kamunyuni	
Public meeting at Kamunyuni