The Kenya Power and Lighting Co. Ltd

ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT (ESIA) STUDY

FOR THE PROPOSED **NANYUKI-MERU, ISHIARA-KIENI, MWINGI-KITUI-WOTE-SULTAN HAMUD** 132 kV TRANSMISSION LINE

FINAL REPORT

Submitted by:

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Disclosure Page

This ESIA Report is hereby disclosed for public review as follows:-

Proponent: The Kenya Power and Lighting co. Ltd

Assignment: Environmental and Social Impact Assessment Study Report for the proposed Nanyuki-Meru, Ishiara-Kieni, Mwingi-Kitui-Wote-Sultan Hamud 123 kV Transmission Line

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John Guda

Deputy Manager –Safety/Health and Environment

EXECUTIVE SUMMARY

Introduction:

The Kenya Power and Lighting Co. Ltd (KPLC) is the Utility mandated by the Government of Kenya to manage transmission, distribution and supply of electric power to consumers and currently controls the national power transmission network comprised of 1323 km of 220 kV, 2085km of 132 kV and 632km of 66kV transmission lines. With support from the World bank, KPLC is planning to develop 264 kilometers of single circuit 132kV Transmission Lines connecting Nanyuki-Meru, Ishiara-Kieni-Embu and, Mwingi-Kitui-Wote-Sultan Hamud for purposes of improving performance of the national grid while catering for increased load growth.

Contract No. **KPLC1/1F/8/3/6/2009** in respect of Consultancy Services towards preparation of this Environmental and Social Impact Assessment Study report became effective on 17th December 2009 when Repcon Associates (The Consultant) was commissioned following a successful tendering process. This document outlines the Draft Final ESIA Report prepared in line with this contract.

Scope of the ESIA Report:

The framework and depth of the ESIA Study was dictated by the reigning legislation namely EMCA 1999 and its Legal Notice 101 of June 2003 which has defined parameters for conduct of ESIA studies in Kenya. However, the Study was designed to further address client expectations as stipulated in the Terms of Reference (see Appendix 1.1) issued under this contract and, among other milestones, all the 11 tasks specified in the TORs have been addressed fully as part of this study.

Objectives of the ESIA Study:

The Environmental and Social Impact Assessment [ESIA] was planned to achieve the following objectives;

- To identify and assess potential environmental and social impacts of the proposed project.
- To identify all potential significant adverse environmental and social impacts of the proposed project and recommend measures for mitigation measures.
- To verify compliance with the environmental regulations and industry's standards
- To generate baseline data for monitoring and evaluation of how well the mitigation measures will be implemented during the project cycle
- To recommend cost effective measures to be implemented to mitigate the expected impact.
- To prepare an environmental impact assessment report compliant to the Environmental Management and Co-ordination Act [1999] and detailing findings and recommendations.

- To indentify and quantify different categories of Project–Affected-People [PAPs] who would require some form of assistance, compensation, rehabilitation or relocation.
- To provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project.

ESIA Approach:

The approach to this ESIA Study was informed by the need to generate information to facilitate decision making on the net environmental worth of the proposed transmission lines project. As such, an investigative approach aimed at generating requisite data and information on the project was pursued in this study.

ESIA Methodology:

The systematic investigative and reporting methodology specified for conduct of ESIA Studies (Legal Notice 101 of EMCA) was adopted in this Study. Baseline data on project design was generated through discussion with the client and review of project documentation. Opinions formed were revalidated through field work entailing site investigations and interviews with potentially affected people and secondary stakeholders.

To identify, predict, analyze and evaluate potential impacts that may emanate from the project, diverse study methods and tools including use of checklists, matrices, expert opinions and observations were employed. An Environmental and Social Management Plan comprising and impact mitigation plan and modalities for monitoring and evaluation were then developed to guide environmental management during all phases of project development.

Once approved by both the KPLC and NEMA, this ESIA report will be disclosed both locally and at the World Bank Info-shop whereby accruing comments will be used to finalize the report.

The ESIA Team:

This ESIA study was undertaken by a multidisciplinary team bringing together skills as follows:-

Mr. Michael M. Wairagu-EIA Lead Expert
Ms. Nancy Kanyi-Environmentalist
Eng. John W. Njaaga-Electrical Engineer
Mr. Richard N. Ng'ang'a-Occupational Health and Safety Expert
Mr. G.G. Aritho- Land Economist

Ms. Lillian Owiti-Sociologist

Mr. N. Gachathi-Ecologist

Policy, legal and regulatory framework:

This ESIA Study Report has been developed to ensure that the proposed development of power transmission lines is in conformity with national policy aspirations towards securing sustainable development. Specifically, this ESIA Study report has been developed to ensure compliance with requirements of the Environmental Management and Coordination Act (EMCA) 1999-Kenya's supreme environmental law, and the World Bank's safeguard requirements. Section 58 of EMCA requires proposed developments to be subjected to environmental assessment to be conducted in line with the Second Schedule (of EMCA) and the Legal Notice 101 (Regulations for Environmental Assessment and Audit) of June 2003. As well, Op 4.10 of the World Bank demands environmental assessment for certain categories of projects and since the proposed transmission lines would fall in Category B, this ESIA Study Report has been prepared. The entire ESIA process for this project has been design to conform to the regulatory framework stipulated by the National Environmental Management Authority (NEMA)-the body that will review this report and make decisions on grant of an environmental license to the development.

Project description:

The project entails development of 264 kilometres of 132 kV transmission lines connecting Nanyuki-Meru, Ishiara-Kieni and Mwingi-Kitui-Wote-Sultan Hamud. The project starts at the boundary of the Rift Valley Province at Nanyuki in Laikipia East District and traverses a total of 14 Eastern Province Districts to end at Sultan Hamud town on the boundary of Rift Valley Province.

Project activities:

The project will entail construction of power lines comprised of electrical conductors supported on 27metre high pylons constructed of stainless steel metal. Close to 1000 steel towers (pylons) comprising both angle towers and line towers will be constructed for purposes of mounting the conductors on which the 132kV power supply will be transmitted. The project will require a 30-metre wide Right of Way corridor along the entire routes of traverse implying that about 792 ha of land will be acquired for the project. Further, all physical structures and trees growing above 7m height will be cleared in line with requirements of the KPLC.

Once commissioned, the project will be operated by the KPLC.

Site ownership:

With the exception of the 700m stretch of gazetted Imenti Forest in Meru that is traversed by the project, the rest of the land (over 99%) within the routes of traverse is privately owned agricultural land. Further, with the exception of a few large-scale farms encountered in the Timau area and one ranch at Sultan Hamud, the bulk of the land is controlled by over 2000 small holder farmers.

Bio-physical setting:

Relief of the routes of traverse generally ranges from around 1040m above sea level in the Kitui area to over 2000m above sea level at the base of Mt. Kenya in Meru. With the exception of sections in Nzaui, Migwani and Mbeere districts, the terrain of to be traversed by the Project is generally flat and undulating. The project was designed to skirt steep areas as manifested by passage on the slopes of has Kitui hills, Kakoli Ridge, Kithumba, Nzaui, and Kyemundu Hills.

Geomorphology of the project area ranges from volcanic footridge and footslopes at the base of Mt. Kenya slowly graduating to the volcanic lava outflow of the Yatta plateau which is heavily dissected by the Athi River and tributaries, notably the Thwake. Across the Thwake River in Makueni, the dominant geomorphic features are remnant basement complex hills as typified by the Nzaui which outcrop from the generally undulating local terrain.

At the base of Mt. Kenya, are deeply weathered greyish sandy clay loam to clay but in areas of poor drainage, the tendency is for heavy clays to develop. Along the Yatta plateau and other volcanic belts that suffer inadequate rainfall, soils display high variability in depth, texture and reaction and will often be underlain by lithic phases with occasional outcrops of granite. Within the basement complex belt across the Athi, soils are diverse but mainly dominated by sandy clay loam to clay loam.

The proposed transmission lines traverse three drainage basins namely; - Ewaso Ngiro, Tana and Athi. Main drainage lines traversed include: Nanyuki, Likii, Sirimon, Timau, Ena, Thuchi, Tana, Tiva, Whita Syano, Athi, Thwake, Kaiti among others. The section between Wote and Sultan Hamud in Nzaui District (Matiliku area) has a particularly high drainage density which is traversed by the transmission line.

Climate varies greatly within the routes of traverse with rainfall being highest at Meru and Kieni both of which enjoy an easterly exposure on the base of Mt. Kenya which secures relatively higher humidity. Away from the base of Mt. Kenya towards the lowlands of the greater Kitui and Machakos districts, rainfall displays a marked drop with altitude with Wote recording an annual low of 565 mm. With the exception of Meru and Kieni, all other areas traversed by the project record huge annual moisture deficits with climatic regimes ranging from semi-arid to semi-humid.

The vegetation cover in the arid sections traversed by the project largely comprises of indigenous trees and shrubs dominated by Acacias, yellow wood, combretum, etc while that within the humid belt has been largely substituted with exotic trees dominated by grevillea, casuarinas, blue gums, cassia siamea, neem etc all of which grow to heights generally above 8 metres.

Socio-cultural setting:

At the start of the project, the Nanyuki –Meru Section of the TLs traverses peri-urban Nanyuki which is largely cosmopolitan then passes through farms owned by Kenyans of European descent. All other Sections of the project up to Sultan Hamud traverse largely rural settlements dominated by the Meru, Mbeere, Embu and Akamba peoples respectively.

Highest population densities in excess of 400 persons per square kilometre are encountered within the humid Kieni /Runyenjes section of the project, with the lowest occurring in the Yatta plateau section of Kitui District. Within the section between Wote and Sultan Hamud, moderately high densities in the range of 200 persons per square Kilometre will be found.

With the exception of the Nanyuki/Timau area where a few large-scale farms are found, the project largely traverses small holder settlements where small scale mixed farming is the main economic mainstay.

Economically sensitive resources:

Land: Land is just about the most important and widely coveted resource in Kenya, access to which is a pre-requisite to economic production, settlement through ownership of shelter, and it offers security in old age and upon eventual death; all of which account for the huge interest that vests in land within Kenya where the dream to own land is commonly held by majority of citizenry. Against this background, the requirement for land to be set aside for construction of the proposed transmission lines is likely to have major impacts within the routes of traverse.

Private and public investments: Many private and public investments;- buildings, institutions, trees, developed farms etc will be traversed by the project with the prospect that quite a number will be cleared out of the Right of Way corridor and measures must be put in place to insure against retrogressive impacts of infrastructure.

Existing infrastructure: Along the entire routes of traverse, diverse infrastructure is encountered as follows:- diverse power transmission lines (132kV lines at Nanyuki, Kitui and Sultan Hamud, widely occurring low voltage power transmission and distribution lines), the Military Air base and airport at Nanyuki, the sewage treatment lagoons at Nanyuki, the airstrip at Kitui, among others. Together with local roads and water supply lines, these resources are economically and strategically crucial hence the need to flag them to ensure planning for their mutual co-existence and harmony on the side of the proposed development.

Ecologically sensitive resources:

Within the proposed rout of traverse, several ecologically fragile resources can be identified as follows:

Shallow soils on hilly slopes: Quite a number of these are traversed by the proposed lines which will imply that their stripping bare of trees to create the ROW may expose them to overgrazing and accelerated erosion. Some of the slopes especially in the Nzaui area have very shallow soils whose erosion will expose the local bedrock and thus alter the local hydrology.

Vegetation cover in the ASAL sections of the Routes of traverse: ASAL vegetation is usually delicate on account of inherently poor capacity for regeneration which possibly explains the observed declining cover on account of exploitation for charcoal making, wood carving, building and fencing materials, clearing for crop production and pastures, cutting for building and fencing among others. The proposed clearing of ASAL woody vegetation base to give way to the ROW will take place against this worrying background.

Findings of the ESIA Study:

Summary of public consultations:

From the total of 2106 people interviewed for this study (2064 questionnaires administered directly on PAPs and 42 interviews with other stakeholders), this ESIA can confirm that the project enjoys overwhelming

support. The project is seen as being strategic to stabilising rural power supply which is crucial to sustained economic growth. In order to sustain this overwhelming public support, project development should proceed simultaneously with resolution of stakeholder concerns as provided for in the ESMMP to be unveiled in sections below. Some of the stakeholder concerns recorded are summarised here below.

i) Matters pertaining to land acquisition and compensation were a major concern to the local residents, and hence considered to be very critical. The farmers requested that in the event that land acquisition has to be done, then, adequate compensation for land and property that are likely to be taken up by the ROW be adequate.

ii) Stakeholders whose properties risk displacement by the project expressed the need for project rerouting to be explored so as to save their properties from destruction. Stakeholders in provincial administration required that a standardised information package be used to disseminate the project to stakeholders in order to minimize speculation and dis-information which could earn the project considerable hostility. As well, there is need to establish a cut-off date for registration of PAP so as to avoid speculative land buying as commonly happens in projects entailing land acquisition and compensation.

iii) The provincial administration observed that the process of land acquisition and compensation is likely to trigger family disputes and recommended that village elders be involved in identifying *bonfide* land owners to be negotiated with.

iv) Stakeholders in government enquired on the possibility of communities in routes of traverse to tap power supply from the 132kV line and thus benefit locally. This was seen as an incentive to win support for the project.

v) Stakeholders in the crop and livestock production sectors were concerned that removal of trees in the right of way will have harmful effects such as loss of shade and shelter belts in semi-arid areas, affect fuel-wood supply, affect yield of mangoes which is an emerging cash crop, affect bee production which is based on availability of trees etc. Acacia trees also form the basis for dry season fodder supply and are also useful in the production of silk worms which is catching up in the Kitui-Mwingi area.

vi) It was felt that construction of tower foundations will fix agricultural land and put it out of production thus impacting on food security especially in areas where land sizes are small while construction work during the cropping season can have similar effects through destruction of the standing crop.

vii) The Laikipia airbase of the Kenya Air Force was concerned that construction and operation of another high voltage power transmission line in close proximity to their airbase has potential to interfere with their signal transmission system and proposed that the TL be constructed underground.

viii) Consultations with forestry personnel revealed that the propped TL does not traverse protected areas. However, for the small section of South Imenti forest traversed, steel pylons will require to be secured to prevent elephant calves being trapped in the steel tower which would move the cows to wreak havoc in course of mounting rescue missions. As well, measures require to be taken to secure the steel pylons against scratching by elephants and attendant risks of destruction.

ix) KFS staff also observed that proponent should put in place measures to mitigate tree removal possibly through supporting reforestation programmes to ensure that appropriate balances of standing woody biomass are enhanced rather that eroded by the project.

Potential positive impacts anticipated:

This ESIA Study has identified diverse impacts both direct and indirect. Positive implications of the project emanate from its potential to create short-term business and employment opportunities to both professional staff and workers during the design phase while, at construction phase, traders will benefit from opportunities to supply construction material while locals will be employed in works. Upon commissioning, the project could supply electric power to up to 18000 households in Nanyuki and Eastern Kenya and unlock the business potential of powered areas. Through adoption of electricity and cutting down on use of fossil fuels, the project has potential to favor cutting down on Green House Gas emissions to the benefit of the global climate.

Potential adverse impacts:

Development of the project will however introduce some adverse impacts the most drastic of which is creation of a 264 kilometer long way leave traversing 2064 farms all of which will surrender a total of 792ha. The clearing of physical assets and trees from within the 30m wide ROW corridor followed by erection of a 27m high permanent steel structure where none existed before has drastic consequences in terms of opportunity costs on land, loss of biodiversity, loss of carbon sinks while powering of the transmission line will pose hazards of exposing people to electro-magnetic fields.

Residual and cumulative impacts:

Of the 28 adverse impacts anticipated, 22 can be effectively mitigated but 6 are long-term in effect and will persist even after mitigation. Indeed, given the widely acknowledged deforestation which has seen forest

cover in Kenya decreased from 3% in the 1980s to less than 2% currently, the clearing of trees in another 792ha to create the ROW certainly has cumulative effects. Similar long-term impacts are anticipated from powering of the transmission lines which will enhance existing electromagnetic field which are claimed to expose people to health hazards.

Assessment of project alternatives:

A comparison of all the options is summarised in table below. From the analysis, the proposal to investment in a high voltage overhead transmission line as currently designed seems to be the preferred option which is though costly is justifiable on technical considerations. Any adverse impacts will be mitigated as per the ESMMP developed from the project.

Analysis of alternatives

Level of evaluation	Option evaluated	Advantages	Disadvantages	Preferred option	Mitigation of adverse impacts
Project	No project scenario	Savings to the national economy, will avoid environmental and social costs	Economic losses due to power outages, slowed economic growth	Develop project	As per ESMMP
Selection of route of traverse	Merits of selected route	Stabilised power supply to target areas	These are common to all routes	Proceed with selected route	As per ESMMP
Choice of technology	Transmission vs local generation	Cut down on transmission costs, will avoid displacement and environmental costs	Requires multiple investments in generating stations. Will still require transmitting to points of consumption.	Transmission option	AS per ESSMP
	Use of one 33kV line as opposed to three 333kV	Savings on power loss due to use of high voltage lines.	Probably more expensive than 33 kV lines	Use of the 132kV transmission	AS per ESMMP

Level of evaluation	Option evaluated	Advantages	Disadvantages	Preferred option	Mitigation of adverse impacts
	lines.			line.	
	Overhead vs underground cables	It is cheaper to develop and maintain.	Takes more land, displaces people, and increases hazards of accidents and exposure to EMR.	Use OHTL	As per ESMMP
	Lattice structures vs concrete poles	Lattice structures are lighter to construct and are longer lasting.	Lattice structures Are more expensive and take more land hence displacing more people.	Use of lattice steel structures	As per ESMMP
	Lattice structures vs. hollow spun pipes	Hollow spun poles are cheaper and take less land compared to lattice structures.	They are more expensive to transport and construct compared to lattice structures.	Use of lattice steel	As per ESMMP.

The ESMMP for the project:

An ESMMP has been developed whose pursuit can greatly improve the overall net effect of the project. This ESIA observes that the bulk of adverse impacts will manifest at the Construction stage in which case, the core effort in mitigation will be concentrated in the contract for construction. This ESIA therefore requires that the ESMMP be integrated into the Design Report with appropriate allocation of funds in the Bills of Quantities. The contract for construction should bear clauses binding the contractor to implement

impact mitigation as part of the civil works. The KPLC will mount own internal monitoring to ascertain environmental and social sensitivity at all stages of project development.

Total Cost of the Project including Resettlement Compensation:

It is estimated that the project will cost a total of US$ 18,397,171 (Eighteen Million, three hundred and Ninety seven thousand, one hundred and seventy one United States of America dollars only equivalents to Ksh 1,398,185,006 (One Billion, Three Hundred and Ninety Eight Million, Nine Hundred and Eighty Five thousands, six shillings only). This estimate is based on the average unit cost of US$ 90,000 required to construct a kilometer of 132kV Transmission Line in Kenya and includes Ksh 502,470,720 earmarked for resettlement compensation as par the RAP.

Recommendations of this ESIA:

In the view of this study, the project as currently proposed project is environmentally sound. This report has disclosed all potential adverse impacts most of which have readily available means to effective mitigation as already disclosed, and to be implemented as part of the project design. Overall, the project enjoys a net positive regime which will greatly improve upon pursuit of the ESMMP as proposed. Our recommendation is for the implementation of this project to be supported at all levels.

List of Abbreviations

AOJ = Area of Jurisdiction

BOQs = Bill of Quantities

CAP= Chapter of the Laws of Kenya

CITES = Convention on International Trade in Endangered Species

EA = Environmental Assessment

EHS = Environment Health and Safety

EMCA 1999 = Environment Management and Coordination Act 1999

EMP = Environmental Management Plan

ERC = Electricity Regulatory Commission

ESIA = Environmental and Social Impact Assessment

ESMMP = Environmental and Social Management and Monitoring Plan

GDP = Gross Domestic Product

GHG = Green House Gases

GoK = Government of Kenya

HV = High Voltage

IMP = Impact Mitigation Plan

IPPs = Independent Power Producers

KENGEN = Kenya Electricity Generating Company

KFS = Kenya Forestry Service

KLPC = Kenya Power and Lighting Company Limited

kV=Kilo volts

KWS = Kenya Wildlife Service

M&E= Monitoring & Evaluation

MDGs = Millennium Development Goals

MoE = Ministry of Energy

MW = Mega Watts

MWI = Ministry of Water and Irrigation

NEMA = National Environment Management Authority

O&M = Operation and Maintenance

PAC = Program Audit Consultant

PAPs = Project Affected Persons

PMs = Project Managers

RE = Resident Engineer

RETs = Renewable Energy Technologies

RAP = Resettlement Action Plan

SHS = Solar Home Systems

SMEs = Small and Micro- Enterprises

TL = Transmission Line

TORs = Terms of Reference

US$ = United States Dollar

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CHAPTER ONE: INTRODUCTION

1.1: The Assignment

The Kenya Power and Lighting Co. Ltd (KPLC) is the Utility mandated by the Government of Kenya to manage transmission, distribution and supply of electric power to consumers. In this capacity, the Utility currently owns and operates a national transmission network comprised of 1323 km of 220 kV, 2085km of 132 kV and 632km of 66kV transmission lines and is currently in the process of planning for development of 300 kilometers of single circuit 132kV Transmission Lines connecting Nanyuki-Meru, Ishiara-Kieni-Embu and, Mwingi-Kitui-Wote-Sultan Hamud. The latter project is being developed with the support of the World Bank for purposes of improving performance of the national grid while catering for increased load growth.

In line with existing national legislation and international practice, the proposed Transmission Line Project requires to be subjected to a comprehensive Environmental and Social Impact Assessment. Pursuant to this requirement Repcon Associates-a Nairobi-based Consultancy was commissioned to prepare an Environmental and Social Impact Assessment Report to guide environmental and social management in all phases of project development.

Contract No. **KPLC1/1F/8/3/6/2009** in respect of Consultancy Services in the Environmental and Social Impact Assessment for the proposed Nanyuki-Meru, Ishiara-Kieni-Embu, Mwingi-Kitui-Wote-Sultan Hamud 132 kV Transmission Line (hereafter termed The Study) became effective on 17th December 2009 when Repcon Associates (*The Consultant*) was commissioned to undertake the studies following a successful tendering and evaluation process.

This report presents the Final ESIA Report in respect of the proposed transmission line.

1.2: Scope and objectives of the ESIA

1.2.1: Study scope

The Second Schedule of EMCA-1999 has identified power transmission among projects that require to be subjected to environmental assessments in which case, this ESIA Study has been conceived and implemented. As well given the scale and scope of the proposed development, this ESIA Study has been designed to go to the full cycle stage culminating in production of an Environmental Impact Assessment

Study report for review by NEMA. Towards this, the TORs that were developed at the Scoping Stage of this Project have already been submitted and approved by NEMA.

In addition to adherence to the Second Schedule of EMCA, the framework and depth of the ESIA Study was dictated by reining legislation namely EMCA 1999 and its Legal Notice 101 of June 2003 which has defined parameters for conduct of ESIA studies in Kenya. However, the Study was designed to further address client expectations as stipulated in the Terms of Reference issued under this contract and, among other milestones, all the 11 tasks specified in the TORs have been addressed fully as part of this study.

1.2.2: Study Objectives

The Terms of Reference have identified objectives for the Environmental and Social Impact Assessment (ESIA) Study as follows:-

- To identify and assess potential environmental and social impacts of the proposed project.
- To identify all potential significant adverse environmental and social impacts of the proposed project and recommend measures for mitigation measures.
- To verify compliance with the environmental regulations and industry's standards
- To generate baseline data for monitoring and evaluation of how well the mitigation measures will be implemented during the project cycle
- To recommend cost effective measures to be implemented to mitigate the expected impact.
- To prepare an environmental impact assessment report compliant to the Environmental Management and Coordination Act [1999] and detailing findings and recommendations.
- To indentify and quantify different categories of Project–Affected-People [PAPs] who would require some form of assistance, compensation, rehabilitation or relocation.
- To provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project.

1.2.3: Procedure for the Full Cycle EIA Study

Procedures of the full cycle ESIA Study as adopted the proposed power transmission lines are outlined in regulations 18 and 19 of Legal Notice 101 (June 2003) of EMCA. The procedure pursued in the cycle of this project is as follows:-

The first step of the EIA procedure is developing and submitting a project report by the proponent. This report should state:

- the nature of the project;
- the location of the project including the physical area that may be affected by the project's activities;
- the type of activities to be carried out during the project construction, operation and decommissioning phases;
- the project design;
- the materials to be used, products and by-products, including waste to be generated by the project and the respective disposal methods;
- the project's potential environmental impacts and the mitigation measures to be taken during and after project implementation;
- an action plan for the prevention and management of possible accidents during the project cycle;
- a plan to ensure the health and safety of the workers and neighbouring communities;
- the economic and socio-cultural impacts to the local community and the nation in general;
- the project budget;
- any other information the authorities may require.

1.3: The ESIA Team

This ESIA study was undertaken by a multidisciplinary team bringing together skills as follows:-

- Mr. Michael M. Wairagu-EIA Lead Expert
- Ms. Nancy Kanyi-Environmentalist
- Eng. John W. Njaaga-Electrical Engineer
- Mr. Richard N. Ng'ang'a-Occupational Health and Safety Expert
- Mr. G.G. Aritho- Land Economist
- Ms. Lillian Owiti-Sociologist
- Mr. N. Gachathi-Ecologist

1.4: Approach and methodology to the ESIA

An ESIA Study is primarily a tool aimed at facilitating identification and mitigation of adverse impacts of an activity before its implementation commences while creating an opportunity for enhancing positive impacts and thus improving on the entire net worth of the project.

For the purposes of this EA study, the following study procedure was pursued: -

Discussions with client representatives: Discussions were held with relevant staff of the KPLC responsible for Safety, Health and Environment, Energy Recovery Project, Estates and Way Leaves with a view to better understanding project scope, design and motivation. From such discussions, the consultant obtained maps and project design data which helped better clarify the project scope.

Data collection for the project report

The ESIA Study process involved review of project reports with a view to familiarizing with the focus and objectives of the entire programme. The core reports reviewed here included the Feasibility Study Reports for the Energy Access Scale-up Programme (I, II & III) from which background planning data on the proposed project was obtained. Secondary data for the entire Routes of traverse was obtained from GOK planning documents such as District Development Plans, Poverty Reduction Strategy Papers, Welfare Monitoring Survey Reports, etc which provided an insight into the socio-environmental baseline. Preliminary opinions formed from review of such documentation were re-validated during fieldwork undertaken within districts to be traversed by the transmission lines.

Field work and public consultations

Fieldwork largely entailed onsite investigations so as to familiarize with the baseline environment of the area potentially affected by the project. Analysis of potential impacts was based on investigations undertaken along the entire routes of traverse where data on physiographic, pedology, hydrology and drainage, ecology and cover vegetation, land tenure, settlement and land-use patterns, ecologically and economically sensitive resources were collected. Accruing information formed the basis of impact prediction. Further, and in line with requirements of the National Environmental Management Authority-NEMA, the views of project affected people and stakeholders to the proposed development were solicited as part of the ESIA process. Such views/comments not only served to inform the design process but also formed a basis for discussion between the community and study team towards improving the overall quality of the proposed interventions. Stakeholders in government including the provincial administration,

land-based sectors, etc were also consulted to clarify various issued and to ensure that proposed development was in harmony with sectoral policies and strategies.

Data analysis and impact prediction

Upon data analysis, potential environmental impacts (both positive and adverse) were predicted based on available tools. The magnitude, significance, and acceptability of predicted impacts were evaluated with a view to determining whether observed adverse impacts are significant enough to warrant mitigation. The potential environmental impacts were described in both quantitative and qualitative terms through application of existing body of knowledge, checklists, flow charts, and monographs and from input from diverse stakeholders. In particular, impact prediction in this study drew heavily on three documents namely: - The *Sectoral checklists for the Power Sector developed for SADDC Countries; the Checklist of Environmental Characteristics* developed by the Department of Environmental Affairs of the Republic of South Africa and the *Reference Guidelines for Environmental Assessments* (which incorporates the Leopold Matrix) developed by USAID / REDSO / WCA – Abidjan.

Impacts were further screened for occurrence and significance of residual (those which cannot be mitigated satisfactorily) and cumulative impacts with a view to providing a basis of making recommendations on the way forward for the project.

Formulation of an Environmental and Social Management Plan

Measures or interventions necessary to minimise, reduce, avoid or offset identified adverse impacts were evaluated and presented in form of an Impact Mitigation Plan for the proposed development. Such evaluation also included an assessment of Project Alternatives as reported in Chapter Five below. The ESMMP also identified modalities for monitoring and evaluation to ensure compliance in implementation of proposed mitigation measures. This involved development of monitoring indicators and procedures for continuous generation of project monitoring data and information.

Reporting procedure

The ESIA study as described above culminated with production of a Draft ESIA Study Report which was reviewed by the client and emergent comments applied towards development of this Final Version of the ESIA. The Final ESIA Report will be submitted to NEMA for review following which it will be processed further in line with Legal Notice 101 of EMCA.

1.4: Presentation of this ESIA Report

This ESIA Report is presented in 10 chapters as follows:-

- Chapter One provides and Introduction to the ESIA Report.
- Chapter Two provides a description of the project as proposed by the KPLC.
- Chapter Three reviews relevant policies, legal, regulatory and administrative frameworks governing conduct of environmental assessment in Kenya.
- Chapter Four provides the pre-project baseline environment while Chapter Five provides an analysis of alternatives to the project.
- Chapter Six reports on the outcome of stakeholder consultations while in Chapter Seven, potential impacts of the project are analysed.
- Chapter Eight outlines the Environmental and Social Management and Monitoring Plan (ESMMP) developed for the project with requisite capacity for implementation being reviewed in Chapter Nine.
- Chapter Ten provides the conclusion and recommendations of this ESIA Study.

CHAPTER TWO: PROJECT DESCRIPTION

2.1: Overview

This chapter provides an overview of the proposed transmission lines as currently designed. The description borrows largely from documentation availed by the KPLC.

2.2: Objectives of the Project

The peak electricity demand in Kenya is 1,050 MW and demand is growing 8 percent annually. Power consumption is however constrained by instability in supply and blackouts across the country are a frequent occurrence, causing business to sometimes suffer huge losses.

In the capacity of the Utility mandated by the GoK to oversee distribution of electric power, the KPLC developed the Least Cost Power Development Plan which, among other interventions identified the need to develop additional 132kV transmission lines intended to improve performance of the national grid while simultaneously catering for increased load growth. Specific goals of the proposed development of 132 kV transmission lines include:-

i) To extend the transmission and distribution lines as well as new and reinforced distribution lines with the aim of reducing technical losses, stabilizing voltage conditions and thereby coping with additional demand.
ii) To increase access to electricity to 20 % by 2010 by accelerating connection rates.
iii) Upgrading of voltage so as to increase supply capacity and reduce system losses.
iv) Provide alternative electricity supply paths to increase reliability and improve quality in the regions.

2.3: Project Justification

The project is justifiable in that it will stabilize power supply and thus cushion current consumers against losses occasioned by power failures and blackouts. As well, expansion of power supply will improve access by new consumers and thus facilitate investments hitherto constrained by lack of electric power.

2.4: The proposed routes of traverse

2.4.1: Administrative territories to be traversed

As currently designed, the transmission lines will largely pass through Eastern province starting at its border with Rift Valley Province at Nanyuki and ending at the border with the latter province at Sultan Hamud- a

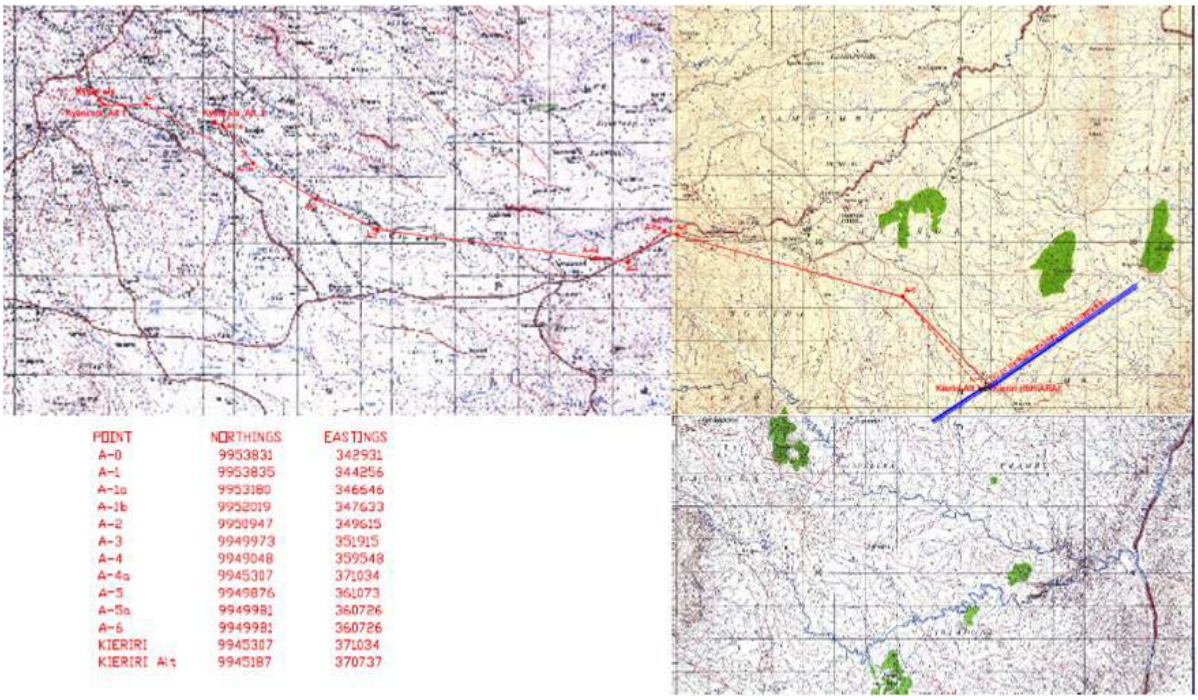
distance of 264 kilometres. A total of 11 districts, 42 locations and 113 sub-locations will be traversed by the project.

2.4.2: Physical tracing of the routes of traverse

Transmission lines as currently designed will be constructed in three sections with dimensions as follows:-

i) Nanyuki – Meru 132kV Line: Construction of approximately 74 km of 132 kV transmission line interconnector between Nanyuki and Meru.
ii) Ishiara – Kieni: Construction of approximately 30km of 132 kV single circuit transmission line.
iii) Mwingi – Kitui – Wote – Sultan Hamud: Construction of approximately 160km of single circuit 132 kV transmission line between Mwingi and Sultan Hamud.

During feasibility studies undertaken for this project, the routes of traverse was identified and clearly delineated in 1:50,000 scale Survey of Kenya Maps on which, all angle points were geo-referenced. For the ESIA study, all the angle points were identified on the ground by use of GPS following which, the transects in-between and their distances were established as a precursor further detailed. Appendix 3.1 provides maps for the proposed Routes of traverse a sample of which is provided in Fig 2.1 below. Details of site conditions along the RoT are provide in Chapter Four below. However, a full description of the alignment is provided in Annex C of the Final Feasibility Study Report in respect if the **Kenya Energy Access Upscale Programme** as prepared by Ms. Norconsult.



POINT	NORTHINGS	EASTINGS
A-0	9953831	342931
A-1	9953835	344256
A-1a	9953180	346546
A-1b	9952019	347633
A-2	9950947	349615
A-3	9949973	351915
A-4	9949048	359548
A-4a	9945387	371034
A-5	9949876	361073
A-5a	9949981	360726
A-6	9949981	360726
KIERIRI	9945387	371034
KIERIRI Alt	9945187	370737

Figure 2.1: Typical routes of traverse as plotted on 1: 50, 000 scale maps

2.4: Design features of the transmission lines

2.5.1: Components

Transmission lines essentially comprise of Towers on which conductors are mounted. Design features for both components are highlighted below.

(i) <u>The Towers:</u>

The basic building block of the TL is the Tower which supports transmission lines (conductors) either on one side (single circuit) or, on both sides (double circuit). The beginning and end of sections of a TL (angle points) are marked and supported by Tension Towers also called Angle Towers in between which are found Line Towers at spacing of 270-350 metres. Design features for Towers are presented in Fig 2.2 below. The towers are mainly erected of stainless steel and range in height from 20 to 25 metres above ground level. On the towers are mounted insulators which support conductors on the towers.

Lattice steel self-supporting towers are recommended for all transmission lines. The recommendation result from an overall evaluation of lattice steel structures versus pole structures (single pole or H-frames) of wood, concrete or steel as accounted for in the following. Although wood and concrete structures could involve a 20-30% cost savings on structures compared to conventional lattice steel structures the performance of wooden poles has proved poor due to their short life time and subsequent poor reliability and very high operational and maintenance costs.

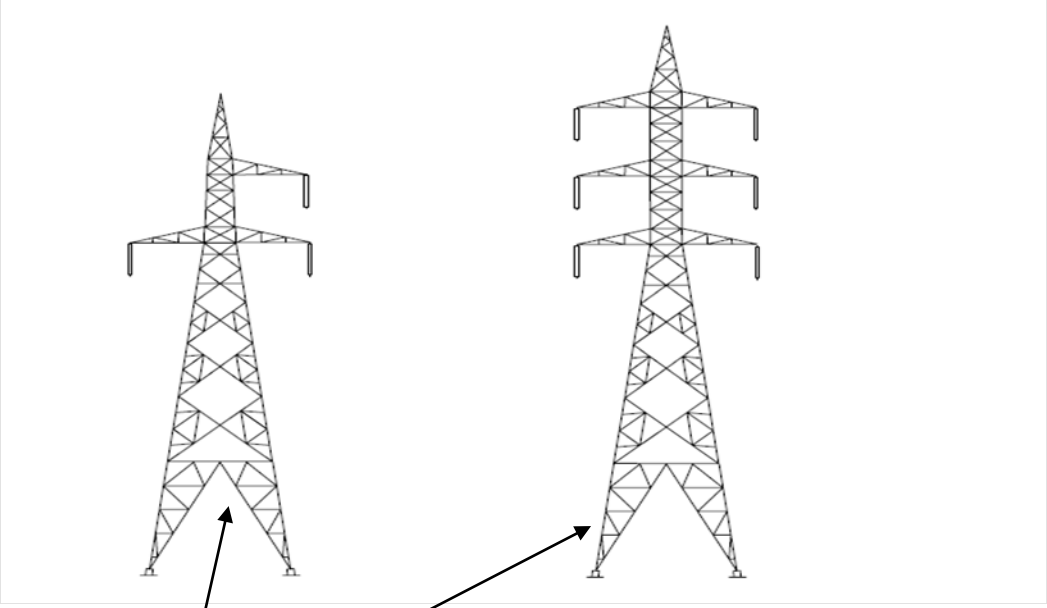


Figure 2.2: Single and double circuit lattice steel tower configurations

Tower foundations: Based on the observation of the ground conditions during the line routes surveys conventional pad and chimney reinforced concrete pad & chimney foundations are recommended. On certain sections where poor soils or submerged conditions are identified a raft type design might be required. Hard rock foundations are not foreseen but weathered rock exists which might require heavy excavation equipment and supply of imported backfill for the pad & chimney foundations. All towers are assumed permanently grounded with an individual tower footing resistance aimed to be less than 20 Ohm. Over the first 1.5 km or 3 to 4 spans out of any substation, all towers, including the terminal towers, should be connected together by continuous counterpoise cable, which also should be connected to the substation-earthing grid. At tower sites in urban areas often frequented by people, additional protective earthing should be installed aimed at less than 10 *Ohm*s.

(ii) Conductors:

Specifications: Conductors comprise the core media through which, power transmission takes place. In the design of the proposed TL, the Wolf Conductor is preferred on account of higher efficiency of transmission, thus resulting in lower losses of energy and cumulative un-served energy. The conductors recommended for the various sub-project options are Aluminium Conductor Steel Reinforced (ACSR) "Wolf" and "Lynx" conductors which are in accordance with KPLC's standards. The technical particulars of conductors are as specified in table 2.1 below:

Table 2.1: Technical specifications for conductor material

Specification		Conductors	
Material		ACSR	ACSR
Conductor designation		Wolf	Lynx
Cross-section	mm^2	194.9	226.2
Overall diameter	mm	18.13	19.53
Stranding Aluminium	No x mm	30 x 2.59	30 x 2.79
Stranding Steel	No x mm	7 x 2.59	7 x 2.79
Weight	kg/km	726	842
Nominal breaking load	N	69,200	79,800
Final modulus of elasticity	N/mm^2	81,000	81,000
Elongation coefficient	$x\ 10^{-5}/°C$	1.78	1.78
Current rating 2)	AMP	355	386
Rated DC resistance at	20 °C Ω/km	0.1828	0.1576
Standard	IEC	60209	60209

Note 2: Wind speed of 0.0447 m/s, ambient temperature 20 °C, temperature rise 30 °C ar intensity of solar radiation 850 W/m^2.

Conductor configuration: The current practice of the KPLC is to use a triangle conductor configuration on single circuit lines with the two lower phases on the same horizontal plane. The configuration results in a slightly lower and lighter tower with a modest cost saving compared to the typical triangular configuration with the three phases on three levels. For lines longer than 100 kilometres, a full transposition (three sections) of

the three phases is recommended due to the impedance asymmetry resulting in a corresponding voltage and current unbalance at the line end.

2.5.2: Land requirement by the transmission lines

Dimensions of the wayleave: The practice of the KPLC is to require a way leave corridor of equivalent to 15m width on either side of the Center Line for 132 kV lines. Along the 30m wide corridor, an appropriate clearance between conductors and vegetation and structures needs be maintained which requires that houses and trees in excess of 7.5 metres are removed for the entire life of the transmission line. However, farming and grazing within the corridor is generally permitted. As for the tower foundations, they will require a permanent area of approximately 6-8 m x 6-8 m (36-64 m^2) based on a typical 132 kV line tower.

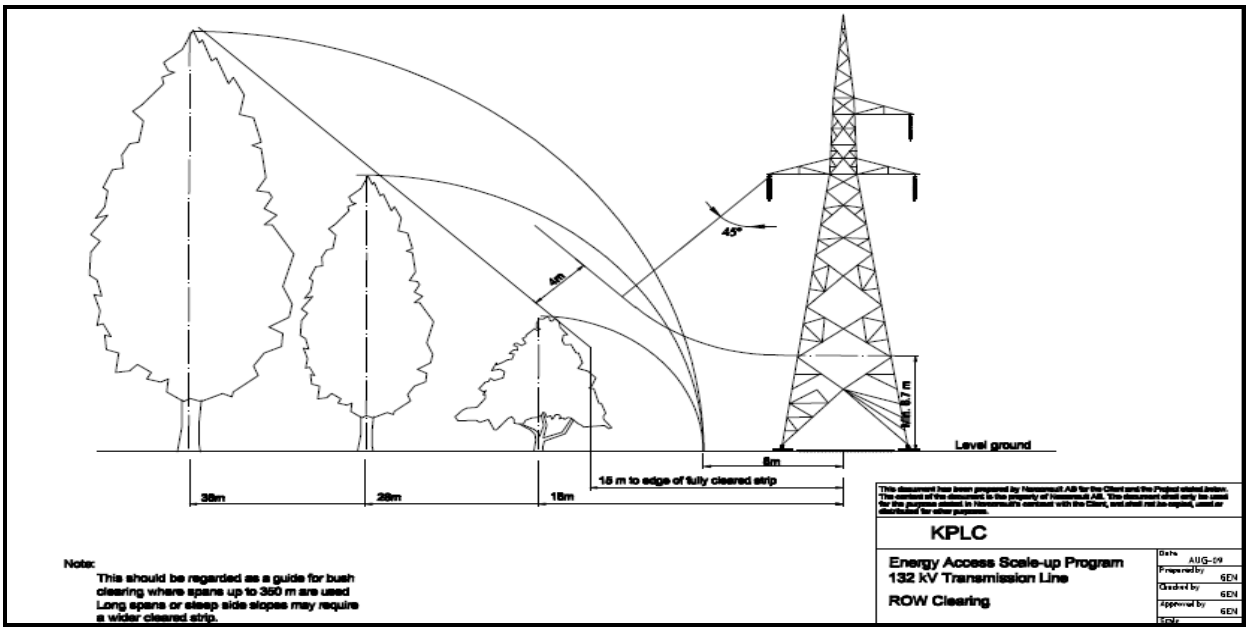


Figure 2.3: Modelling ROW requirements for TLs

Gross land requirements in the project: Table 2.4 below provides an outline of potential land requirements for the proposed transmission lines and substations. The latter was derived based on GPS-based computation of distances between angle points as marked by coordinates. Based on such computations, total length of the

transmission lines is estimated at 264 kilometers which, at a corridor width of 30 metres will require a total ROW covering 792 hectares. Out of this ROW, a maximum of 6.4ha (15.4 acres) will be fixed in tower foundations.

Table 2.2: Land requirements for the proposed transmission lines

Land requirement	*Dimensions*	*Area required(ha)*
Wayleave	Total length: 264km	Area: 792 ha
	Width: 30m	
Tower foundations	Dimensions; 64m2	Area:6.4ha
	Total number: 1000	

2.6: Project activities

Towards development of the transmission lines, activities are anticipated as follows:-

Design works: Feasibilities studies have already been undertaken which paved the way for design works including this ESIA Study. Detailed design will involves survey-work to peg out the ROT on the ground and mark out the Centre Line following which the wayleave will be determined and negotiated with the land owners.

Construction activity: Construction will involve delivery of factory made components of the lattice structures, conductors, insulators and other components of the transmission line. Foundations will be constructed following which, the towers will be erected. The major task will entail mounting of conductors on the towers and connecting to target power intake and off-take facilities following which the project will be commissioned.

Operation phase: Upon powering, the project will then be operated by the KPLC alongside other investments in target districts.

2.7: Land ownership within routes of traverse

With the exception of the 700m stretch of gazette Imenti Forest in Meru that is traversed by the project, the rest of the land (over 99%) within the routes of traverse is privately owned. Further, with the exception of a

few large-scale farms encountered in the Timau area and one ranch at Sultan Hamud, the bulk of the land is controlled by over 2000 small holder farmers and plot owners.

2.8: Total Cost of the Project

It is estimated that the project will cost a total of US$ 18,397,171 (Eighteen Million, three hundred and Ninety seven thousand, one hundred and seventy one United States of America dollars only equivalents to Ksh 1,398,185,006 (One Billion, Three Hundred and Ninety Eight Million, Nine Hundred and Eighty Five thousands, six shillings only). This estimate is based on the average unit cost of US$ 90,000 required to construct a kilometer of 132kV Transmission Line in Kenya and includes Ksh 502,470,720 earmarked for resettlement compensation as par the RAP.

CHAPTER THREE: POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

The proposed Transmission lines will comply with all Kenyan Legal requirements and the World Bank's environmental and social safeguard policies as outlined in sections below under.

3.1 Policy Frameworks

3.1.1: Environmental Policy of the Kenya Government

The policy of the Kenya Government guarantees every citizen a clean and healthy environment. Towards this aspiration, the GOK pursues a policy strategy of integrating environmental aspects into national development plans. The broad objectives of the national environmental policy as expounded in Sessional Paper No 6 of 1996 include:

- Optimal use of natural land and water resources in improving the quality of human environment;
- Sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations;
- Integration of environmental conservation and economic activities into the process of sustainable development;
- Meet national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer and maintaining an ecological balance on earth.

3.1.2: Environmental Safeguard Policies of the World Bank

(i) Overview of World Bank's Safeguard Policies

World Bank projects and activities are governed by Operational Policies, which are clearly spelt out in the Bank's Operational Manual ("Bank Procedures" and "Good Practices"). The Environmental and Social Safeguard Policies whose objectives is to prevent and mitigate undue harm to people and their environment

in the development process have often provided a platform for the participation of stakeholders in project design and are thus an important instrument for building ownership among local populations. The SG policies are thus a cornerstone to the Bank's support to sustainable poverty reduction and since their adoption, the effectiveness and development impact of projects and programs supported by the Bank has substantially increased. There are 11 safeguard policies as follows:-

The World Bank's safeguard policies are designed to ensure that projects proposed for Bank financing are environmentally and socially sustainable, and thus improve decision-making. These operational policies include:

- OP 4.01 Environmental Assessment;
- OP 4.04 Natural Habitats;
- OP 4.09 Pest Management;
- OP 4.11 Cultural Heritage;
- OP 4.12 Involuntary Resettlement;
- OP 4.10 Indigenous People;
- OP 4.36 Forests;
- OP 4.37 Safety of Dams;
- OP 7.50 Projects on International Waterways;
- OP 7.60 Projects in Disputed Areas.

The focus and thinking behind each policy is highlighted below.

Operational policy 4.01- Environmental Assessment: The World Bank's environmental assessment policy and recommended processing are described in OP 4.01 which is considered to be the umbrella policy for the Bank's environmental 'safeguard policies'. Under OP 4.10, the Bank requires environmental assessment for certain category of projects so as to improve decision making and ensure that project options under consideration are sound and sustainable, and that potentially affected people have been properly consulted.

OP 4.01 further outlines clear modalities for disclosing information for all projects targeting to attract World Bank funding; it requires that ESIA reports be disclosed as separate and stand alone reports by the Executing Agencies and the World Bank as a condition for World Bank appraisal. With regard to the project under review, our experience informs that when proposed development are subjected to environmental and social assessment as stipulated by EMCA and its tools, the same process simultaneously takes fully resolves requirements of World bank under OP 4.10. In keeping with this trend, this ESIA report will be made publicly available to project-affected groups within the entire routes of traverse at places to be specified by

NEMA following which, their comments will be incorporated in the final ESIA and will also influence design of the project.

Following revisions, the ESIA will be officially submitted to the World Bank for further disclosure and processing.

Operational Policy 4.04: Natural Habitats seeks to ensure that World Bank-supported infrastructure and other development projects take into account the conservation of biodiversity, as well as the numerous environmental services and products which natural habitats provide to human society. The policy strictly limits the circumstances under which any Bank-supported project can damage natural habitats (land and water areas where most of the native plant and animal species are still present). Specifically, the policy prohibits Bank support for projects which would lead to the significant loss or degradation of any Critical Natural Habitats, whose definition includes those natural habitats which are legally protected, officially proposed for protection, or unprotected but of known high conservation value.

The only natural habitat within the Routes of traverse is the 700m stretch of Imenti Forest where the proposed TL will pass and which is gazetted under the Forests Act Cap 385 and currently protected under Forests Act 2002 and the wildlife Act Cap 376. In line with requirements of OP 4.10, the proposed TL has been subjected to this ESIA so as to rule out any extensive damage to this protected natural habitat. Indeed, as part of the ESIA, consultation were undertaken with staff of the KWS and KFS in charge of this forest who confirmed that the proposed TL will no impact adversely on the forest provided that no new forest will be cleared for the ROW as the TL will utilize the existing road reserve.

Operational Policy/Bank Procedure 4.36- Forests: This tool aims to reduce deforestation, enhance the environmental contribution of forested areas, promote afforestation, reduce poverty, and encourage economic development. Combating deforestation and promoting sustainable forest conservation and management have been high on the international agenda for two decades. However, little has been achieved so far and the world's forests and forest dependent people continue to experience unacceptably high rates of forest loss and degradation. The Bank is therefore currently finalizing a revised approach to forestry issues, in recognition of the fact that forests play an increasingly important role in poverty alleviation, economic development, and for providing local as well as global environmental services.

For the relevance of this ESIA to OP 4.36, the reader is referred to the write up on OP 4.04 above.

Operational Policy 4.09 on Pest Management requires all rural development and health sector projects to avoid using harmful pesticides in favour of Integrated Pest Management (IPM) techniques. Where pesticides have to be used in crop protection or in the fight against vector-borne disease, the Bank-funded project should include a Pest Management Plan (PMP), prepared by the borrower, either as a stand-alone document or as part of an Environmental Assessment.

Development of power transmission lines as proposed by the KPLC has no known relationship with Pest Management and it is unlikely that this SGP will be triggered.

Operational Policy 4.11- Physical Cultural Resources: Cultural resources are important as sources of valuable historical and scientific information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The loss of such resources is irreversible, but fortunately, it is often avoidable.

The objective of OP.11 is to avoid or mitigate adverse impacts on cultural resources from development projects that the World Bank finances. This ESIA can report that no assets within the domain of OP 4.11 were identified within the entire RoT.

Operational Policy 4.12: Involuntary Resettlement is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts. Towards this, OP 4.12 requires that a Resettlement Action Plan (RAP) be prepared for any projects where massive displacement is anticipated and in line with this, an RAP for this project has been prepared and issued as Volume Two to this report.

Operational Policy 4.20 on Indigenous Peoples underscores the need for Borrowers and Bank staff to identify indigenous peoples, consult with them, ensure that they participate in, and benefit from Bank-funded operations in a culturally appropriate way - and that adverse impacts on them are avoided, or where not feasible, minimized or mitigated.

This ESIA hereby confirms that communities fitting the description of Indigenous Peoples (characterised by primary extraction of natural resources through hunting and gathering) were not encountered within the area to be traversed by the proposed project.

Operational Policy 4.37 on Safety on Dams: Dam safety is a matter of significant importance in many countries in the world today because of the presence of a large number of dams, existing, under construction or planned. The safe operation of dams has significant social, economic, and environmental relevance.

The proposed project will not entail construction of dams.

Operational Policy 7.50- Projects on International Waterways. Projects located in International Highways **may affect the relations between** the World Bank and its borrowers, and between riparian states. Therefore, the Bank attaches great importance to the riparians making appropriate agreements or arrangements for the entire waterway, or parts thereof, and stands ready to assist in this regard. In the absence of such agreements or arrangements, the Bank requires, as a general rule, that the prospective borrower notifies the other riparians of the project. The Policy lays down detailed procedures for the notification requirement, including the role of the Bank in affecting the notification, period of reply and the procedures in case there is an objection by one of the riparian to the project.

Operational Policy 7.60: Projects in Disputed Areas may affect the relations between the Bank and its borrowers, and between the claimants to the disputed area. Therefore, the Bank will only finance projects in disputed areas when either there is no objection from the other claimant to the disputed area, or when the special circumstances of the case support Bank financing, notwithstanding the objection. The policy details those special circumstances. In such cases, the project documents should include a statement emphasizing that by supporting the project, the Bank does not intend to make any judgment on the legal or other status of the territories concerned or to prejudice the final determination of the parties' claims.

None of the sections of the proposed transmission lines will traverse any disputed areas.

(ii) BP 17.50- Disclosure of Operational Information

BB 17.50 set out modalities for disclosure of information on projects supported by the World Bank. Further to this policy, in 2002 the Bank promulgated a Disclosure Policy in order to make information about its activities widely available. The policy establishes the Bank's general approach to opening its records, and details the many Bank documents available to the public. As the policy demonstrates, the Bank believes that widespread sharing of information is essential for development. It stimulates public debate, broadens public understanding, and enhances transparency and accountability. It also strengthens public support for efforts to improve the lives of people in developing countries, facilitates coordination among the many parties involved in development, and improves the quality of assistance projects and programs.

(iii) Potential triggers to WB SGPs

In sections below, an analysis of potential triggers to WB SGPs by the proposed project is provided. Results are tabulated in 3.1 below.

Table 3.1: Analysis of potential triggers to World Bank safeguard policies

World Bank Safeguard policy	Potential Triggers	Trigger mechanism
Environmental Assessment (OP4.0)	Triggered	Project is category B and has to undergo mandatory ESIA as specified by OP4.10
Natural Habitats (OP 4.04)	Triggered	RoT passes through protected forests in Mt. Kenya
Forestry (OP 4.36)	Triggered	As above
Pest Management (OP 4.09)	No trigger	Project has no known interaction with this trigger
Cultural Property (OPN 11.03)	No trigger	Project has no know interaction with cultural properties
Indigenous Peoples (OP4.10)	No Trigger	There are no known IPs in the Routes of traverse
Involuntary Resettlement (OP)	Triggered	Project will require land acquisition for the ROW
Safety of Dams (OP 4.37)	No Trigger	Project will not involve construction of dams
Projects on International Waters (OP 7.50)	No trigger	No project activities are planned for in International Waters
Projects in Disputed Areas (OP.60)	No Trigger	There are no sites classified as disputed in the project area.
Disclosure of Operational information (BP 17.50)	Triggered	Both the WB and GOK require that projects be disclosed before development
Total triggers	5	

Notes: ESIA process in respect of the proposed transmission lines has taken cognisance of other World Bank Policies namely;- (i): Interim Guidance Note on land use planning recently unveiled by the Operations Policy and Country Services Quality Assurance and Compliance Unit and the Legal Department

Environmental and International Law Unit. (ii): The Environmental Health and Safety Guidelines. (*www.ifc.org/ifcext/sustainability.nsf/Content/EnvironmentalGuidelines*)

From table 3.1, it is apparent that the development of power transmission lines by the KPLC is likely to trigger 5 out of 11 WB safeguards out of which, displacement of settlements to give way for transmission lines is likely to be the most severe. It is in recognition of this prospect that a Resettlement Action Plan has been prepared to guide resolution of all resettlement concerns.

3.2: The Legal Framework

Kenya has an umbrella Environmental law; the ***Environmental Management and Coordination Act (EMCA) 1999*** which was enacted in 2000 with a view to harmonizing environmental legislation previously scattered in 77 national laws. This is the supreme environmental law that governs conduct of environmental management including conduct of ESIA studies in Kenya.

3.2.1: Requirement for conduct of ESIA Studies under EMCA 1999

Under EMCA, ESIA studies are mainstreamed into development planning as follows:-

i) **Section 58 of the Environmental Law** requires that an Environmental Impact Assessment (EIA) Study precede all development activities proposed to be implemented in Kenya.

ii) The Act further requires that EIA studies so designed, be executed in accordance with the Guidelines for Conduct of EIAs and Environmental Audits (Kenya Gazette Supplement No. 56 of 13th June 2003) as published by the National Environmental Management Authority (NEMA).

iii) The Second Schedule of EMCA specifies the nature of projects that should undergo environmental and social impact assessment. Under EMCA however, all projects irrespective of size are to be subjected to ESIA studies. Under Electricity infrastructure, the Second Schedule identifies the following candidate projects as meriting ESIA Studies:-

- Electricity generation stations,
- Electrical transmission lines;
- Electrical substations;
- Pumped storage schemes; have been specified as projects to be subjected to EIA.

The ESIA Study for the proposed development of power transmission lines by KPLC has thus been designed and conducted in response to this legal requirement. The ESIA Study has however also taken cognisance of other legal instruments under EMCA and revealed relevance of other national statutes as briefly highlighted in sections below.

3.2.2: Legal Tools under EMCA

Under EMCA 1999, sectoral rules and regulations have been promulgated and gazetted as follows:-

- **Environmental (Impact Assessment and Audit) Regulations, 2003 (Legal Notice 101- Kenya Gazette Supplement No. 56 of 13th June 2003):** The Environmental (Impact Assessment and Audit) Regulations, 2003, provide the basis for procedures for carrying out Environmental Impact Assessments (EIAs) and Environmental Audits (EAs). 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". Regulation 4(1) further states that: ''...no proponent should implement a project:

  i) Likely to have a negative environmental impact; or
  ii) 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...''. Among other requirements, these guidelines also prescribe the Format and content of Project Reports and EIA Study Reports.

- **Environmental Management and Co-ordination Act (Waste Management) Regulations 2006**: These are described in Legal Notice No. 121 of the Kenya Gazette Supplement No. 69 of September 2006. These Regulations apply to all categories of waste as provided in the Regulations. These include:
  - Industrial wastes;
  - Hazardous and toxic wastes;
  - Pesticides and toxic substances;
  - Biomedical wastes;
  - Radio-active substances.

  These Regulations outline requirements for handling, storing, transporting, and treatment / disposal of all waste categories as provided therein.

- **Environmental Management and Coordination Act (Water Quality) Regulations 2006**: These are described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006. These

Regulations apply to drinking water, water used for agricultural purposes, water used for recreational purposes, water used for fisheries and wildlife and water used for any other purposes. This includes the following: Protection of sources of water for domestic use; Water for industrial use and effluent discharge; Water for agricultural use. These Regulations outline:

- Quality standards for sources of domestic water;
- Quality monitoring for sources of domestic water;
- Standards for effluent discharge into the environment;
- Monitoring guide for discharge into the environment;
- Standards for effluent discharge into public sewers;
- Monitoring for discharge of treated effluent into the environment.

- **Conservation of Biological Diversity (BD) Regulations 2006**: These regulations are described in Legal Notice No. 160 of the Kenya Gazette Supplement No. 84 of December 2006. These Regulations apply to conservation of biodiversity which includes Conservation of threatened species, Inventory and monitoring of BD and protection of environmentally significant areas, access to genetic resources, benefit sharing and offences and penalties. Given that the project will traverse 700m of the Imenti Forest which is used by elephant migrating to the world-re-known Nkunga Forest that allegedly serves as a maternity ground, these rules alongside the Wildlife Management and coordination Act will be deployed in minimising and mitigating any potential impacts of the project.

- **National Sand Harvesting Guidelines, 2007**: These Guidelines apply to all sand harvesting activities in Kenya to ensure sustainable utilization of the sand resource and proper management of the environment. Among Key features, the guidelines empower respective DECs to regulate sand harvesting within areas of jurisdiction implying that, sand should only be sources from approved sites and by approved dealers.

- **Guidelines on Noise level**: NEMA has recently gazetted guidelines on noise control. In conformity to these guidelines, the ESIA will formulate measures to ensure that; - the Contractor keeps noise level within acceptable limits and construction activities shall, where possible, be confined to normal working hours in the residential areas; Schools, hospitals and other noise sensitive areas shall be notified by the Contractor at least 5 days before construction is due to commence in their vicinity. Any excessively noisy activity shall be conducted outside of school hours, where approved by the RE; Any complaints received by the Contractor regarding noise will be recorded and communicated to the RE; The Contractor must adhere to Noise Prevention and Control Rules of April 2005.

3.2.3: Review of potential triggers to the legal tools of EMCA

The proposed development of power transmission lines by the KPLC has been screened against these tools with results that (table 3.2 below) five of the six tools will be triggered. Detailed analysis of the trigger mechanism and modalities for mitigation are provided in Chapter Six below.

Table 3.2: Analysis of potential triggers to EMCA tools

Legal Tool	Status	Trigger mechanism
EIA and Audit regulations	Triggered	ESIA Study has to conform to these rules
Waste Management Rules	Triggered	Construction likely to generate solid waste
Water Quality rules	No triggers	No direct interaction with water resources.
Conservation of Biodiversity regulations	Triggered	Routes of reverse passes through some protected reserves and natural vegetation Belts
National Sand Harvesting Rules	Triggered	Construction of tower foundations will require sand sourcing
Ambient Air Quality (Noise) Regulations	Triggered	Both construction activity and construction crew likely to generate noise

In particular, specifications of these guidelines would require to be captured in the Contracts for Construction to ensure that contractors are legally bound to undertake mitigation alongside general construction work.

3.2.4: Modalities for Inter-sectoral Coordination of ESIA studies under EMCA

In recognition that EMCA is an umbrella law coordinating diverse sectoral statutes all of which are still in force, Legal Notice 101 of EMCA requires that the respective sectors be consulted as Lead Agencies in making decisions pertaining to environmental assessment for projects in respective sectors. This is to ensure that NEMA does not approve projects that contradict sector policies and legislation.

As part of this ESIA, an analysis of Kenyan laws considered relevant to development and operation of power transmission lines was undertaken following which, 17 potential triggers were identified. In sections below, an analysis of the triggers and possible mitigation is provided.

(i) The Energy Act of 2006

The Energy Sector in Kenya is regulated by the ERC which was established under the Energy Act of 2006. The Energy Act 2006 was enacted to amend and consolidate the laws relating to energy, to provide for the

establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority, and for connected purposes. Section (4) of the Energy Act establishes the ERC as an independent body corporate in the performance of its functions and duties and exercise of its powers. Section 6 of the Energy Act empowers the ERC to execute tasks pursuant to its mandate as follows:-

- Formulate, enforce and review environmental, health, safety and quality standards for the energy sector, in coordination with other statutory authorities;
- Enforce and review regulations, codes and standards for the energy sector;

Thus, under the Energy Act, clauses in Section 6 complement EMCA in establishing the position of ERC as Lead Agency in environmental protection in the energy sector. Thus, the ERC has full mandate to ensure environmental protection within the energy sector in the capacity of *de jure* Lead Agency. Under the now repealed **Electric Power Act, 1997 (No 11 of 1997),** the predecessor of ERC had issued the Electric Power (Complaints and Disputes Resolution) Rules 2006 **(Kenya Gazette Supplement No. 56 of 4th August 2006- Legal Notice No 106)**[1] to provide a dispute resolution mechanism for any person who has a complaint regarding any matter within the powers and functions of the Electricity Regulatory Board. [2] This provides a mechanism for resolution of any grievances that may touch on environmental matters.

[1]Section 123 (2) (b) of the Energy Act provides for the legal relevance of Legal Notice 106 as follows:- 'any statutory instruments issued by the Electricity Regulatory Board or the Minister under the provisions of the Electric Power Act, 1997 and the Petroleum Act before the commencement of this Act shall be deemed to be

[1]Section 123 (2) (b) of the Energy Act provides for the legal relevance of Legal Notice 106 as follows:- 'any statutory instruments issued by the Electricity Regulatory Board or the Minister under the provisions of the Electric Power Act, 1997 and the Petroleum Act before the commencement of this Act shall be deemed to be statutory instruments granted by the Commission under the provisions of this Act and shall remain in force until specifically revoked under this Act.'

The ERC operates in a policy environment that requires full environmental sensitivity and compliance. Indeed, the Energy Act requires the ERC to be subordinate to EMCA in all its dealings. Section 30(1) and (2) of the Energy Act 2006 requires that '*The Commission shall, in granting or rejecting an application for a licence or permit, take into consideration–*

- *the impact of the undertaking on the social, cultural or recreational life of the community;*
- *the need to protect the environment and to conserve the natural resources in accordance with the Environmental Management and Coordination Act of 1999.* '

Section 31(2)(a) of the Energy Act stipulates that '*All licences or permits issued by the Commission shall include among others... (a) a requirement that the licensee or permit holder shall comply with all applicable environmental,* health and safety laws. 'An analysis of documents available in the ERC reveals that the Commission has put in place tools and a mechanism towards executing its environmental protection role in the energy Sector. This is exemplified by the following:-

In September 2005, ERC's predecessor- the ERB, developed an *Environmental, Health& Safety Policy Framework for the Electric Power Sub-Sector* as an additional regulatory instrument for purposes of enforcing environmental and safety regulations in the electric power sub-sector as then provided for in the repealed *Electric Power Act, No. 11 of 1997,* and now *Energy Act 2006.* This policy framework document gives guidelines and emphasizes the standards for EHS in the energy sub-sector as well as the monitoring protocol in electric power generating stations. A lot emphasis has been put on existing electrical installations and operations.

For new electrical installations, a checklist has been developed for the petroleum energy sub-sector that shows the requirements for new applicants. This includes a NEMA license be submitted together with the last EHS audit conducted. Section 90 of the Energy Act, 2006 states, "*Any person intending to construct a pipeline, refinery, bulk storage facility or retail dispensing site shall, before commencing such construction, apply in writing to the Commission for a permit to do so"* and such an application shall be accompanied by among others documents an environmental impact assessment report. The checklist is however silent on EIA requirement in the electrical subsector.

Under the now repealed **ELECTRIC POWER ACT No 11 of 1997**, the predecessor of ERC had issued the Electric Power (Complaints and Disputes Resolution) Rules 2006 **(Kenya Gazette Supplement No. 56 of**

4th August 2006- Legal Notice No 106) to provide a dispute resolution mechanism for any person who has a complaint regarding any matter within the powers and functions of the Electricity Regulatory Board[3]. This provides a mechanism for resolution of any grievances that may touch on environmental matters. Other Regulatory Instruments used by ERC include:-

- Kenya Electricity Grid Code
- Electric Power (Licensing) Rules, 2005
- Industrial Safety Code
- Retail Electricity Tariffs Review Policy, 2005
- Model Power Purchase Agreement
- Electrical Power (Installation Works) Rules, 2006
- Kenya Electricity Grid Code
- Electric Power (Licensing) Rules, 2005
- Industrial Safety Code
- Retail Electricity Tariffs Review Policy, 2005
- Model Power Purchase Agreement
- Electrical Power (Installation Works) Rules, 2006

This ESIA Study has partly been undertaken in fulfilment of requirements of the Energy Act and indeed, the final output will be reviewed by the ERC in the capacity of Lead Agency.

(ii) The Wildlife (Conservation and Management) Act (Cap 376):

This principal Act regulates wildlife conservation and management in Kenya. The Act establishes Kenya Wildlife Service (KWS) as the implementing agency. Under section 9 and subsection 3A, the functions of KWS are stated among others as: to provide advice to the government and local authorities and landowners on the best methods of wildlife conservation and management and authority to ensure viability of conservation areas. Furthermore, the Minister responsible for wildlife has discretionary powers to promulgate such regulations to enhance the management of such conservation areas, so long as the regulations so promulgated are reasonable and not *ultra vires* to the parent Act.

[3] **Section 123 (2) (b) of the Energy Act provides for the legal relevance of Legal Notice 106 as follows:- 'any statutory instruments issued by the Electricity Regulatory Board or the Minister under the provisions of the Electric Power Act, 1997 and the Petroleum Act before the commencement of this Act shall be deemed to be statutory instruments granted by the Commission under the provisions of this Act and shall remain in force until specifically revoked under this Act.'**

The proposed routes of traverse have been ascertained to avoid any land protected under Cap 376. Interests of this Act with regard to the Imenti Forest which is also an elephant sanctuary are catered under the Forests Act 2005 as discussed in section below.

(iii) The Forests Act 2005:

The Forests Act 2005 repealed Cap 385 of the Laws of Kenya and provides for the establishment, control and regulation of Forests. The Act confers powers on the Minister responsible of Forests to set aside specific areas for the conservation of fauna and flora, for the management of water catchments, prevention of soil erosion or for the protection and management of indigenous forests on alienated Government land. Such forest land includes those formerly gazetted under Cap 385, thus essentially putting the control of all Kenyan forests under a single statute. The Forests Act makes illegal, any alienation of gazetted forest land for any purposes considered contradictory to the dictum of conservation, requiring that, such proposals to be debated and approved by Parliament, after completion of a comprehensive ESIA Study.

This ESIA Study has ruled out any significant interaction between the proposed project and gazetted forestland. Indeed, the only interaction is the 700m stretch of the Imenti Forest that will be traversed by the transmission line. In this section however, the ROT will utilize an existing road reserve with the result that virgin forest will not be opened up for the project. The only impact therefore will manifest in form of the trees to be cleared to pave way for the way leave in this forest area which is considered insignificant.

(iv) The Agriculture Act, Cap 318 of the Laws of Kenya: This statute seeks to promote and maintain a stable agriculture, to provide for the conservation of the soil and its fertility and to stimulate the development of agricultural land in accordance with the accepted practices of good land management and good husbandry. This Act primarily guides and regulates farming practices. The Agriculture Act is the principal land use statute covering, *inter-alia*, soil conservation and agricultural land use in general.

The Agricultural Land-Use Rules under Cap 318 are clear on activities proscribed in riparian areas and it's essential that the proposed construction of transmission lines does not contradict requirements of this Act. Further, the project traverses sections of lower Easter province where crop failures and food shortages are almost perennial and it would be imperative that measures be taken to minimize crop damage at all stages of the project. *It is expected that construction will take place after harvest when fields are bare, otherwise, modalities for effecting compensation for any crops damaged for been inbuilt into the RAP.*

(v) The Kenya Roads Act 2007:

This Act created three public bodies to cater for the national roads development and maintenance programme as follows:-

i) ***The Kenya National Highways Authority*** charged with the responsibility of managing and maintaining all road works on class A, B, C as well as other rural paved roads.

ii) ***The Kenya Rural Roads Authority*** responsible for all rural and small urban roads of class D and below.

iii) ***The Kenya Urban Roads Authority*** to manage and maintain all road works on urban roads in cities and major towns.

There is likelihood that provisions of this Act will be triggered in diverse sections of the 264km long transmission lines. The requirement is for the project survey and design to ensure compliance with all requirements under this Act.

(vi) Legislation pertaining to land tenure:

Currently, there are numerous statutes that specifically deal with rights of ownership and control of land. These statutes make provisions for the conferring and vesting of interests in land under three tenure categories namely;- Government land, Trust Land and Private land as briefly reviewed here4 below.

Government Lands Act, Cap. 280 (revised 1984): This Act deals with government land which includes forest reserves, other government reserves, townships, alienated and un-alienated government land and national parks. In this Act, Section 3 gives the President powers, subject to any other written law, to "make grants or dispositions of any estates, interests or rights in or over alienated Government land." The powers of the President over government land also extend to forest reserves, because these are administered under the government land tenure.

With the exception of Forest land currently controlled under the Forests Act 2005, this study did not come across any government owned land within the routes of traverse.

Trust Lands Act Cap. 288 of 1962 (revised 1970): At independence, all land that was not in private or government ownership became Trust Land, under the control of County Councils to be used for the benefit of the residents of the area. Currently, approximately 78.5% of the total land area in Kenya is Trust Land. The Trust Land Act makes provision for rights in Trust Land and controls the occupation of land. The Act also

sets out the procedures for the setting aside of land for a variety of purposes likely to benefit the persons ordinarily resident in that area or for transfer to the Government. The Government may, by written notice to a council, state that a parcel of land is required to be set apart; compensation shall be paid for this land. Of particular relevance to conservation is the fact that the Act makes provisions for general conservation, protection and controlled utilization of trees and other forest products on land, other than gazetted Forest Reserves.

This ESIA study did not come across any land falling under Trust lands category.

The Land Adjudication Act, Cap. 284 of 1968 (revised 1977): This Act provides for the ascertainment and recording of rights and interests in Trust land. Land that is adjudicated under this Act is then registered under the Registered Lands Act or the Land (Group Representatives) Act. The Department of Land Adjudication and Settlement of the Ministry of Lands and Settlements is responsible for implementing this Act. This Act has potential implications in the management of forests in that the adjudication officer in declaring specific sections for adjudication is empowered to exclude areas of ecological importance, such as watershed areas and hilltops from being converted into private ownership.

This study did confirm that all lands to be traversed by the proposed transmission lines are adjudicated and registered.

Registered Lands Act, Cap. 300 of 1963 (revised 1989): Land that is adjudicated or set apart under section 117 and 118 of the Constitution is registered under this Act. This Act confers freehold title to land and protects land that is registered. In the provisions of section 4 it states that, "except as otherwise provided in this Act, no other written law and no practice or procedure relating to land shall apply to land registered under this Act so far as it is inconsistent with this Act".

The bulk of lands within the proposed routes of traverse is privately registered under this Act which requires that negotiations of the proposed wayleave be undertaken with the bonafide registered owners and interests there-in.

(vi) The Physical Planning Act (Cap 286):

This Act provides for the preparation and implementation of physical development plans for connected purposes. It establishes the responsibility for the physical planning at various levels of government mainly the District Level. The Act provides for a hierarchy of plans in which guidelines are laid down for the future physical development of areas referred to in the specific plan. The intention is that the three-tier order plans, the national development plan, regional development plan, and the local physical development plan should

concentrate on broad policy issues. The Act also advocates for public participation in the preparation of plans and requires that proper consideration be given to the potential for economic and social development.

This ESIA study has confirmed that the Feasibility Study took account of regional development plans in identifying the alignment of proposed power transmission lines. Public consultations have been undertaken as part of the ESIA and the same will be continued when this report is advertised and displayed for the statutory public review.

(vii) The Occupation Health and Safety Act 2007

This is an Act of Parliament to provide for the safety, health and welfare of 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. The Act has the following functions among others:

- Secures safety and health for people legally in all workplaces by minimization of exposure of workers to hazards (gases, fumes & vapours, energies, dangerous machinery/equipment, temperatures, and biological agents) at their workplaces.
- Prevents employment of children in workplaces where their safety and health is at risk.
- Encourages entrepreneurs to set achievable safety targets for their enterprises.
- Promotes reporting of work-place accidents, dangerous occurrences and ill health with a view to finding out their causes and preventing of similar occurrences in future.
- Promotes creation of a safety culture at workplaces through education and training in occupational safety and health.

Section 8.2 of this ESIA has outlined clear modalities to be followed by contractors towards mitigating/minimizing/avoiding hazards to occupational health and safety.

(viii) The Antiquities and Monuments Act, 1983 Cap 215:

The Act aim to preserve Kenya's national heritage. Kenya is rich in its antiquities, monuments and cultural and natural sites which are spread all over the country. The National Museums of Kenya is the custodian of the country's cultural heritage, its principal mission being to collect, document, preserve and enhance knowledge, appreciation, management and the use of these resources for the benefit of Kenya and the world. Through the National Museums of Kenya many of these sites are protected by law by having them gazetted under the Act.

This study has ascertained that assets protected under this act are not encountered anywhere within the routes of traverse.

(ix) Occupiers Liability Act (Cap. 34)

Rules of Common Law regulates the duty which an occupier of premises owes to his visitors in respect of danger and risk due to the state of the premises or to things omitted or attributes an affliction on his/her health to a toxic materials in the premises.

In additional to creation of a wayleave, the KPLC will mount a public sensitisation programme to ensure that people are aware of the hazards posed by presence of powered transmission lines.

(x) Way Leaves Act (Cap. 292)

The Act provides for certain undertakings to be constructed e.g. transmission lines, pipelines, canals, pathways etc., through, over or under any lands. This project is under the provision of the Act. Section 3 of the Act states that the Government may carry any works through, over or under any land whatsoever provided it shall not interfere with any existing building or structures of an ongoing activity.

As a precursor to construction of the transmission lines, KPLC will acquire rights to a 30m-wide corridor along the entire routes of traverse as allowed for under this Act.

(xi) Penal Code (Cap.63)

The Act makes it criminal for anybody to pollute common resources such as air, public water supply, acoustic quality, etc and stipulates fines for diverse offences.

The ESMMP prepared as part of this ESIA has identified nuisances as potential adverse impacts of the project and has recommended activities towards mitigation/ minimisation/ avoidance of nuisances arising from the project activities.

(xii) The Standards Act Cap 496

The Act is meant to promote the standardization of the specification of commodities, and to provide for the standardization of commodities and codes of practice; to establish a Kenya Bureau of Standards, to define its functions and provide for its management and control. Code of practice is interpreted in the Act as a set of rules relating to the methods to be applied or the procedure to be adopted in connexion with the

construction, installation, testing, sampling, operation or use of any article, apparatus, instrument, device or process.

The Act contains various specifications touching on electrical products and the Proponent shall ensure that commodities and codes of practice utilised in the project adhere to the provisions of this Act.

(xiii) Public Roads and Roads of Access Act (Cap. 399)

Sections 8 and 9 of the Act provides for the dedication, conversion or alignment of public travel lines including construction of access roads adjacent lands from the nearest part of a public road. Section 10 and 11 allows for notices to be served on the adjacent land owners seeking permission to construct the respective roads.

The proponent has confirmed to this study that no new access roads will be opened up and the project will rely on existing roads.

(xiv) The Lakes and Rivers Act Chapter 409 Laws of Kenya

This Act provides for protection of river, lakes and associated flora and fauna. The Act should however be read in conjunction with the Water Act 2002 which has clearly outlined modalities for the management of Riparian areas.

In line with requirements of the Water Act 2002 and its Water Management Rules, the development of transmission lines will avoid riparian areas but where construction in such sites is inevitable, an authorization will be obtained from the Water Resources Management Authority (WRMA).

(xv) The Limitations of Actions Act (Cap. 22)

This Act provides for recognition of squatters and the conditions under which they would have rights for compensation for loss of land. If squatters have been in occupation of private land for over twelve (12) years, then they would have acquired rights as adverse possessors of that land as provided under the limitation of Actions Act, section 7.

The issue of restoration of livelihoods are quite central to the operations of the KPLC and indeed the World Bank in capacity of Financier. In line with requirements of OP 4.12, the KPLC has commissioned a Resettlement Action Plan (RAP) to guide resolution of all displacement concerns occasioned by the proposed development.

(xvi) The Civil Aviation Act, Cap 394

Under this Act, the Kenya Civil Aviation Authority (KCAA) has to authorise and approve the height of all proposed masts for purposes of ensuring the safety of flying aircraft over the proposed project area. For purposes of this study, this ACT is crucial given that the proposed routes of traverse comes in very close proximity of aviation infrastructure namely;- the Laikipia Air base which operates a runway, the Kitui Airstrip and the Timau-based large-scale farms that rely on small aircraft for aerial spraying.

This ESIA study has identified interference with aviation services as a major adverse impact of the proposed transmission lines and the KPLC shall seek authorization of the KCAA for the installation of the lattice steel self-supporting towers in line with this Act.

(xvii) The Water Act 2002

In March 2003, the *Water Act 2002* came into effect to provide a legal framework for management and conservation of the national water resource base in line with policy changes in the sector. New institutions with separate functions have now been established, and decentralized decision making is reflected in autonomous regional bodies. Henceforth, these are the institutions with which all works touching on water resources have to coordinate with. They include:

Ministry of Water and Irrigation: The MWI is the trustee of all water resources in the country. The present key roles and functions of the MWI have been defined in the National Water and Sanitation Services as: water policy formulation; water resources management policy; apportionment of water resources and abstraction licensing; appointment of water undertakers; regulation, setting and approval of standards; approval of water tariffs, levies, rates and charges; development and operation and maintenance of urban and rural water supply systems; wastewater treatment and control; water quality and pollution control; catchment area conservation; water conservation (by National Water Conservation and Pipeline Corporation); irrigation and dam construction schemes; flood control and land reclamation (MWRMD, 2003).

The Water Resource Management Authority: This is a body corporate charged (under Section 8(1) of the Water Act 2002) with the overall responsibility of overseeing sustainable development of the national water resource base. The functions of the WRMA as provided in Section 8 of the *Water Act 2002* is to manage, protect and conserve the water resources with regional offices at catchment levels for

decentralized decision-making, quick response to water resources management problems and for speedy water allocation process.

In order to coordinate activities in water resource management, WRMA has issued Guidelines for Water Resource Management, Part IX of which specifies code of conduct with regard to activities in riparian areas. Thus, under these rules, activities in construction of pylons require to obtain approval from WRMA.

3.2.5: Relevant International Conventions, Treaties and Agreements

Kenya is a signatory as well as a party to various international conventions, treaties and protocols relating to the environment and aimed at achieving sustainable development. While there are few treaties pertaining to impacts of manufacturing, many international treaties touch on this issue. According to the Registrar of International Treaties and other Agreements in Environment (UNEP 1999), there are 216 such treaties, 29 of which are of interest to Kenya. The country is a signatory to 16 such agreements, which range from use of oil, protection of natural resources and, protection of the atmosphere. The agreements are both regional and international and became legally binding on Kenya upon ratification thereof by the rightfully designated Kenyan Authority.

Protocols towards protection of the natural environment: There are 12 agreements of significance to Kenya especially due to its high dependence on fuel wood and hydropower. At international level, Kenya has signed and ratified the Convention on Biological Diversity, 1992; United Nations Convention to Combat Desertification 1994; the International Plant Protection Convention 1951; the Convention on Wetlands of International Importance (Ramsar, 1971); Convention on International Trade in Endangered Species (CITES) of Wild Fauna and Flora, 1990, which protects forests as habitat for endangered species; and also the Convention concerning the Protection of World Cultural and Natural Heritage, 1972, which also protects threatened plants.

Protection of the Atmosphere: Most of the greenhouse and ozone depleting emissions emanate from man's activities in sourcing energy and as such, the conventions in this area mainly aim at protecting the atmosphere from harmful emissions. Kenya is party to the Vienna Convention of 1985 on Protection of the Ozone Layer together with its three Protocols of 1990, 1992 and 1994. Kenya is also a signatory to the

United Nations Framework Convention on Climate Change 1992, which principally aims at cutting down on emission of greenhouse gases.

Other Non-Legally Binding Instruments: The Declaration of the United Nations Human Environment (Stockholm 1972); The 1982 World Charter for Nature and, The Rio Declaration on Environment and Development have significant nature, industry and transport issues embedded in them.

3.3: The Regulatory Framework

3.3.1: Regulatory framework for this ESIA Study:

This ESIA study is subject to control by two administrative frameworks:-

(i) The Kenya Power and Lighting Company-KPLC: In the capacity of Employer, the KPLC has defined the scope and coverage of the Project which to a large extent determines the depth of the study to be undertaken. Towards this, the Employer has stipulated TORs for the Study inclusive of tasks to be executed towards ensuring a comprehensive, legally proficient study output. KPLC thus wields the administrative framework towards supervision and quality control of the study.

(ii) The National Environmental Management Authority: EMCA 1999 allows for formation of the National Environmental Management Authority (NEMA) as the body charged with overall coordination of environmental protection in Kenya. A Director General (DG) appointed by the President heads the Authority established in 2001. Several Directors in charge of Enforcement, Education, Policy, who are assisted by Assistant Directors and Senior Officers under them, assist the DG. To facilitate coordination of environmental matters at District level, EMCA 1999 allows for creation of District Environmental Committees (DEC) traditionally chaired by respective District Commissioners. To each DEC in the country is attached a District Environmental Officer who oversees environmental coordination among diverse sectors and is also secretary to the DEC.

Thus this ESIA Study recognizes NEMA as the sole regulator of EIA processes in Kenya. Indeed, the second objective of the ESIA is to facilitate Environmental Licensing of the 132kV Transmission line by NEMA; in which case, the ESIA has to ensure compliance with all standards as set out by NEMA in capacity of Environmental Regulator in Kenya.

The ESIA has thus been tied up to the NEMA institutional framework at Head Office, Provincial Offices (Rift Valley and Eastern) and respective District Environment Offices.

3.3.2: Resolution of Kenyan and WB requirements for Environmental and Social Impact Assessment

By virtue of source of finding, the proposed development of TLs by the KPLC is subject to both Kenyan and World Bank requirements for impact assessment. As such, this ESIA study has been formulated to address and cater for both Kenyan and World Bank requirements for impact assessment. Previous experience has shown that both OP 4.10 of the World Bank and EMCA 1999 are generally aligned in principle and objective:-

- Both require Environmental Assessment before project implementation (which includes an assessment of social impacts)
- Both require public disclosure of ESIA reports and stakeholder consultation during preparation
- While OP 4.01 of World Bank stipulates different scales of ESIA for different category of projects, EMCA requires ESIA for all sizes of projects, which are required to be scoped as relevant
- Where EMCA requires Strategic Environmental Assessments, OP 4.01 requires that an Environmental Assessment be conducted depending on the project category while an ESMF should be prepared for Programmes. EMCA recognizes other sectoral laws while WB has safeguards for specific interests.
- The Bank requires that stakeholder consultations be undertaken during planning, implementation and operation phases of the project which is equivalent to the statutory annual environmental audits at the operation phase of projects in Kenya.

The understanding of this ESIA study is that, pursuit of an in-depth ESIA process as stipulated by EMCA 1999 is adequate to address all World Bank requirements for environmental and social assessment. This is a major guiding principle in this study.

CHAPTER FOUR: THE BASELINE ENVIRONMENT

4.1: The Bio-physical baseline

4.1.1: Location and administrative set-up

With the exception of the initial 20 km stretch which falls in the Laikipia District of Rift Valley Province, the bulk of proposed transmission lines fall within the Eastern Province of Kenya where the line traverses the

former districts of Meru Central, Embu, Mbere, Mwingi, Kitui and Makueni to end at Sultan Hamud town at the border of Eastern and Rift Valley Provinces.

4.1.2: Relief and physiographic profile

Three distinct geomorphic units namely;- Plateaus and high level plains; Volcanic Footridges; and, Upper Middle level Uplands are encountered within the routes of traverse with an administrative span and coverage as outlined in table 4.1 below.

Table: 4.1: Occurrence of physiographic units along the routes of traverse

Section of the Routes of traverse	*Districts covered*	*Dominant geomorphic unit*	*Physiographic description*
Nanyuki-Meru	Nanyuki, Meru Cetral	Plateaus and high level plains	Flat to undulating with slopes generally less than 8%
Ishiara-Kieni	Mbeere, Embu	Volcanic Footridiges	Dissected lower slopes of Mt. Kenya
Mwingi-Kitui-Wote-Sultan Hamud	Mwingi, Kitui, Machakos and Makueni	Lower middle level uplands	Undulating to dissected plateaus

With the exception of the section between Ishiara and Kieni which is steep on account of location on the eroded slopes of Mt. Kenya, the rest of the route of traverse is generally flat to undulating. A key feature of the project however is the apparently deliberate attempt to locate the project at the base of hills apparently to keep off from densely populated areas. This is particularly the case in Mwingi, Kitui and Makueni areas where the line traverses the slopes of Kitui hills, and Kakoli Ridge, Kithumba, Nzaui, and Kyemundu Hills where motorised access is quite challenged.

Altitude along the entire routes of traverse generally ranges from around 1300 in Makueni to 2200m above sea level at the base of Mt. Kenya in Meru.

(i) Geology and soils

Soils along the routes of traverse are mainly influence by the local geology and climatic regime (table 4.2 below). At the base of Mt. Kenya, soils developed from tertially volcanic volcanic ashes are deeply

weathered greyish sandy clay loam to clay but in areas of poor drainage, the tendency is for heavy clays to develop. Along the Laikipia and Yatta plateaus and other volcanic belts that suffer inadequate rainfall, soils display high variability in depth, texture and reaction and will often be underlain by lithic phases with occasional outcrops of granite. Within the basement complex belt across the Athi, soils are diverse but mainly dominated by sandy clay loam to clay loam (complex of ferrasols and cambisols).

Table 4.2: Geology and soil occurrence along the routes of traverse

Section of the Routes of traverse	*Districts covered*	*Dominant geomorphic unit*	*Geology*	*Dominant soils*
Nanyuki-Meru	Nanyuki, Meru Central	Plateaus and high level plains	Tertiary volcanic rocks-olivene basalts, nepheline phonolites	Complex of well drained, shallow to moderately deep cambisols with pockets of vertic clays on account of seasonal moisture deficit
Ishiara-Kieni	Meru Central Mbeere, Embu	Volcanic footridiges	Tertiary volcanic rocks-Olivene basalts, nepheline phonolites	Soils are deeply weathered on account of heavy rainfall and comprise of humic nitosols and nitro-chromic cambisols.
Mwingi-Kitui-Wote-Sultan Hamud	Mwingi, Kitui, Machakos and Makueni	Lower middle level uplands	Basement system rocks rich in ferro-magnesian minerals	Combination of ferrasols and acrisols

(ii) Drainage lines and patterns:

The proposed transmission lines traverses Three of the Five national Drainage basins name:- namely;- Ewaso Ngiro (basin 5), Tana (basin 4) and Athi (basin 3). Main drainage lines (rivers) crossed include: Nanyuki, Likii, Sirimon, Timau, Ena, Thuchi, Tiva, Whita Syano, Athi, Thwake, Kaiti among others. The section between Wote and Sultan Hamud in Nzaui District (Matiliku area) has a particularly high drainage density which is traversed by the transmission line.

Table 4.3: Drainage along the routes of traverse

Section of the Routes of traverse	*Districts covered*	*Drainage basin*	*Main rivers*
Nanyuki-Meru	Nanyuki, Meru Central	Ewaso Ngiro	Nanyuki, Ontulili,Teleswani, , Sirimon,Timau,
Ishiara-Kieni	Meru Central Mbeere, Embu	Tana	Ena, Thuchi
Mwingi-Kitui-Wote-Sultan Hamud	Mwingi, Kitui, Machakos and Makueni	Athi	Tiva, Whita Syano, Athi, Thwake, Kaiti

(iii) Climatic regime

Analysed climatic data for the routes of traverse is provided in Table 4.4 and Fig 4.1. Climate varies greatly within the routes of traverse with rainfall being highest at Meru and Kieni both of which enjoy an easterly exposure on the base of Mt. Kenya which secures relatively higher humidity. Away from the base of Mt. Kenya, rainfall displays a marked drop with altitude with Wote recording an annual low of 565 mm. The converse is also true for potential evapo-transpiration whose inverse relationship with altitude confers high annual evaporative demands in the low altitude points of Wote, Sultan Hamud, Mwingi and Kitui which cannot be matched by available rainfall inputs resulting in huge scarcity of moisture annually. Thus, with the exception of Meru and Kieni, all other areas traversed by the project record huge annual moisture deficits with climatic regimes ranging from semi-arid to semi-humid.

Table 4.4: Climatic regimes along the routes of traverse

Routes of	Area	Alt	Rainfall	PET	Moisture	P/Eo	climatic

traverse		*(masl)*	(mm)	(mm)	balance (mm)	Ratio	regime
Nanyuki-Meru	*Nanyuki*	2200	758	1280	-522	0.59	semi-humid
	Timau	2243	890	1468	-578	0.61	semi-humid
	Meru	1700	1392	1438	-46	0.97	humid
Ishiara-Kieni	*Kieni*	1600	1600	1573	27	1.02	humid
	Ishiara	1158	944	2028	-1084	0.47	Semi-arid
Mwingi-Kitui-Wote-Sultan Hamud	*Mwingi*	1242	686	2559	-1873	0.27	semi-arid
	Migwani	1149	830	1952	-1122	0.43	semi-arid
	Kitui	1108	1034	1952	-918	0.53	semi-humid
	Wote	1234	565	1712	-1147	0.33	semi-arid
	Sultan Hamud	1152	612	2112	-1500	0.29	semi-arid

Source: Diverse sources

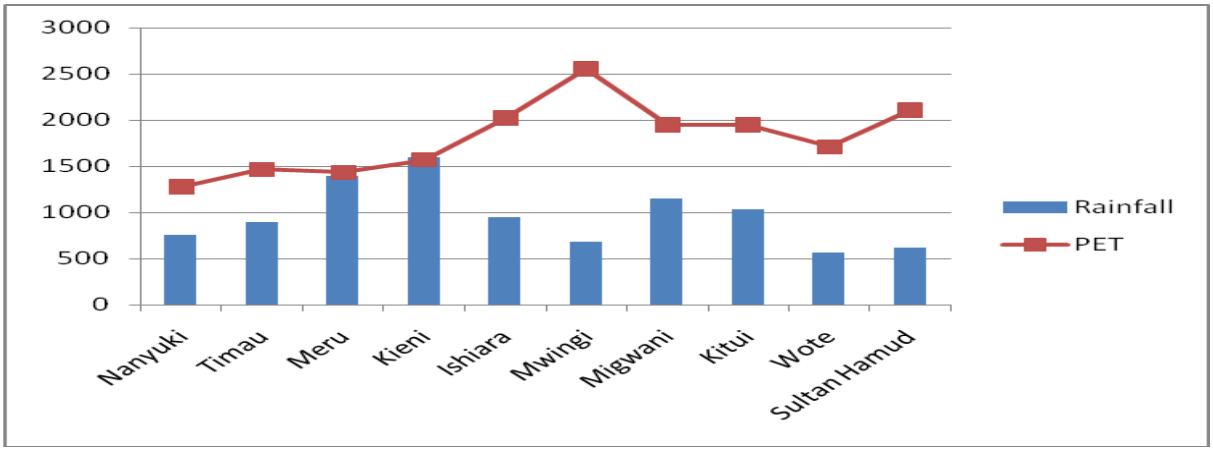


Figure 4.1: Moisture balance analysis along Routes of traverse:

Note that the annual moisture deficit (aridity) increases away from Mt.Kenya

(iv) Cover vegetation

Original natural cover vegetation in the routes of traverse (Table 4.5) has largely been altered through human action and that encountered today is largely either introduced or derived from secondary regeneration.

The exception to this rule are the few remnant patches of forest and woodlands along the routes of traverse namely;- South Imenti Forest, Ilika, Kyemundu and Nzaui (peripheral effect).

Table 4.5: Vegetation along the routes of traverse

Routes of traverse	Districts covered	Dominant natural vegetation	Current vegetation
Nanyuki-Meru	Nanyuki, Meru Central	Dense woodlands dominated by Cedar *(Juniperus procera), Dodonea viscose, Olea africana, Vitex keniensis* moving to open plains and then dense forest merging with Imenti Forest.	Patches of open woodlands, separated by farmlands and ranches. Scattered isolated trees increasing to woodlands towards the Imenti forest.
Ishiara-Kieni	Meru Central Mbeere, Embu	Thick tropical forests dominated by *Croton macrostachys, Ficus natalensis, Vitex keniensis in the highlands but slowly giving* way to semi-deciduous forests towards Ishiara.	Most of the natural forest is replaced by farmlands under agroforestry systems dominated by Grevillea and Eucalyptus spp. Indigenous trees increase towards the lowlands.
Mwingi-Kitui-Wote-Sultan Hamud	Mwingi, Kitui, Machakos and Makueni	ASAL woodlands dominated by Acacias, Croton, *Pilostigma, Combretum, Terminalia, Azanza garkeana,* etc.	Woodlands still persist but proportion of woody species has thinned out.

Plate 4.1: Remnant natural vegetation in Nanyuki area

Plate 4.2: Remnant natural vegetation in Imenti Forest

4.2: The socio-economic profile

4.2.1: The inhabitants

At the start of the project, the Nanyuki–Meru Section of the TLs traverses peri-urban Nanyuki which is largely cosmopolitan then passes through farms owned by Kenyans of European descent. All other sections of the project up to Sultan Hamud traverse largely rural settlements dominated by the Meru, Mbeere, Embu and Akamba peoples respectively.

4.2.2: Population density and distribution

For purposes of the proposed construction of power transmission lines, occurrence, distribution and density of population is critical as a determinant of the magnitude of displacement and compensation payoff to be anticipated. An analysis of settlement patterns within the routes of traverse (table 4.6) revealed that population distribution varies mainly under influence of the local agro-ecology. Highest population densities of 461persons per square kilometre are encountered within the humid Kieni /Runyenjes section of the project, with the lowest occurring in the Yatta plateau section of Kitui District. Within the section between Wote and Sultan Hamud, moderately high densities in the range of 200 persons per square kilometre will be found.

Table 4.6: Population distribution in the routes of traverse

Routes of traverse	District [4]	Division	Population Density (pers/km^2)
Nanyuki-Meru	*Laikipia*	Nanyuki	
	Meru Central	Timau	72
		Meru Central	167
Ishiara-Kieni	*Embu*	Runyenjes	431
		Kyeni	461
	Mbeere	Siakago	98
Mwingi-Kitui-Wote-Sultan Hamud	*Mwingi*	Migwani	101
		Central	69
	Kitui	Matinyani	151
		Central	153
		Yatta	35
	Makueni	Kalawa	80
		Wote	111
		Matiliku	162
		Mbitini	212

[4] Most of the old districts have since been subdivided to create new ones for which data is yet to be extracted and assembled.

4.2.3: Socio-economic parameters in the routes of traverse

Land tenure systems: The nature of land tenure within the proposed routes of traverse is provided in table 4.7 below. With the exception of the 700m of Imenti Forest traversed by the project, the rest of the land encountered within the three routes of traverse is privately owned. No other category of lands ownership is encountered within the three proposed routes of traverse.

Table 4.7: Nature of land tenure in the routes of traverse

Routes of traverse	Forestland	Trustland	Private land	Totals
Nanyuki- Meru	1	1	762	764
Ishiara-Kieni	0	0	396	396
Mwingi-Kitui-Wote-Sultan Hamud	0	0	904	904
Totals	*1*	*1*	*2062*	*2064*

Category of land-use types: Farming is the dominant land-use category in the routes of traverse accounting for 98.3% of the total land inventory. 34 land parcels owned by institutions such as schools and churches are encountered and account for 1.6% of the total inventory (table 4.8 below) with forest land accounting for 0.4%.

Table 4.8: Category of land-use types

Type of land use	Total tally	Percentage
Farming	2028	98.3
Institutions	33	1.65
Forestry	1	0.05
Total	2064	100

Size of land holdings:

An analysis of sizes of land holdings within the routes of traverse is provided in table 4.9 below. Of the 2064 farms to be traversed by the proposed lines, 98.9% are small holdings of below 50 acres size with 82.6% being of 10 acres and below. 76.7% of the land holdings fall between 1-10 acres making this category to be the dominant land size in the routes of traverse.

Table 4.9: Analysis of land holdings along the routes of traverse

Size of land holding (acres)	*Total recorded*	*Percentage*	*Percentage below 50 acres*	*Percentage between 1 to 10 acres*
< 1	122	5.9	98.9	5.9
1 - 3	694	33.6		76.7
4 - 10	889	43.1		
11 - 15	186	9.0		16.3
16 - 50	150	7.3		
> 50	23	1.1	1.1	1.1
Total inventory	2064	100.0	100	100

Livelihood systems: From discussions with KPLC staff, it emerged that the routes of traverse was deliberately selected with a view to avoiding high density settlement areas including urban centers on which account, it traverses largely rural settlements where the economic mainstay is agriculture. Indeed, analysis of the inventory of farm enterprises encountered within the routes of traverse (Table 4.10 below) revealed that agriculture is the dominant land use with both food and cash crop farming accounting for 97% of the total farmers in the traverse. Lands under fallow/ residential use account for 2.6% while pure livestock and cash crop production make for only 0.4% of the entire routes of traverse. Thus, decidedly, agriculture is the dominant land-use / livelihood system within the traverse areas.

Table 4.10: Analysis of farm-based enterprises in the routes of traverse

Type of farm enterprises	Number /Inventory	Percentage
Fallow/residential	53	2.6
Food crops/livestock	1151	55.8
Food crops /livestock + cash crops	853	41.2
Livestock only	2	0.1
Cash crops only	7	0.3
Totals	2064	100

From social-economic surveys conducted as part of this study, livelihood systems along the routes of

traverse were identified as summarised in table 4.11 below. With the exception of the Nanyuki/Timau area where a few large-scale farms are found, the project largely traverses small holder settlements where small scale mixed farming is the main economic mainstay.

Table 4.11: Livelihood analysis within the routes of traverse

Area	climatic regime	Livelihood systems	Specific activities
Nanyuki	semi-humid	Small scale commercial, rental houses, intensive mixed farming, horticulture, tourism	Rental small scale business, rental houses, dairy farming, small/ medium scale irrigation, game ranching, tourism
Timau	semi-humid	Medium to large-scale farming, agro-pastoralists,	Commercial flower and vegetable farming, agro-forestry, small holder dairy farms under mixed cropping systems
Meru	humid	Agro-pastoralists,	Small holder dairy, cropping of potatoes, maize and pulses
Ishiara	Semi-humid	Agro-pastoralists	Goat rearing supplemented by cropping of maize, millet, mangoes, and tobacco in some places. Intensive agro-forestry.
Kieni	humid	Intensive mixed farming with tea, coffee and dairy	Dairy farming mixed with tea, coffee and small scale business. Intensive agro-forestry with grevillea, mangoes and indigenous trees
Mwingi	semi-arid	Agro-pastoralists,	Basically goat keeping in rangelands supplemented by limited cultivation.
Migwani	semi-arid	Agro-pastoralists	Cultivation of maize, pulses, mangoes, oranges supplemented by livestock production under semi-confined system. Intensive agroforestry with grevillea, mango trees among others.
Kitui	semi-humid	Agro-pastoralists	Cultivation of maize, pulses, mango, etc supplemented by keeping of goats and local cattle breeds. Between Tiva and Wote,
Tiva	Semi-arid	Agro-pastoralists	
Wote	semi-arid	Agro-pastoralists	

Area	climatic regime	Livelihood systems	Specific activities
		/horticulture	pastoralism based on keeping of native cattle and goats seems the dominant activity as few of the lands are opened for cultivation. However, between Wote and Sultan Hamud, crop production is intensified especially within less hilly areas in Nzaui district but this is replaced by livestock keeping on the slopes of local hills.
Sultan Hamud	semi-arid	Agro-pastoralists	

Role of agro-forestry in rural economies: The vegetation cover in the arid sections traversed by the project largely comprises of indigenous trees and shrubs dominated by Acacias, yellow wood, combretum, etc while that within the humid belt has been largely substituted with exotic trees dominated by grevillea, casuarinas, blue gums, cassia siamea, neem etc all of which grow to heights generally above 8 metres. Exotic agro-forestry plays a pivotal role in the rural economies as sources of construction materials, biomass energy, food, fodder and is also a major source of cash income. Other ways through which agro-forestry underpins rural economies-especially in small urban areas is through provision of timber that is traded in the construction and joinery work, commercial fuel wood used in the tea curing industry, posts and poles in power transmission while in the semi-arid belt, trees are vital in the provision of shade, shelter belts, pods and forage for livestock, a base for the honey and silk wool industries, among others. These present potential opportunity costs to be occasioned by construction of the proposed transmission line.

Trees within the routes of traverse

4.2.3: Economic performance within the routes of traverse

Economic performance varies greatly within the routes of traverse. However, from analysis of 2 main indicators to economic well-being-namely access to land and type house owned residents, it emerged that most of the people subsist just along or below the poverty line.

Access to land: Land-ownership in the traverse ranges from quarter acre plots to over 10,000 (Table 4.12 below). Top extreme is the case of Wangu Empori who singularly controls 11,200 acres but, as appeared from table 4.6 above, 76.7% of the lands within the routes of traverse range from 1 to 10 acres in size.

Table 4.12: Analysis of land holdings within the route of traverse

Route of transmission	Mean land holding (acres)	Max land holding (acres)	Min holding (acres)	Mode (acres)
Nanyuki Meru	18	11,200	0.25	2
Ishiara Kieni	10.8	105	1	8
Mwingi-Kitui-Wote-S/Hamud	3.72	100	0.25	2

Access to housing: An analysis of the nature of physical development of farms within the traverse was undertaken as tabulated in 4.13 below. 60.4% of farms within the traverse are developed with dwelling houses and other ancillary structures of which, 62.8% have three structures and above with 16.6% having only one structure. Of the developed farms (1246), 90% have afforded a main house made of timber-wall and above which implies possible just a very small poverty gap. Care has to be taken to ensure that proposed development does not widen this gap.

Table 4.13: analysis of physical developments within the traverse

Farms developed with structures		Number of structures in RoT		Type of structures in on farm	Tally of farms	Percentage
Developed	1246	None	818	*None*	*818∗*	
Not developed	818	1	207	Thatched / Mud	15	1.204
		2	257	Iron sheet / mud	115	9.23
		>3	783	Iron sheet / timber	470	37.64
				Bricks	429	34.43
				Stone	218	17.5
Totals			**2064**		**2064**	

∗Excluded from computation of percentages

4.3: Sensitive resources and emerging concerns within the routes of traverse

Within the routes of traverse, resources considered sensitive on both economic and ecological scales can be identified as follows:-

4.3.1: Economically sensitive resources

Land: Land is just about the most important and widely coveted resource in Kenya. Access to land is a pre-requisite to economic production, shelter and settlement and it offers security in old age and upon eventual

death. Such demand for land accounts for the huge interest that vests in land within Kenya where the dream to own land is commonly held by majority of citizenry. Against this background, the requirement for land to be set aside for construction of the proposed transmission lines is likely to have major impacts within the routes of traverse.

Private and public investments: Many private and public investments;- buildings, institutions, trees, developed farms etc will be traversed by the project with the prospect that quite a number will be cleared out of the Right of Way corridor and measures must be put in place to insure against retrogressive impacts of infrastructure.

Existing infrastructure: Along the entire routes of traverse, diverse infrastructure is encountered as follows:- diverse power transmission lines (132kV lines at Nanyuki, Kitui and Sultan Hamud, widely occurring low voltage power transmission and distribution lines), the Military Air base and airport at Nanyuki, the sewage treatment lagoons at Nanyuki, the airstrip at Kitui, among others. Together with local roads and water supply lines, these resources are economically and strategically crucial hence the need to flag them to ensure planning for their mutual co-existence and harmony on the side of the proposed development.

4.3.2: Ecologically sensitive resources

Within the proposed rout of traverse, several ecologically fragile resources can be identified as follows:

Shallow soils on hilly slopes: Quite a number of these are traversed by the proposed lines which will imply that their stripping bare of trees to create the ROW may expose them to overgrazing and accelerated erosion. Some of the slopes especially in the Nzaui area have very shallow soils whose erosion will expose the local bedrock and thus alter the local hydrology.

River valleys and channels: The proposed power transmission lines will traverse numerous drainage lines as already identified in section 4.1.2 above where soil erosion is already a worrying concern. Precautionary measures require to be put in place especially during excavation works to ensure that soil erosion is not aggravated.

Vegetation cover in the ASAL sections of the Routes of traverse: ASAL vegetation is usually delicate on account of inherently poor capacity for regeneration which possibly explains the observed declining cover on

account of exploitation for charcoal making, wood carving, building and fencing materials, clearing for crop production and pastures, cutting for building and fencing among others. The proposed clearing of ASAL woody vegetation base to give way to the ROW will take place against this worrying background.

Wildlife migratory corridors and reserves: The Imenti Forest section of the traverse is frequently used by elephants en route to the Nyambene Hills but more so to the L. Nkunga elephant maternity. The latter is a sacred lake located 11 kilometres north if the route of traverse from Kiirua market and is reputed to serve as a maternity for elephants.

CHAPTER FIVE: ANALYSIS OF ALTERNATIVES

5.1: Overview

In sections below, we provide some background to the process that informed formulation of the project in its current design. Notably, the project was subjected to detailed feasibility studies where diverse options were

considered leading to identification of the project and choice of technological options as currently proposed. Project alternatives were considered at diverse levels namely; technological options, route of coverage etc out of which, an overhead transmission line supported by steel pylons and traversing Nanyuki-Meru; Ishiara-Kieni and Mwingi-Kitui-Wote-Sultan Hamud was selected. Some of the options considered are briefly reviewed in sections below:-

5.2: Levels in evaluating project alternatives

5.2.1: Evaluation of the *No Project* option

Domestic access to electricity remains low in Kenya and the country has one of the lowest percentage coverage by electricity among African countries. Firms operating in Kenya persistently report erratic power supply as being one of the most important impediments to their competitiveness. Consequently, development of the proposed transmission lines is being undertaken as part of a wider national initiative aimed at stabilizing national grid power supply through control of outages and transmission losses for which there is no other feasible alternative. The no-project scenario would imply continuation of inadequate power supply, increasing outages and losses to business which is clearly no desirable for an economy that is struggling to recover from impacts of political violence and drought. As such, any initiative with potential to increase the percentage of Kenyan population covered by electricity is economically justifiable and strategic as it is in line the current government emphasis on increasing the number of connections nationally, particularly in rural areas and for industrial sectors.

Provision of additional power supply has been identified as crucial to achievement of the national development aspirations as elaborated in the national development blue print –the Vision 2030 in which case, the focus is on modalities for supply rather than the justification of what is clearly a strategic policy intervention.

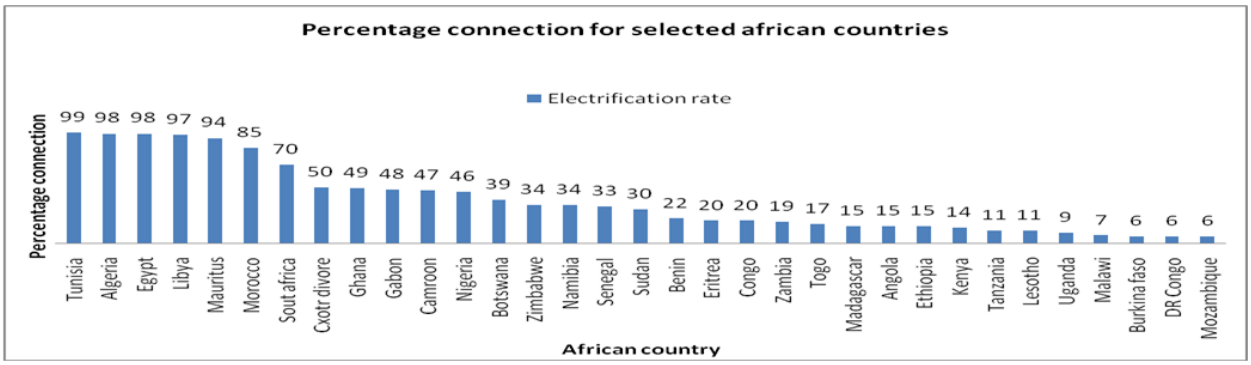


Figure 5.1: Percentage coverage by electricity for selected African countries

(Source: Africa Business, 2009: African Economic Review)

5.2.2: Options in the selection of the routes of traverse

Selection of the routes of traverse was guided by technical criteria as follows:-

- The need to minimise line length and angle points.
- Avoid steep terrain and areas with landslide risk.
- Avoid marshes and areas with seasonal flooding.
- Avoid areas with rivers and rough terrain between access roads and corridor.

Further, environmental, resettlement and land compensation aspects have been taken into consideration in an effort to minimize negative visual from exposed towers and corridors through dense forest, avoid heavily urbanized areas, airports and airport approach roads, national defence property and; avoid national parks, ecological or biosphere reserves and protected areas in general. Pursuit of such criteria was however not always clear though as the RoT could apparently have been better oriented in certain sections. This is the case with Angle Point B2-4 in Migwani where the RoT takes an almost 90° turn to traverse right over a compound with permanent residential buildings which could otherwise have been easily avoided.

5.3: Choice between diverse transmission technologies

Transmission vs local generation: The option of generating power locally as opposed constructing long distance transmission lines was evaluated. With 60% of Kenyan electric power being generated from hydro, the local capacity for hydro is almost exhausted which would mean investment in other sources such as wind and solar whose capacity to generate adequate power to stabilize current supply while coping with increased load is questionable. Local generation would also require multi[le investment in generating stations backed up transmission lines to the points of consumption and will end up being more expensive eventually.

Choice between one HVTL or several LVTL: Towards meeting the desired power supply to diverse points, the choice of either using three 33kV lines, two 66kV lines as opposed to one 132kV line were reviewed with the latter being the favoured option on technical grounds. Transmitting electricity at high voltage reduces the fraction of energy lost to resistance. For a given amount of power, a higher voltage reduces the current and thus the resistive losses in the conductor. For example, raising the voltage by a factor of 10 reduces the current by a corresponding factor of 10 and therefore the I^2R losses by a factor of 100, provided the same sized conductors are used in both cases. Even if the conductor size (cross-sectional area) is reduced 10-fold to match the lower current the I^2R losses are still reduced 10-fold. Long distance transmission is typically done with overhead lines at voltages of 115 to 1,200 kV.

Overhead versus underground transmission lines: The choice between overhead versus underground transmission lines was also considered. Indeed, electric power can be transmitted by underground power cables which assist the transmission of power across: densely populated urban areas, areas where land is unavailable or planning consent is difficult, rivers and other natural obstacles, land with outstanding natural or environmental heritage, areas of significant or prestigious infrastructural development and land whose value must be maintained for future urban expansion and rural development. Some other advantages of underground power cables include;-

- Less subject to damage from severe weather conditions (mainly lightning, wind and freezing)
- Greatly reduced emission, into the surrounding area, of electromagnetic fields (EMF). All electric currents generate EMF, but the shielding provided by the earth surrounding underground cables restricts their range and power.
- Underground cables need a narrower surrounding strip of about 1–10 meters to install, whereas an overhead line requires a surrounding strip of about 20–200 meters wide to be kept permanently clear for safety, maintenance and repair.
- Underground cables pose no hazard to low flying aircraft or to wildlife, and are significantly safer as they pose no shock hazard (except to the unwary digger).

Some disadvantages of underground power cables:

- Undergrounding is more expensive, since the cost of burying cables at transmission voltages is several times greater than overhead power lines, and the life-cycle cost of an underground power cable is two to four times the cost of an overhead power line. Above-ground lines cost around $10 per foot and underground lines cost in the range of $20 to $40 per foot.

- Whereas finding and repairing overhead wire breaks can be accomplished in hours, underground repairs can take days or weeks, and for this reason redundant lines are run.
- Underground power cables, due to their proximity to earth, cannot be maintained live, whereas overhead power cables can be.
- Operations are more difficult since the high reactive power of underground cables produces large charging currents and so makes voltage control more difficult.

Given all these considerations, construction of overhead transmission lines is the option apparently favored by the KPLC.

Lattice steel vs solid concrete poles: Solid concrete poles though manufactured locally but their reliability casting high uncertainty on any cost savings from lower supply costs and potentially reduced way leave costs. Further, the high weight (above 4 tons) of these poles also involves higher transport and erection costs as heavy lifting and erection equipment is required emphasising line sections with poor access conditions.

Hollow spun steel poles: Internationally manufactured hollow spun concrete poles or steel poles could, for longer lines with high RoW costs prove competitive to lattice steel structures due to lower maintenance and way leave costs but the same considerations with respect to transport and erections costs would apply. Accordingly such poles would only be recommended where it is not possible to obtain a RoW width above 15 metre. It should also be mentioned that it is considered as a precondition for implementing such monopole lines that a complete training program for KPLC's maintenance staff in the installation and maintenance of such lines is required including the purchase of the requisite lifting, erection and maintenance equipment.

5.4: The preferred option

A comparison of all the options is summarised in table 5.1 below. From the analysis, the proposal to investment in a high voltage overhead transmission line as currently designed seems to be the preferred option which is though costly is justifiable on technical considerations. Any adverse impacts will be mitigated as per the ESMMP unveiled in Chapter eight below.

Table 5.1: Analysis of alternatives

Level of evaluation	Option evaluated	Advantages	Disadvantages	Preferred option	Mitigation of adverse impacts
Project	No project scenario	Savings to the national economy, will avoid environmental and social costs	Economic losses due to power outages, slowed economic growth	Develop project	As per ESMMP
Selection of route of traverse	Merits of selected route	Stabilised power supply to target areas	These are common to all routes	Proceed with selected route	As per ESMMP
Choice of technology	Transmission vs local generation	Cut down on transmission costs, will avoid displacement and environmental costs	Requires multiple investments in generating stations. Will still require transmitting to points of consumption.	Transmission option	AS per ESSMP
	Use of one 33kV line as opposed to three 333kV lines.	Savings on power loss due to use of high voltage lines.	Probably more expensive than 33 kV lines	Use of the 132kV transmission line.	AS per ESMMP
	Overhead vs underground cables	It is cheaper to develop and maintain.	Takes more land, displaces people, and increases hazards of accidents and exposure to EMR.	Use OHTL	As per ESMMP

	Lattice structures vs concrete poles	Lattice structures are lighter to construct and are longer lasting.	Lattice structures Are more expensive and take more land hence displacing more people.	Use of lattice steel structures	As per ESMMP
	Lattice structures vs hollow spun pipes	Hollow spun poles are cheaper and take less land compared to lattice structures.	They are more expensive to transport and construct compared to lattice structures.	Use of lattice steel	As per ESMMP.

CHAPTER SIX: STAKEHOLDER CONSULTATION

6.1: Approach to Stakeholder Consultations

It is a mandatory requirement under Legal Notice of 101 of EMCA 1999 for all environmental assessment process in Kenya to incorporate Public Consultation. The aim is to ensure that all stakeholder interests are identified and incorporated in project development, implementation and operation. Of necessity, stakeholder consultations should take place alongside project design and implementation to ensure that the project puts in place measures to cater for stakeholder concerns in all project phases. In case of the proposed development of power transmission lines, public consultations followed several steps as follows: -

6.2: Briefing by the Design Engineers

Briefing commenced after negotiating the contract and consisted of discussions between the Consultant and KPLC staff from the SH&E, Design and Project Development Departments. During such discussion, the client clarified expectations; mode of contract administration and deliverables on the contract, procedures adopted by the KPLC and also provided information on project design to the consultant. Notably, the consultant obtained design reports and maps from the feasibility study phases of the project and also obtained contacts for other KPLC staff previously involved in the project and also in project sites.

6.3: Identification of other stakeholders

The proposed transmission lines comprise a unique project in that, right from onset, project design entails acquisition of land for construction of permanent overhead structures traversing close to 264kilometers of land. Of necessity, numerous people are likely to be affected by the project and are therefore *bonafide* stakeholders demarcated by the decision to follow the proposed routes of traverse. The same we identified and mapped to prepare the Inventory of Project affected people as presented in Appendix 3.1 of Volume Two of this report.

This study also identified a second category of stakeholders comprised of GoK officers in charge of diverse sectors, which are likely to be impacted by the project. This category was also consulted as key informants on sectoral policy and to advise this EIA study on mitigation measures to be put in place so as to minimize adverse impacts in respective sectors. In this category were also included local policy makers and opinion leaders, local administration, local authorities, civic leaders.

6.4: Modalities for stakeholder consultation

Each category of stakeholders called for a different approach to consultation.

6.4.1: Consultation with Project Affected People

Inventory of Project Affected People was based on administration of a questionnaire specifically designed for this purpose. The tool was administered on all land owners likely to be affected by the project for purposes of capturing details on their identity and asset ownership so as to assemble an asset register and compute the likely compensation bill. Appendix 6.1 presents a copy of the questionnaire administered on the 2064 persons likely to be affected by the transmission line.

6.4.2: Consultations with Secondary Stakeholders

Under this category, a cross section of stakeholders were met and these included; civil servants, local government officials and the local residents. Consultations took place in respective offices and in the field where possible. Consultations were made either with individual officers or in Focus Group Discussions involving several officers in a group. For this category of stakeholders, a semi-structured questionnaire providing for the Institution, name and designation of officer consulted, issues raised and signed feedback was used to guide the discussions. Discussions started with the consultant team explaining the project to the target officer following which, they were asked to identify their fundamental concerns on the same. After discussion, the officers were requested to fill and sign the form administered by the consultant in a system that was deemed useful and as a strategy to cut down on paperwork while capturing and documenting for future reference-the signed comments of target informants. Appendix 6.2 provides the signed comments of all secondary stakeholders consulted.

6.4.3: Indirect consultations

Numerous individuals and institutions previously played diverse roles in the formulation and design of the power transmission lines project and though it was not possible to make direct contacts with them, the same was achieved through study and review of outputs left behind in form of reports. Thus, considerable time input was devoted to review of project documents towards preparation of this ESIA report. Appendix 6.3 provides a list of documents reviewed as part of this study.

6.5: Total stakeholders consulted

Table 6.1 provides a breakdown of the stakeholders consulted. Towards preparation of the RAP, this study endeavoured to contact and administer questionnaires on all people potentially affected by the project who

numbered over 2064 while another 42 representing secondary stakeholders where contacted. In total, 2106 persons were interviewed for this study.

6.6: Outcome of the Stakeholder consultations

Outcome of stakeholder consultations including issues discussed and concerns raised are reported verbatim in Appendix 6.2 and summarised in matrix form in table 6.1 below. Core concerns are briefly highlighted in sections below.

6.6.1: General outcomes

Advantages of the project were identified by diverse stakeholders as follows:

i) Project is a sign of government commitment to development of target areas
ii) Supply of electricity will unlock economic development in the targeted areas
iii) People will be employed in the construction work
iv) People will sell land for proposed sub-stations and thus generate money for investment
v) Electricity will be available for rural supply

Disadvantages of the project were identified as follows;-

i) The project will displace people and their property and fail to pay adequate compensation,
ii) Presence of electric lines will expose people to accidents and health hazards

Table 6.1: Summary of stakeholders consulted

Category of stakeholder	Office consulted	Number consulted	Station
Provincial Administration	District Commissioners	3	Kitui/Mwingi/ Laikipia East
Kenya Forest Service	Zonal Managers	3	Kitui/ Mwingi/ Meru
Kenya Wildlife Service	District Wardens	2	Meru/ Mwingi
Ministry of Agriculture	District Agricultural Officer	2	Mwingi/ Laikipia East
Ministry of Livestock Development	District Livestock Production Officer	1	Mwingi
National Environment	District Environment Officer	1	Mwingi (out of office)

Category of stakeholder	Office consulted	Number consulted	Station
Management Authority			
Ministry of Planning and Vision 2030	District Development Officer	2	Kitui/ Laikipia East
Ministry of Lands – Planning Department	District Physical Planner	1	Laikipia East
Ministry of Lands – Districts Lands Office	District Land Registrar	1	Meru Central
Land adjudication officers	Land adjudication officers	3	Kitui
	District land adjudication Officer	1	Mwingi
Kenya Power and Lighting company	Dept of Environment, Health and Safety	3	Hq
	Dept of Transmission	1	Hq
	Dept of Project development	1	Hq
	Real Estate Department	1	Hq
KEFRI	Regional Research Center -Kitui	3	Tiva Tree Nursery
Municipal Council of Nanyuki	Administrative Officer	1	
Nanyuki Water & Sewerage Company (NAWASCO)	Technical Manager	1	
Wangu Investment Co. – EMBORI Farm	Human Resource Manager	1	
Laikipia Teachers SACCO	A.M. Kimaru-Chairman	1	Nanyuki
Kenya Air Force-Laikipia Airbase	Lt. Colonel Richard Kenduiwa & Major Waweru	2	Nanyuki Airbase
Inoro Secondary School	Principal	1	Nanyuki
Large-scale farms	Gordon Herbert- Aloes Farm	1	Timau
	Alex Wratislaw- O-Sinyatt	1	Timau
	Simon Van de Berg Director - Timaflor	1	Timau
	Directors- Field Outdoor Enterprises Limited, Nanyuki	2	Nanyuki

Category of stakeholder	Office consulted	Number consulted	Station
	Major Muiu-Sultan Hamud	1	Sultan Hamud
Potentially affected people	Farmers in small holder farms	2064	Entire routes of traverse
Total stakeholders consulted		**2102**	

6.6.2: Specific concerns

Need to explore the option of underground passage of the transmission line:

The Laikipia airbase of the Kenya Air Force was concerned that construction and operation of another high voltage power transmission line in close proximity to their airbase has potential to interfere with their signal transmission system. Indeed, they were concerned that the existing Nanyuki-Nyahururu 132kV line already interferes with their communication and is actually situated in the takeoff routes at the end of their runway. Their proposal was for the TL to be constructed underground.

Need to explore possibility of rerouting the TLs:

Some stakeholders, more-so those whose properties risk displacement by the project expressed the need for project rerouting to be explored so as to save their properties from destruction. Indeed, some expressed unwillingness to give way to the TL.

Modalities for stakeholder sensitisation:

Stakeholders in provincial administration required that a standardised information package be used to disseminate the project to stakeholders-more so those whose properties will be affected. It was felt that such a move will minimize speculation and dis-information which could earn the project considerable hostility. As well, there is need to establish a cut-off date for registration of PAP so as to avoid speculative land buying as commonly happens in projects entailing land acquisition and compensation.

The role of village elders in dispute resolution:

The provincial administration observed that the process of land acquisition and compensation is likely to trigger family disputes and recommended that village elders be involved in identifying *bonfide* land owners to be negotiated with. This is the point where assistant chiefs would also be involved.

Questions of power supply along routes of traverse:

Stakeholders in government enquired on the possibility of communities in routes of traverse to tap power supply from the 132kV line and thus benefit locally. This was seen as an incentive to win support for the project.

Potential impact on agricultural economies:

Stakeholders in the crop and livestock production sectors were concerned that removal of trees in the right of way will have harmful effects such as loss of shade and shelter belts in semi-arid areas, affect fuel-wood supply, affect yield of mangoes which is an emerging cash crop, affect bee production which is based on availability of trees etc. As well, construction of tower foundations will fix agricultural land and put it out of production thus impacting on food security especially in areas where land sizes are small while construction work during the cropping season can have similar effects through destruction of the standing crop.

Acacia trees also form the basis for dry season fodder supply and are also useful in the production of silk worms which is catching up in the Kitui-Mwingi area.

Concerns over adequacy of compensation for acquired land

Matters pertaining to land acquisition and compensation were a major concern to the local residents, and hence considered to be very critical. The farmers requested that in the event that land acquisition has to be done, then, adequate compensation for land and property that are likely to be taken up by the ROW be adequate. The major concern from the farmers is that if adequate compensation is not granted, then this would leave them poorer against the wishes of poverty eradication. The communities along the ROW also expressed doubts as to whether the compensations will be honoured based on experiences on similar projects some years back where compensation was not paid on time thus occasioning suffering.

There may be a few cases where the current owners are not the registered owners of the land. This may arise from the registered owner dying interstate, and his or her kin take ownership without formally transferring the parcel of land through the laid down legal mechanisms.

Potential impact on protected areas:

Consultations with forestry personnel in Kitui and Mwingi revealed that the proposed TL does not traverse protected areas. However, for the small section of South Imenti forest traversed, steel pylons will require to be secured to prevent elephant calves being trapped in the steel tower which would move the elephants to wreak havoc in course of mounting rescue mission. As well, measures require to be taken to secure the steel pylons against scratching by elephants and attendant risks of destruction.

Impact of tree removal on the nesting and breeding patterns of avifauna:

It was observed that within the ASAL areas, and indeed other ecological zones, birds mainly use trees for nesting and breeding in which case, removal of the latter for purposes of the right of way has potential to affect nesting and breeding. The situation is even more desperate where the TL clears isolated trees which may be the only nesting ground available in vicinity.

Modalities for mitigating against tree removal

Technical staff of the KFS at Kitui were concerned over the manner to be applied in removing trees for creation of Right of Way in respect of power lines. They observed that, although the same is expressly allowed for under Cap 314, sections 64 and 65 of the same allows for application of appropriate silvicultural practices in the management of trees under the RoW but the latter is ignored in favour of indiscriminate felling and removal. Their case is that, the spirit of section 64/65 of the Act should prevail where trees are to be affected by the ROW.

KFS staff also observed that proponent should put in place measures to mitigate tree removal possibly through supporting reforestation programmes to ensure that appropriate balances of standing woody biomass are enhanced rather that eroded by the project.

6.7: Overall picture from the stakeholder consultations

The overall picture emergent from the stakeholder consultations is that the project is seen as being strategic to stabilising rural power supply which is crucial to sustained economic growth. In order to sustain this overwhelming public support, project development should proceed simultaneously with resolution of stakeholder concerns as provided for in the ESMMP to be unveiled in sections below.

CHAPTER SEVEN: POTENTIAL IMPACTS FROM THE PROJECT

7.1: Generic Social and Environmental Impacts

7.1.1 Nature and scope of impacts

The power transmission line as proposed will require space in terms of both vertical and horizontal projection and depending on the current physical and social characteristics of this space, some impacts are likely to be triggered whose analysis is the subject of this chapter.

Potential impacts as predicted and scoped in sections below has been undertaken in line with procedures described in section 1.5 above. As it will appear, many of the effects-that of increasing supply of electric power at national level and the attendant prospect of catalysing development of the local economy through improved trade and employment opportunities are immensely positive. There will nevertheless be some negative effects during the construction and operation phase whose means to mitigation and management is outlined in chapter eight.

Table 7.1 below provides a summary of predicted impacts based on the four core phases of the project namely;- design, construction design and operation phases.

7.2: Impacts at Design Stage

As at the time of preparing this report, a feasibility study had been undertaken and completed and among other findings, few if any adverse impacts were attributed to this process. Generally, the design phase is associated with positive impacts mainly manifested through creation of business opportunities for professionals involved in the design work, support staff hired in the enumeration survey, etc, while the country benefits from generation of additional planning data which will influence policy decisions within long time frames. Adverse impacts would mainly be manifested through site disturbances and accidents associated with field survey work.

7.3: Impacts at the Construction Phase

7.3.1: Positive impacts

Positive impacts at construction stage will manifest as follows:-

Creation of business opportunities: The proposed transmission lines will comprise of close to 240km of conductors supported on close to 1000 towers (pylons) constructed of galvanised steel metal each mounted on a reinforced concrete apron covering 64m^2. Construction work will therefore entail a huge investment which will go into procurement of construction material and the hiring of labour and equipment thus opening up extensive trade opportunities. Other economic benefits will accrue through creation of employment opportunities for both skilled and semi-skilled labour engaged in construction activities.

At local level, communities will benefit from short-term employment opportunities in the construction activity.

Table 7.1: Matrix for Impact Prediction

PROJECT PHASE	SOURCE OF IMPACT	POTENTIAL IMPACT	SEVERITY *	PERSISTENCE	
Design Stage	Design Studies, field surveys and inventories	Creation of temporary opportunities for gainful employment	2P	Short-term	
		Generation of additional site-specific data /study reports	P	Long-term	
		Capacity building and sensitization	P	Long-term	
		Minor site disturbances including crop destruction during survey work	N	Short-term	Reversible
		Minor accidents during survey work	N	Short-term	Reversible
Construction Phase	Supply of materials	Business opportunities in supply and transport of construction materials	2P	Short term	
		Opening access to remote areas through construction of access routes	2P	Long-term	
		Degradation along material delivery and storage areas	N	Short-term	Reversible
	Construction work	Short-term employment in construction	2P	Long-term	
		Revenue to GoK and Local Authorities through taxes	P	Short-term	
		Land acquisition and clearance for ROW	2N	Long term	Reversible
		Opportunity costs on land taken by ROW	2N	Long-term	Reversible
		Destruction of biodiversity in ROW	2N	Long-term	Reversible

PROJECT PHASE	SOURCE OF IMPACT	POTENTIAL IMPACT	SEVERITY *	PERSISTENCE	
		Loss of Carbon sink from felling trees	2N		
		Occupational health and safety concerns for construction crew	N	Short-term	Reversible
		Generation of waste from construction activity	N	Short-term	Reversible
		Permanent visual intrusion into space	2N	Long-term	Irreversible
		Hazards to wildlife and avifauna	N	Long-term	Irreversible
		Socio-impacts of construction crew and labour camps	N	Short-term	Reversible
		Loss of nesting grounds for avifauna, bees, and dry season fodder in dry areas	N	Long-term	Reversible
		Impact on existing and future infrastructures	N	Long-term	Reversible
		Sanitation concerns from construction crew, wastes from construction sites	N	Short-term	Reversible
Operation Phase	Enhanced supply of electricity to close to 18000 homes and business centers	Economic gains from improved and stabilised power supply	2P, 2P	Long-term	
		Enhanced delivery of services in medicare, education, admin, telecommunication, etc	2P, 2P	Long-term	
	Positive environmental impacts	Enhanced rural access through development of maintenance roads	P	Long-term	

PROJECT PHASE	SOURCE OF IMPACT	POTENTIAL IMPACT	SEVERITY *	PERSISTENCE	
		Financial gains in oil to electricity substitution, maintenance costs for diesel engines, etc	2P, 2P	Long-term	
		Employment creation, reduced cost of investment	2P	Long-term	
		Cutting down on GHG emissions from petroleum to electricity substitutions	2P	Long-term	
		Health/ safety impacts of using clean energy sources	2P	Long-term	
		Possible reduction in solid waste from lead acid batteries, dry cells, candle residues, waste oil/ spares from gensets etc	2P	Long-term	
		Creation of habitat for fauna biodiversity	P	Long-term	
	Adverse impacts associated with presence of charged high voltage wires and associated infrastructure	Exposure to EMF	2N	Long-term	Irreversible
		Hazards to the aviation industry	N	Long-term	Reversible
		Impact on avifauna and other wildlife	N	Long term	Reversible
		Disincentive on use of other energy sources e.g. RETs	2N	Long-term	Irreversible
Net environmental worth of the project		**33P (33 positive outputs, mainly long-term), 26N (26 adverse outputs, 11 long-term, 6 irreversible), Net score=7P (Net positive impact before mitigation**			**Some adverse impacts irreversible**

∗N = low negative impact; 2N = moderately severe impact; 0 = no impact; P = positive impact, 2P = significantly positive

7.3.2: Negative impacts of construction activity

Adverse impacts at construction stage will manifest as follows:-

Land acquisition and clearance for the right of way:

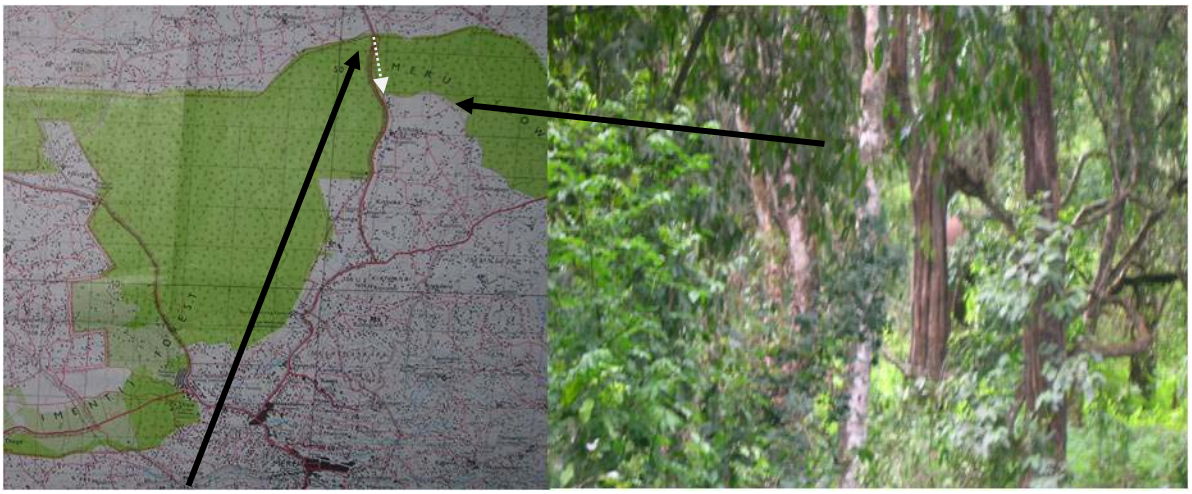
From inventories undertaken as part of the RAP Study, the proposed 264km of transmission lines will traverse 2064 farms all of which will cede a total of 792 ha of land required for the 30m wide Right of Way corridor. Indeed, the inevitable and mandatory removal of physical structures including trees falling within this corridor amounts to the most drastic impact of the entire project. And though design and alignment of the TLs attempted to avoid heavily settled areas, creation of the ROW corridor will require clearing of several trees on each of the 1500 plus farms traversed while a number of physical structures will also be affected.

Opportunity costs on land taken by ROW:

With the exception of sections near the Nanyuki substation where land-use is mainly urban, the rest of the routes of traverse is mainly occupied by agricultural settlements under either irrigated or rain-fed agriculture depending on the climatic condition. Irrespective of the land-use scenario, the entire 6.4ha of land to be occupied by the tower foundations will be fixed out of agricultural production for the entire economic life of the project at the expense of food security. As well, removal of trees has implications to food security (mangoes) cash income (mangoes, bee keeping, charcoal making), fodder supply (ASAL trees) and household energy supply, etc.

Destruction of biodiversity along routes of proposed power lines:

Alignment of power lines in proposed routes will require that all trees along the routes be removed so as to establish a clear wayleave. This amounts to reduction in total woody cover in a country whose forest cover is considered far below the minimum requirements for conservation. Assuming that at a very bare minimum of 100 trees will be removed in every kilometre of power line, close to 30,000 trees, equivalent to 12 hectares of forests will be harvested to create way leaves. Where indigenous trees are removed, this amounts to loss of indigenous biodiversity and may decimate germiplasm reservoirs required for regeneration of such trees.



700m of the Imenti Forest will be traversed by the Nanyuki-Meru Line (white line)

Loss of carbon sink associated with tree clearing for ROW:

Clearing the equivalent of 12 ha of trees for the ROW has implications to climate change as this standing woody biomass will be lost from the local ecology. Globally, the carbon sink will be further reduced. Assuming an annual growth rate of 60 cubic metres per hectare of fast growing forests, 12ha of forests have capacity to fix close to 524 tonnes of carbon annually which would be lost when such trees are cleared from agro-forestry systems.

The process of felling trees to create ROW can interrupt economic activity such as transport, trade, learning and also poses short-term risks of injury to people and damage to property including existing infrastructure such as power and telecommunication lines. Such risks though short-term can have grievous impacts especially where fatal injuries of major damage to property are occasioned and tend to increase with density of settlement and development.

Hazards associated with transport and delivery of construction materials: Construction of close to 1000 pylons for the project will require an estimated 4400 tonnes of galvanised steel metal (assuming a requirement of 4 and 12 tons to construct Line Towers and Angle Towers respectively) while the 264 of TLs will require 5000 tons of conductors whose transportation raises concerns in terms of impact on local roads and safety of other road users.

On-the-ground inventory work undertaken as part of the RAP study has revealed that most sites proposed for construction of pylons are fairly inaccessible from the nearest access road implying that delivery of

construction materials (at least 4 tons of metal and 3 tonnes of conductors) to such remote sites will require making of new roads (and sometimes a new bridge) which will occasion disturbance of target land with attendant risks of loss of cropland, vegetation cover and investments such as hedges and fences. Further, given the rough terrain on certain sites, stripping the land of vegetation and topsoil in road construction has potential to accelerate soil erosion.

Transport of construction materials and clearing of trees for the RoW both have potential to undermine safety of other road users

Challenges/ concerns in the storage of construction materials and components

Privatisation of services in construction of power transmission and distribution lines in Kenya have created a huge demand for transformers, conductors etc which poses huge challenges in the management of such stores given the increasing cases of theft of the same. Against such a background, the storage of power transmission materials worth millions of shillings can easily escalate incidence of crime whereby resultant searches and arrests serving only to antagonise the project from host communities.

Typical materials and waste in construction of power lines

Occupational Health and Safety Impacts on workers: Construction, testing and commissioning of electric power lines exposes workers to multiple occupational hazards such as injury or loss of life from accidental falling, motor accidents, electrocution, attack by wildlife (elephants in Imenti forest, reptiles in Yatta Plateau, etc), etc which are costly to both affected families in terms of loss of income and the government through loss of productive labour and increased dependency. Though such risks prevail only during the construction phase, their impacts can be long lasting depending on the degree of injury sustained.

Social vices associated with construction crew: The bringing together of people into a new area has potential to introduce social vices more so when lumped together in a labour camp. However, it is the understanding of this study that labour camps will not be established.

Generation of construction waste: Junk in form of scrap metal, plastics, pvc cords, etc will be generated from construction activity. Such waste, estimated at 10% of all construction materials has potential to pose environmental challenges unless appropriately disposed.

7.4: Impacts at the Operation Phase

Extension of the transmission and distribution lines and installation of new and reinforced distribution lines with the aim of reducing technical losses and improving voltage conditions is potentially very beneficial especially on economic and environmental fronts. We highlight some of the benefits here below.

7.4.1: Positive socio-economic impacts

As pointed out elsewhere above, the percentage of Kenyan population covered by electricity is very low at 14%, out of which 11% is accounted for by rural populations. Positive benefits will manifest as follows:-

- Positive benefits of increased coverage and access to electric power will accrue from provision of a relatively cleaner, more readily convertible source of energy.
- Provision of electric power will open up market centres to investments such as engineering services, welding, banking, computer services, etc that are difficult to provide in absence of grid electricity.
- Electricity supply to rural centres will, therefore, widen opportunities for gainful employment, human resource development and rural commerce all of which are recipe for rural transformation.
- Once connected to grid electricity, some institutions such as schools and water supply projects currently relying on diesel-based generators and pump sets will now shift to a relatively cheaper, cleaner and more reliable energy source and in the process, cut down on financial strains imposed by purchase of diesel fuels. In the process, schools taking advantage of continuous supply of electricity will light for longer hours and thus mount more aggressive study/tuition programmes thus greatly improving on quality of delivery of education.
- Similarly, health institutions connecting to grid electricity will be able to adopt power driven technologies and thus widen the array of services –imaging, immunization, sterilization, theatre, etc, hitherto difficult to provide.
- Improved lighting in homes will motivate school / college going students to comfortably undertake evening studies, and women and men will gain some precious time for themselves to extend income generating work into the evening hours.
- Use of electricity for lighting and heating will also improve quality of indoor ambient conditions thus improving the health of the people.

7.4.2: Positive environmental impacts

On the environmental front, positive benefits will mainly accrue from substitution from use of petroleum fuels to electric power as follows:-

Cutting on smoke/GHG emissions: Within some urban households, supply of electric power could see a possible reduction in use of biomass energy such as charcoal and firewood for cooking and heating through adoption of electric stoves and other energy saving appliances thus improving domestic air quality with a possible impact on family health. However, owing to economic and social considerations (type and quality of meals), most rural folk connecting to electricity still opt for charcoal and firewood in cooking instead only preferring to use electricity for lighting and watching television.

Thus, substitution from petroleum fuels to electricity will immediately cut down smoke emitted from burning of fuels (in lighting, heating and motion) and thus improve on air quality for local residents including those operating the gen-sets.

By far however, the most drastic impact of building and operating the proposed transmission lines will be the cutting down of Green House Gas emissions currently associated with burning of fossil fuels in lighting, heating and operating diesel engines. Some comparative computations on GHC emission is provided here below:-

- National coverage by electricity: 14% equivalent to 0.84 million households
- Target coverage by Energy Access programme: an extra 6% equivalent to 360000 households
- Estimated contribution of TL in Eastern Kenya (1.2%):18, 000 households
- Annual kerosene consumption per urban household: 90 litres
- Annual kerosene consumption for 18 000 households: 1620 tonnes
- Annual greenhouse gas from 18,000 households[5]: 1450 tonnes (UNEP & WMO, 1991).

From the analysis, it is apparent that, by facilitating 18000 households to substitute from kerosene to electricity, about 1450 tonnes of carbon will be withheld from release into the atmosphere and this is by far

[5] **Assuming a conversion factor of 42.62 gigajoule (GJ) per ton of fossil fuel and a carbon content of 21.0kg per GJ.**

the most drastic environmental effect of developing and operating the power transmission lines. This figure more than compensates for the 560 annual carbon fixing capacity lost through tree clearance for the ROW but for the equation to hold, the transformation from kerosene to electricity has to be facilitated though incentives packages, marketing, credit facilities, etc.

Cutting down on solid wastes associated with use of Lead Acid batteries and other dry cells: A shift to use of electricity in lighting of homes and institutions will trigger a reduction in solid waste disposal associated with use of lead exide[6] and dry cells batteries. By year 2000, there were about 150,000 homes using solar powered technology (SHS) in Kenya (Ministry of Energy, 2002) while many other homes use lead acid batteries to power television sets. The SHS rely on a lead-acid battery recharged by solar-voltaic cells mounted on top of houses, which serve to intercept and convert solar radiation into an electric current which then recharges the lead acid battery. However, like other lead acid batteries, SHS batteries have an economic life of only one year after which, they have to be replaced.

Given a choice, all the SHS users would immediately shift to use of grid electricity and therefore provide immediate market for the scheme.

Cutting down on waste oils/ spares/ oil leaks: Routine operation and maintenance of diesel powered engines releases waste oils, spares, occasional oil leaks, etc, all of which are environmentally hazardous especially when in contact with water. The phasing out of diesel engines upon substitution to electricity will go some way towards eliminating environmental pollution associated with operation of diesel powered engines.

[6] These are commonly used to support solar powered systems and have to be replaced almost on an annual basis. This implies that annually, over 100, 000 lead acid batteries could be released to the environment from solar powered homes alone with many more being released from non-SHS.

A shift from diesel engineers to electric motors will eliminate pollution form maintenance of diesel engines

7.4.3: Adverse social and environmental Impacts of operating the TLs

Operation of the close to 264km of power transmission lines has numerous socio-environmental benefits as enumerated above. However, for such benefits to be felt down to all intended beneficiaries, there is need to insure against trends and actions with potential to trigger adverse impacts that can erode accrued benefits. Such potential adverse impacts and their causes are briefly highlighted here below.

Exposure to Electro-Magnetic Fields (EMF): There are claims that exposure of human beings to electro-magnetic fields associated with presence of high voltage electricity in close proximity to human settlements has adverse health implications. An epidemiological study recently documented higher rates of childhood leukemia among those born within 600 metres of a power line compared with those born further away. And though the authors discount establishing a clear-cut linkage between childhood leukemia and exposures to electromagnetic fields from power lines, the study involved 29,081 cases of cancer in children aged 0-14 years who were diagnosed during 1962-95 this has been hailed as the largest study to date of childhood cancer and power lines. From this study, it was documented that compared with children born more than 600 metres from a line, the risk of leukemia was greater by a factor of 1.69 for those born within 200 metres and by a factor of 1.23 for those born between 200 and 600 metres; both these elevations were statistically significant. In contrast to leukemia, there was no tendency for the risk of other childhood malignancies to increase with increasing proximity to a power line.

Possible impacts on aviation: The Military base at Nanyuki has already raised concerns on the possible impacts of high voltage transmission lines of the safety of operating their runway and communication systems and given the prevalence of other airstrips in the Timau area, this is an issue that KPLC requires to address with the directorate of civil aviation.

Possible impacts on visual intrusion: Creation of a 27m high steel lattice structures supporting wires where none existed before will change entire landscapes and introduce visual obstacles where none existed before. This can be frustrating to local residents who will have to get used to changed neighbourhoods and possibly trends.

Disincentive on use of other energy sources eg RETs: Before the supply of grid electricity, there is a common trend towards adoption of other RETs (Renewable Energy Technologies) such as SHS, Wind-driven generators, etc amongst the more progressive of rural residents. However, such interventions almost entirely cease once connection to grid electricity is assured. As such, in a country whose firm generation capacity is inadequate to meet the demand, supply of grid electricity provides a strong dis-incentive against exploration of other, equally viable options for lighting and heating in rural areas. This is a long-term trend whose reversal requires intervention at policy level.

Influence on land-use/ future development: Like any other infrastructure, installation of power lines has a strong influence on any future development. Thus, given that power lines normally follow existing way leaves, improper siting has potential to complicate or compromise future development. As well, installation of power supply infrastructure including lattice steel pylons and power lines permanently takes up land that is not available for other uses. Thus, where a power line passes along the boundary of a road reserve, the farmer neighbouring the road reserve is rendered unable to invest in tree planting along his plot boundary, and is thus unable to fully optimise use of this land.

Impact on avifauna: Birds occasionally find the electrical wires a resting place. In event of using naked wires, the spacing would be critical as this would affect the lives of birds and especially those with a wide wingspan. Deaths of birds from electrocution have been reported in many areas.

7.5: Overall scenario of impacts before mitigation

From table 7.1, when impacts are analysed on a scale of P, 2P, O, N and 2N (for Positive, Highly Positive, Neutral, Adverse and Severely Adverse), the overall picture that emerges is as below.

Impact	Tally	Implication	Nature of impacts
Positive Count (P)	33 P	33 positive impacts anticipated	Most are long-term
Adverse count (N)	26 N	26 adverse impacts anticipated	11 are long-term and 6 are irreversible
Net impact	7P		

From the table, it is apparent that:-

- A total of 33 positive impacts most of which are long-term in prevalence are anticipated.
- A total of 25 adverse impacts are anticipated out of which 11 are long- term in prevalence while 6 are potentially irreversible.
- The net effect even before mitigation is a total of 7P implying that the project has an anticipated net positive effect before mitigation.

Though the project has an overall net positive effect even before mitigation, an Environmental and Social Management Plan requires to be put in place to cater for the anticipated adverse impacts especially the 6 that are potentially irreversible. In sections below a strategy for environmental and social management in the project is unveiled.

7.6: Management of decommissioning

Design of power transmission lines assumes an economic life of 55-60 years for steel towers and 40 years for transmission cables which implies that, at some point, the system will require to be decommissioned either in whole or by components. Concerns associated with decommissioning would include occupational health and safety hazards, accumulation of scrap metal waste, electrical conductors, insulators and other components which apart from taking up productive space would also pose diverse hazards (health and safety, harbouring of vermin, etc) to local inhabitants and their property. Other impacts would emanate from failure to rehabilitate the concrete foundations of concrete bases back to economic use. The ESSMP unveiled in chapter eight has explicit requirements for management of decommissioning phase impacts.

7.7: Core concerns about the project

Towards attempting mitigation, three adverse impacts stand out as follows:-

- Project will acquire land and displace human settlements

- Project passes through a protected area and has potential to take space originally meant for use by wildlife.
- The project is a huge investment which will create an overhead physical structure that will intrude into space, permanently change the landscape, and pose hazards including health risks to human beings through exposure to the EMF.

The possibility of effectively mitigating such long-term impacts are explored in sections below.

CHAPTER EIGHT: THE ENVIRONMENTAL MANAGEMENT PLAN

8.1: Overview

This chapter outlines the environmental and social management strategy to be pursued in the development and operation of proposed power transmission lines. The strategy comprises of the following:-

- An impact Mitigation Plan
- A monitoring Plan showing the institutional responsibilities, cost head and objectively verifiable indicators for each activity.

8.2: The Impact Mitigation Plan

Preparation of this ESIA report has precede the detailed design in which case, recommendations made here-in have a fair chance of being incorporated into and influence final outcome of the project design process in which case, the latter process also becomes part of the mitigation programme. This study recommends that findings be incorporated into project design as a core mitigation strategy.

Towards mitigation of specific impacts, action will be taken as allowed for in table 8.1 below.

8.2.1: Mitigation at design stage

Mitigation of design stage impacts will require that action be taken as follows:

Site disturbance during field surveys have been minimised through use of existing tracks to access sites of interest and always to avoid crop damage. As well, for field work, sober and serious minded survey teams were selected and sensitised on the need to observe safety requirements during enumeration and site surveys and this has greatly mitigated incidence of accidents. Not a single incidence was reported for the entire field work that lasted upwards of 5 weeks.

8.2.2: Mitigation at construction stage

Action will be taken as follows:

i) **Mitigation of damage associated with land acquisition for ROW:** This study has identified several points where minor re-alignment of the RoT could greatly minimize disturbances with absolutely no engineering implications. They include:-

Leg	Point	Action
Nanyuki Meru		Realignment of Angle points so as to clear the play grounds of Inoro secondary school, and the Military air base. Indeed, possibility of passing line underground in this area should be considered.
Embu Ishiara		
Mwingi-Sultan Hamud	B2-4 angle point	Direction to B2-3 to be re-aligned to the left to avoid overhead traverse on two permanent houses.

Where encroachment on developed property remains inevitable, recommendations of the Resettlement Action Plan should be implemented without delay so as to insure against

impoverishment. Where affected houses comprise the family dwelling units, compensation packages should be staggered in a way to facilitate smooth relocation without occasioning burdens and suffering to the owners.

ii) Strategic role of enhancing tree cover within routes of traverse: Towards mitigating loss of trees and associated biodiversity and carbon sinks, KPLC should arrange with relevant sectors to mount an outreach programme targeting reforestation to conserve and restock lost biodiversity while improving general standing woody biomass Routes of traverse. Indeed, given that hydropower is the single largest generation source for grid electricity in Kenya providing some 677 MW or 55 % of the effective installed capacity, it will be in the long-term strategic interest for KPLC and stakeholders in the power sector to minimize deforestation and upscale conservation for purposes of restoring and maintaining favourable hydrological balance on catchment areas traversed by their power transmission lines.

iii) Transport of construction material: This will take advantage of existing routes and will minimize opening of new roads.

iv) Management of Occupational Health and Safety Hazards

General Health and Safety: The Contractor shall comply with all standard and legally required health and safety regulations as promulgated by Occupational Health and Safety Act and the Factories and Other Places of Work Regulations;

- The Contractor shall provide a standard first aid kit to field staff;
- The Contractor shall ensure that staff are made aware of the risks of contracting or spreading sexually transmitted diseases, particularly HIV/AIDS and how to prevent or minimise such risks;
- The Contractor shall be responsible for the protection of the public and public property from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by the construction activities;
- All works which may pose a hazard to humans and domestic animals are to be protected, fenced, demarcated or cordoned off as instructed by the RE. If appropriate, symbolic warning signs must be erected;

- Speed limits appropriate to the vehicles driven are to be observed at all times on access and haul roads. Operators and drivers are to ensure that they limit their potential to endanger humans and animals at all times by observing strict safety precautions;
- No unauthorised firearms are permitted on site;
- The Contractor shall provide the appropriate Personal Protective Equipment for staff.

(b) Fire Prevention and control: The Contractor shall take all reasonable and precautionary steps to ensure that fires are not started as a consequence of his activities on site;

- The Contractor shall ensure that there is basic fire-fighting equipment available on site;
- Within the protected area, the Contractor will follow all requirements of the Kenya Forest services in fire protection and will observe the Fire Danger Rating precautions.
- Flammable materials should be stored under conditions that will limit the potential for ignition and the spread of fires;
- 'Hot' work activities shall be restricted to a site approved by the RE;

Table 8.1: Matrix for Impact Prediction

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Ranking after mitigation	Persistence
Design Stage	Design Studies, field surveys and inventories	Creation of temporary opportunities for gainful employment	Adopt favourable payment terms	2P	Short-term
		Generation of additional site-specific data /study reports	Better storage and use of accruing data	P	Long-term
		Capacity building and sensitization	Target right group	P	Long-term
		Minor site disturbances including crop destruction during survey work	Use existing tracks	O	Short-term
		Minor accidents during survey work	Proper sensitisation and supervision	N	Short-term
Construction Phase	Supply of materials	Business opportunities in supply and transport of construction materials	Include local traders	2P	Short term
		Transport of material to remote sites	Utilize existing roads and contribute to maintenance	P	Shortermm
		Degradation along material delivery and storage areas	Use and upgrade existing routes. Professional alignment of new routes	P	Short-term
	Construction work	Short-term employment in	Adopt favourable rates	2P	Long-term

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Ranking after mitigation	Persistence
		construction			
		Revenue to GoK and Local Authorities through taxes	Ensure compliance	P	Short-term
		Land acquisition and clearance for ROW	Realignment in places, favourable and prompt compensation in others.	P	Long term
		Opportunity costs on land taken by ROW	Fair compensation. Policy review on long-term relevance of overhead transmission lines	P	Long-term
		Destruction of biodiversity in ROW	Restrict clearing to ROW. Enhance conservation outside ROW	N	Long-term
		Loss of Carbon sink from felling trees	Recreate sink through reforestation. Compensated for by cut in use of fossil fuels in favour of electric power	P	Long term
		Occupational health and safety concerns for construction crew	Use sober staff competent staff, with proper tools and under competent supervision, apply workmen compensation.	N	Short-term
		Generation of waste from	Minimise and recover all	O	Short-term

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Ranking after mitigation	Persistence
		construction activity	waste.		
		Nuisances of noise, dust, vibrations associated with transportation of materials and construction activity	Restrict construction to school holidays but shorten activity to reduce nuisances.	N	Short-term
		Sanitation concerns from construction crew, wastes from construction sites	Arrangements for sanitation facilities plus proper sensitization.	O	Short-term
		Hazards associated with general construction and operation of material stores	Local sourcing of labour who retreat back to their homes at end of days work. Adhere to requirements of the Occupational Health and Safety act, EMCA 1999, Cap 376, Forests Act etc.	O	Short-term
		Loss of nesting grounds for avifauna, bees, and dry season fodder in dry areas	Compensation by trees outside RoW. New habitat created by pylons	O	Long-term
		Impact on existing and future infrastructures	Align new TLs to the local physical development plans	N	Long-term

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Ranking after mitigation	Persistence
Operation Phase	Enhanced supply of electricity to close to 18000 homes and business centers	Economic gains from improved and stabilised power supply	Marketing campaign and incentives to recruit more connections	2P, 2P	Long-term
		Permanent visual intrusion into space	Policy review of relevance of overhead power transmission infrastructure.	2N	Long-term
		Enhanced delivery of services in medicare, education, admin, telecommunication, etc	Develop extra feeder lines to maximize presences of the 132kv power supply.	2P, 2P	Long-term
		Enhanced rural access through development of maintenance roads	Stakeholder consultation in routes selection, routine maintenance	P	Long-term
		Financial gains in oil to electricity substitution, maintenance costs for diesel engines, etc	Develop feeder lines to facilitate power supply. Marketing and incentives to woo new connections.	2P, 2P	Long-term
		Employment creation, reduced cost of investment	As above	2P	Long-term
		Cutting down on GHG emissions from petroleum to electricity substitutions	As above	2P	Long-term

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Ranking after mitigation	Persistence
		Health/ safety impacts of using clean energy sources	As above	2P	Long-term
		Possible reduction in solid waste from lead acid batteries, dry cells, candle residues, waste oil/ spares from gensets etc	As above	2P	Long-term
	Adverse impacts associated with presence of charged high voltage wires and associated infrastructure	Exposure to EMF	Need to apply precautionary principle and restrict human settlement to beyond 30 metres of transmission lines. Explore possibility of underground cabling.	N	Long-term
		Hazards to the aviation industry	Redesign to avoid critical areas	N	Long-term
		Hazards to avifauna and other wildlife	No important Bird areas in the RoT. However, apply insulators	N	Long-term
		Disincentive on use of other energy sources e.g. RETs	Policy measures to develop and promote RETs	N	Long-term
Decommissionin	Demolition activity	Occupational health and Safety	Recovery of construction	O	Short-term

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Ranking after mitigation	Persistence
g phase		Concerns, accumulation of solid waste;- debris and scrap metal, abandoned concrete slabs etc.	materials for recycling and safe disposal, rehabilitation of all concrete slabs to economic use, supervision to reduce on OHS concerns.		
Net environmental worth of the project **36P (36 positive outputs, mainly long-term), 8 (8 adverse outputs, 11 long-term, 6 irreversible),** **Net score=8P (Net positive impact before mitigation**					

Smoking shall not be permitted in those areas where there is a fire hazard. These areas shall include any areas (e.g. park/forest areas) where vegetation or other material is such as to make liable the rapid spread of an initial flame. The Contractor shall ensure that all site personnel are aware of the fire risks and how to deal with any fires that occur. This shall include, but not be limited to:

- Regular fire prevention talks and drills;
- Posting of regular reminders to staff;
- Any fires that occur shall be reported to the RE immediately and then to the relevant authorities;
- In the event of a fire, the Contractor shall immediately employ such plant and personnel as is at his disposal and take all necessary action to prevent the spread of the fire and bring the fire under control;
- Costs incurred through fire damage will be the responsibility of the Contractor, should the Contractor's staff be proven responsible for such a fire.

(c) Emergency Procedures: The Contractor shall submit Method Statements covering the procedures for the main activities which could generate emergency situations through accidents or neglect of responsibilities. These situations include, but are not limited to: accidents at the work place including wildlife invested areas, accidental fires; accidental leaks and spillages and vehicle and plant accidents. Specific to accidents at work place:

- The Contractor shall ensure that his employees are drilled in the procedure for working in protected areas as provided for in Cap 376 and Forests Act of 2005.
- He shall make arrangements for KWS to provide armed rangers to accompany employees working in wildlife invested areas,
- The Contractor shall also ensure that the necessary equipment for work in hazardous area – protective boots, PPEs, helmets, etc are provided.

(d) Mitigation of HIV/AIDS: The contractor in consultation with implementing agencies responsible for HIV/AIDS will mount educational campaigns to keep workers sensitised on the reality of this pandemic. He shall monitor activities regularly to assess effectiveness and impact. This should include an initial, interim and final assessment of basic knowledge, attitude and practices taking account of existing data sources and recognising the limitations due to the short timeframe to show behaviour change. The assessment will be supported by qualitative information from observations on workers behaviour.

(e) Mitigation of Solid Waste: All storage and **construction** sites are to be kept clean, neat and tidy at all times. No burying or dumping of any waste materials, metallic waste, litter or refuse shall be permitted. The Contractor must adhere to Environmental Management and Co-ordination (Waste Management) Regulations 2006. The Contractor shall implement measures to minimise waste and develop a waste management plan to include the following:-

- All personnel shall be instructed to dispose of all waste in a proper manner;
- At all places of work the contractor shall provide litter collection facilities;
- The final disposal of the site waste shall be done at the location that shall be approved by the RE, after consultation with local administration and local leaders;
- The provision of sufficient bins (preferably vermin and weatherproof) at the camp and work sites to store the solid waste produced on a daily basis;
- Wherever possible, materials used or generated by construction shall be recovered at the conclusion of each task for safe disposal including recycling.
- Provision for responsible management of any hazardous waste generated during the construction works.

(e) Wastewater and contaminated water management: No grey water runoff or uncontrolled discharges from any site or working areas (including wash-down areas) to adjacent watercourses and/or water bodies shall be permitted;

- Water containing such pollutants as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site. This particularly applies to water emanating from concrete batching plants and concrete swills;
- The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies;
- Potential pollutants of any kind and in any form shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;
- Wash areas shall be placed and constructed in such a manner so as to ensure that the surrounding areas (including groundwater) are not polluted;
- The Contractor shall notify the RE of any pollution incidents on site.

(f) General materials handling, use and storage: All materials shall be stored within the Contractor's camp unless otherwise approved by the RE;

- Stockpile areas shall be approved by the RE;
- All imported fill, soil and/or sand materials shall be free of weeds, litter and contaminants. Sources of imported materials shall be listed and approved by the RE;
- The Contractor shall ensure that delivery drivers are informed of all procedures and restrictions (including 'No go' areas) required;
- Any electrical or petrol driven pumps shall be equipped and positioned so as not to cause any danger of ignition of the stored product;
- Collection containers (e.g. drip trays) shall be placed under all dispensing mechanisms for hydrocarbons or hazardous liquid substances to ensure no contamination from any leaks is reduced;
- Regular checks shall be conducted by the Contractor on the dispensing mechanisms for all above ground storage tanks to ensure faulty equipment is identified and replaced in timely manner;
- Only empty and externally clean tanks may be stored on bare ground. All empty and externally dirty tanks shall be sealed and stored on an area where the ground has been protected.

8.2.3: Mitigation of Impacts at Operation and Maintenance stage:

Proposed mitigation activities at this stage are focussed on minimising hazards associated with presence of electricity. Hazards of electrocution, fire outbreak etc cannot be eliminated entirely. However, professional design and implementation of electricity supply schemes coupled with implementation of a public sensitisation campaign will greatly reduce incidence of accidents. The Kenya Power and Lighting Co. Ltd, already has an elaborate time-tested procedure for controlling installation and maintenance of power distribution and consumption systems and the same protocols will be adopted in the design of high voltage transmission lines. Specific issues will be mitigated as follows:-

(i) The question of health risks associated with creation of electro-magnetic fields: Though the linkage between EMFs and human health is not clearly understood, some epidemiological studies have indicated a possible association between childhood cancer (specifically leukaemia) and utility wires near residential areas but the studies have been so far inconclusive and weak which means that further research to generate conclusive data is required. Still, the information available would require that a pre-cautionary approach be adopted in addressing these issues. Precedence on this matter has been set as follows:-

- The World Health Organisation (WHO) 2007 fact sheet accepts that: "the evidence related to childhood leukaemia is not strong enough to be considered causal.." and that more research is required to reduce the uncertainty. It also notes that childhood leukaemia is a rare disease and even if ELF EMFs are shown to increase the risk of the disease, the public health impact from a global perspective would be limited. Indeed, the California Department of Health have disputed the scientific studies and placed more emphasis on the epidemiological studies. However, they also acknowledge that there is no conclusive evidence.

- The International Agency for Research on Cancer (IARC) lists EMF as Group 2B agent i.e. possibly carcinogenic based on limited evidence of carcinogenicity. The IARC 2B classification is based mainly on the evidence of childhood leukaemia.

- The first interim report from the Stakeholder Advisory Group on ELF EMFs (SAGE), set up by the UK Department of Health, felt that there was sufficient evidence of a link between close proximity to power lines and childhood leukaemia to consider precautionary measures.

- Two organisations, ICNIRP and IEEE, have developed exposure guidelines. Many countries have adopted the ICNIRP guidelines. Few countries (such as Australia, Sweden and Denmark) as well as the state of California have also adopted precautionary measures. Australia and California require spending a portion of the project cost to reduce electromagnetic fields from new power lines. Sweden has adopted a policy of prudent avoidance i.e. the low-cost avoidance of unnecessary exposure as long as there is scientific uncertainty about the health effects. The approach is to protect people from high magnetic exposures of long duration provided that the cost is reasonable i.e. options of lower exposure should be chosen as long as they do not incur large inconvenience or cost.

Given this precedence, and as more conclusive research is awaited, the recommendation of this study is for the precautionary principle to be applied in the design and construction of high voltage power lines. The precautionary measure being advocated for here include:-

- The horizontal distance to the nearest part of a building (residential and some non residential buildings such as schools) should be 30m for 132kV voltage lines.

- Underground lines, which will also have a visual benefit, could also be considered.

(ii) Towards promoting use of RETs: Towards ensuring that supply of grid electricity does not discourage use of other RETs, solutions can only be sought at policy level. However, adoption of a pricing mechanism that provides electricity consumers with incentives to conserve grid power through adoption of available conservation packages including use of RETs is one option towards sustaining the search for alternatives. Indeed, the disincentive towards search for other energy alternatives is the ain drawback associated with supply of electricity. It is a drawback that has no readily available means for mitigation currently.

(iii) Mitigating impacts of electrocution: Accidental electrocution is mainly mitigated through reservation and maintenance of the RoW. KPLC will undertake routine maintenance of the ROW to clear all vegetation and settlements. The Imenti Forest is an ecologic transition zone and hence an important bird area. At a maximum of 22 m above ground level, there is chance that the transmission lines will generally be below the emergent canopy level of forests and thus below the general migratory flight height of birds. Still, the section of TL within the Mt. Kenya area will require to be marked for purposes of deflecting birds approaching the power line.

All pylons within the elephant invested Imenti forest will require some minor electric fencing to secure them from bay and adult elephants.

8.3: Overview of impacts after mitigation:

Based on the outcome of impact mitigation, this ESIA observes that there is a great potential to mitigate adverse impacts and hence improve the net worth of the proposed transmission lines. From the table below, it is apparent that after mitigation, adverse impacts reduce from 26N to 8N while the positive impacts increase from 33P to 36P given the project a net effect of 28p after mitigation. And of the long-term hazards introduced by the project, these reduce to 6 from 11 after mitigation, in acknowledgment of the fact that some impacts are irreversible and still persist even after mitigation.

Nature of impact	Tally before mitigation	Tally after mitigation
Positives	33P	38P
Negatives	26N	6N

Net	7P	28P
Long-term adverse	11	6
Irreversible adverse impacts	6	6

Overall, the proposed project enjoys a highly positive benefits profile as it will strongly support initiatives towards poverty alleviation and reversal of environmental-degradation both of which are critically important policy aspirations of the Kenya Government. This Study recommends that project development should proceed but factor in the mitigation measures recommended herein. Implementation of this EMP will however require close follow-up and scrutiny to ensure achievement and substance of this esteemed net positive profile of the project. Requirements for monitoring are explored below.

8.4: Monitoring requirements

8.4.1: The concepts

Monitoring involves the collection and analysis of data about project activities. The data should be easy to collect and easy to understand. The focus of monitoring is to use the knowledge gained to correct and adjust project implementation and management in order to achieve project objectives. Monitoring allows project participants to keep track of project activities, to determine whether project objectives are being achieved, and to make whatever changes are necessary to improve project performance.

Evaluation considers the results and effects of a project in terms of the local and regional environment and the quality of life of the participants. Through evaluation, project participants and others attempt to understand and explain the effects of a project. The evaluation builds on the links among environmental problems, causes, and solutions identified in the project proposal and design. It usually focuses on the general and specific objectives of a project and assesses how and to what extent they have been met. The evaluation should include an explicit appraisal of the whether the project has met its stated objectives in terms of the evaluation criteria set.

Evaluation of projects is generally done towards the end of project implementation and should be included, along with monitoring, in project design. Project evaluation is an assessment of project performance and results in light of stated project objectives. Evaluation for purposes of this ESIA is proposed to include a participatory component allowing the project participants to comment on their experience of the project.

To be successful, monitoring and evaluation begins with clear project design followed by identification and elaboration of appropriate criteria and indicators. This document provides guidance about incorporating monitoring and evaluation elements in each stage of the project cycle.

Indicators and means of verification in M&E

Indicators form the key elements of any monitoring and evaluation system. The advantage of identifying indicators is that it provides management and staff with a clear set of targets at each level of performance and ensures that progress can be measured against the targets. Indicators also make possible the comparison of inputs with the completion of outputs and achievement of objectives and goals, thus providing the basis for performance evaluation. For purposes of this ESIA four categories of indicators have been formulated to facilitate monitoring of Progress, Outputs, Effects, Impacts and Compliance in implementing the project.

8.4.2: Procedure for M&E in the development of 132kv TLs

Table 8.2 below provides the matrix of Environmental and Social Management and Monitoring as proposed for the development of 132 Kv transmission lines. From this plan, it is clear that most mitigation activity will take place at the construction stage having been allowed for at the design stage. This study recommends this ESMMP to be applied further as follows:-

- The ESMMP will be integrated into the Design Report- as a standalone chapter and also to moderate design decisions
- Further, it will be integrated into the BOQs to ensure funding allocation of environmental and social mitigation.
- Ultimately, Contracts for Construction will bear clauses from the ESMMP to ensure that the contractor is legally bound to implement impact mitigation

The ESMMP in table 8.2 provides a detailed framework of issues, indicators and responsibilities in monitoring the project.

Progress / Output Monitoring: For purposes of the TLs, the project deliverables (outputs) will be clearly specified in the Bills of Quantities which should be read in conjunction with the Contracts for Construction. Progress will be monitored on the basis of basis of periodic outputs as per the contractual work plan while

outputs will be monitored on the basis of approved units of measure as specified in the Bills of Quantities and the Contract for Works. Such indicators are generally quantitative in nature, e.g., the kilometers of HV lines already completed, number of households compensated for right of way acquisition, number of diesel machine operators connected to grid electricity, etc. Monitoring delivery on social and environmental outputs (prescribed mitigation measures) as identified in this ESIA will be based on the ESMMP as developed for this ESIA with the main responsibility falling on the Project Design Engineer. Successful completion of periodic outputs will be reported in Periodic reports by the PDE and backed up by issuance of payment certificates based on which, payment is effected upon invoicing.

Effect monitoring: This will be used to measure the extent to which the immediate objectives have been achieved and give an idea of the results emanating from implementing the programme e.g., % of diesel pump/gensets already converted into electric motors, number of institutional consumers now using electric power, number and diversity of services now being offered on account of supply of electricity, etc. Effect monitoring especially through end of term Project Evaluation is also useful in documenting lessons learned from project implementation which can also be replicated elsewhere. Effect monitoring will best be achieved through routine and end term Project Evaluation conducted by the KPLC. Alternatively, such information can also accrue from the periodic household surveys usually commissioned by the Central Bureau of Statistics.

Impact monitoring: This is the process through which, assessment of the overall achievement of the project goal has been achieved. Specifically, this is the system that will generate data to gauge the impact of the REP expanding opportunities for service delivery and employment creation in rural areas thus contributing towards alleviation of rural poverty. Other output areas under this category would include environmental impacts e.g. cutting down on GHG emissions, etc.

8.4.3: Requirements for Compliance Monitoring

Compliance monitoring will be mainstreamed into the overall project monitoring system. Compliance monitoring will be based on the ESMMP (table 8.2and will mainly vest on two institutions namely the KPLC in the capacity of Employer, ERC in the capacity of regulator in the power sector and NEMA in the capacity of environmental regulator. The roles of all stakeholders in facilitating achievement of project goals are enumerated in sections below. Tools will be used for monitoring as follows:-

- Completion certificates issued by the Resident Engineer (Supervisor of works) on behalf of the KPLC
- KPLC's internal monitoring reports

- Monitoring reports submitted to NEMA annually
- Monitoring reports produced by the ERC in capacity of regulator in the power sector.

Overall, the responsibility for securing overall soundness and viability of the project vests with the KPLC in the capacity of proponent and employer in this project.

8.5: Roles and Responsibilities in implementing the EMP

This ESIA identifies several crucial players in executing impact mitigation measures for the proposed development of 132 KV TLs. They include:-

The Design Engineer: The design stage of the project is crucial as the point when mitigation measures are inbuilt into the project design and those with financial implications allowed for in the BOQs. This ESIA recommends that Technical Specifications produced as part of the design study should bear inbuilt mitigation measures. Further, as a control strategy to secure compliance by project contractors, clauses binding the latter to implement impact mitigation in course of civil works are factored into the Contracts for Works which are subsequently supervised by the Supervising Engineer. Given this consideration, the Design Engineer plays a very crucial role in incorporating findings from the environmental assessment into the project design- a process already concluded in respect of this ESIA. His role in ensuring compliance by contractors is also crucial to the success of the Impact Mitigation Plan.

The Project Contractor(s): For purposes of this ESIA, the Project Contractor will play the crucial role of offsetting impacts associated with construction activities including those along the material supply chain. Employment of professionally competent contractors is therefore crucial to achievement of the goals of this ESIA.

Table 8.2: Matrix for Environmental and Social Management and Monitoring (ESMMP)

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
Design Stage	Design Studies, field surveys and inventories	Creation of temporary opportunities for gainful employment	Adopt favourable payment terms		Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
		Generation of additional site-specific data /study reports	Better storage and use of accruing data		KPLC	Design reports	KPLC/RE/ NEMA
		Capacity building and sensitization	Target right group		KPLC	Training Reports	KPLC/RE/ NEMA
		Minor site disturbances including crop destruction during survey work	Use existing tracks		Contract for construction	Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
		Minor accidents during survey work	Proper sensitisation and supervision		Contracts for studies	Clauses in contracts for design studies.	KPLC/RE/ NEMA
Construction Phase	Supply of materials	Business opportunities in supply and transport of construction materials	Include local traders		Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
		Opening access to remote areas through construction of access routes	Proper alignment and maintenance		Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
		Degradation along material delivery and storage areas	Use and upgrade existing routes.	1,600,000	Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
	Construction work	Short-term employment in construction	Adopt favourable rates		Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
		Revenue to GoK and Local Authorities through taxes	Ensure compliance		Contracts	Design report, Clauses in contract for construction.	KPLC/RE/ NEMA
		Land acquisition and clearance for ROW	Realignment in places, favourable and prompt compensation in others.	440,000,000	Contract for Design	Clauses in contract for Design studies. Monitoring reports.	KPLC/RE/ NEMA
		Opportunity costs on land taken by ROW	Fair compensation. Policy review on long-	As above	KPLC Internal revenue	Report on RAP implementation	KPLC/RE/ NEMA

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
			term relevance of overhead transmission lines		Policy debate by KPLC	Monitoring reports.	
		Destruction of biodiversity in ROW	Restrict clearing to ROW. Enhance conservation outside ROW	1,200,000	Contract for construction KPLC internal revenue	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
		Loss of Carbon sink from felling trees	Recreate sink through reforestation. Compensated for by cut in use of fossil fuels in favour of electric power	As above	KPLC internal revenue	Approved conservation plan and budget. Monitoring reports.	KPLC/RE/ NEMA
		Occupational health and safety concerns for construction crew	Use sober staff competent staff, with proper tools and under competent supervision, apply workmen compensation. Adhere to requirements of the	400,000	Contract for Construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
			Occupational Health and Safety Act				
		Generation of waste from construction activity	Minimise and recover all waste.	In built in contract for construction	Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
		Sanitation concerns from construction crew, wastes from construction sites	Arrangements for sanitation facilities plus proper sensitization.	Inbuilt in contract for construction	Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA
		Hazards associated with general construction and operation of material stores	Local sourcing of labour who retreat back to their homes at end of days work. Adhere to requirements of the Occupational Health and Safety act, EMCA 1999, Cap 376, Forests Act etc.	As above	Contract for construction	Design report, Clauses in contract for construction. Monitoring reports.	KPLC/RE/ NEMA

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
		Loss of nesting grounds for avifauna, bees, and dry season fodder in dry areas	Compensation by trees outside RoW. New habitat created by pylons				
		Impact on existing and future infrastructures	Align new TLs to the local physical development plans	Contract for construction	Contract for Design	Clauses in contract for Design works. Monitoring reports.	KPLC/RE/ NEMA
Operation Phase	Enhanced supply of electricity to close to 18000 homes and business centers	Economic gains from improved and stabilised power supply	Marketing campaign and incentives to recruit more connections	KPLC internal budget	KPLC internal revenue	Approved marketing programme and budget	KPLC/RE/ NEMA
		Permanent visual intrusion into space	Policy review of relevance of overhead power transmission infrastructure.	600,000	KPLC	Policy debate	KPLC/RE/ NEMA
		Enhanced delivery of services in medicare, education, admin, telecommunication, etc	Develop extra feeder lines to maximize presences of the 132kv power supply.	KPLC internal budgets	Contract for design	Design report, Clauses in contract for design.	KPLC/RE/ NEMA
		Enhanced rural access through maintenance	Stakeholder consultation in routes	Allocated elsewhere	KPLC Internal revenue	Design report, Clauses in contract for	KPLC/RE/ NEMA

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
		of access roads	selection, routine maintenance	above		design.	
		Financial gains in oil to electricity substitution, maintenance costs for diesel engines	Develop feeder lines to facilitate power supply. Marketing and incentives to woo new connections.		Contract for design	Design report, Clauses in contract for design.	KPLC/RE/ NEMA
		Employment creation, reduced cost of investment	As above		Contract for design	Design report, Clauses in contract for design.	KPLC/RE/ NEMA
		Cutting down on GHG emissions from petroleum to electricity substitutions	As above		Contract for design	Design report, Clauses in contract for design.	KPLC/RE/ NEMA
		Health/ safety impacts of using clean energy sources	As above		Contract for design	Design report, Clauses in contract for design.	KPLC/RE/ NEMA
		Possible reduction in solid waste from lead acid batteries, dry cells, candle residues,	As above		Contract for design	Design report, Clauses in contract for design.	KPLC/RE/ NEMA

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
		waste oil/ spares from gensets etc					
	Adverse impacts associated with presence of charged high voltage wires and associated infrastructure	Exposure to EMF	Need to apply precautionary principle. Explore possibility of underground cabling.		Contract for design Policy debate by KPLC	Design report, Clauses in contract for design.	NEMA/ Radiation Control Board.
		Hazards to the aviation industry	Redesign to avoid critical areas		Contract for design	Design report, Clauses in contract for design.	NEMA/Civil Aviation Authority.
		Hazards to avifauna and other wildlife	No important bird areas in the RoT. However, apply insulators	Contract for construction	Contract for design	Design report, Clauses in contract for design.	KPLC/RE/ NEMA
		Disincentive on use of other energy sources e.g. RETs	Policy measures to develop and promote RETs	MOE budget lies	MOE	Approved workplans and budget	NEMA
Decommissioning phase	Demolition activities	OHS concerns, solid and construction waste	Dispose as per existing legislation	KPLC internal			

Project Phase	Source of Impact	Potential Impact	Mitigation/ enhancement	Budget line (ksh)	Responsible cost Head	OVI	Monitoring authority
				budgets			

The Kenya Power and Lightning Co. Ltd: In its capacity as the Employer in the project the KPLC Ltd has overall responsibility of securing the technical and economic viability of the REP in line with performance contract and national policy aspirations.

The National Environment Management Authority-NEMA: EMCA 1999 allows for formation of the National Environmental Management Authority NEMA as the body charged with overall coordination of environmental protection in Kenya. To fully pursue this mandate, NEMA is run by a Board of Management whose decisions are implemented by Director General appointed by the President and assisted by several Directors (in charge of Enforcement, Environmental Education, Policy, etc), Assistant Directors and Senior Officers. Further, to facilitate coordination of environmental matters at District level, EMCA 1999 allows for creation of District Environmental Committees traditionally chaired by respective District Commissioners but coordinated by District Environmental Officers who are employees of NEMA charged with responsibility of implementing and overseeing NEMA mandate at District level.

It is critically important for Project contractors to implement the Impact Mitigation Plan as outlined in this ESIA as failure to do so could see NEMA impose sanctions on project development. This is entirely in their legal mandate.

The Electricity Regulatory Commission (ERC): Among many functions, the ERC is mandated to licence and undertake technical audit of activities of all players in the Power Sector in Kenya and is therefore a crucial stakeholder in the power sector. **The Standards Act, Chapter 496 of the Laws of Kenya,** empowers the ERC to enforce safety regulations and to ensure that electrical apparatus and works meet the standards set by the Kenya Bureau of Standards or, where no such standards exist, with the relevant international standards approved by the Kenya Bureau of Standards.

8.6: Budget for Environmental and Social Mitigation:

A budget line in the tune of Ksh 443,800,000 has been proposed to cater for environmental and social mitigation. The bulk of funds will go towards compensation for land reserved for the wayleave.

CHAPTER NINE: CAPACITY OF STAKEHOLDERS TO IMPLEMENT THE ESMMP

9.1: Capacity Assessment for stakeholders

Successful implementation of this ESMMP hinges very strongly on the ability of diverse stakeholders to effectively play respective roles. In this section, we appraise the capacities of such stakeholders against the perspective of roles identified for them in this ESIA. It is the identified gaps in capacity that will require bridging through capacity building.

9.2: The Stakeholders

Project Design Engineer (PDE): The crucial role of the PDE in integrating this ESMMP in the Project Design has been highlighted elsewhere above. It behoves KPLC in the capacity of Employer to recruit Design teams that are environmentally and socially proficient.

Project Contractors: Electrical Engineers and contractors are normally highly sensitised on Occupational Health and Safety requirements in electrical installation works, but their sensitivity to environmental requirements is normally wanting. For purposes of this ESIA, the bulk of mitigation will take place at construction phase and is therefore the responsibility of contractors whose contracts bear relevant clauses in-building mitigation into the civil works. In order to facilitate contractors to internalize and co-own the Impact Mitigation Plan, Contractors will be taken through a sensitisation course on environmental requirements in rural electrification schemes in course of which, the ESMMP proposed in this ESIA will be discussed.

Capacity of the ERC: By virtue of the Energy Act of 2006 which gave the ERC the mandate to *Enforce Safety and Environmental Regulations in power sub-sector*, the ERC would be expected to play a very central role in ensuring the overall functional soundness of the project. Further, in line with its mandate, the ERC is expected to conduct annual EHS audits for all power generation and distribution facilities to ensure soundness alongside resolution of disputes ensuing amongst stakeholders. Towards executing this mandate, the ERC has put in place an environmental secretariat headed by an environmentalist but the consideration of this ESIA is that this capacity is inadequate to serve the considerably extensive mandate. Indeed, for an institution with such a wide national mandate, the ERC is considered to be under-established; an issue whose restitution is considered outside the mandate of this study.

Capacity to process Project Reports by NEMA: EMCA 1999 allows for formation of the National Environmental management Authority NEMA as the body charged with overall coordination of environmental protection in Kenya. A Director General appointed by the President heads the Authority established in 2001. Several Directors in charge of Enforcement, Education, Policy, who are assisted by Assistant Directors and Senior Officers under them, assist the DG. To facilitate coordination of environmental matters at District level, EMCA 1999 allows for creation of District Environmental Committees traditionally chaired by respective District Commissioners. To each DEC in the country is attached a District Environmental Officer who oversees environmental coordination among diverse sectors and is also secretary to the DEC.

In recognition that EMCA is an umbrella law coordinating diver sectoral statutes all of which are still in force, the Legal Notice 101 of EMCA requires that the respective sectors be consulted as Lead Agencies in making decisions pertaining to environmental assessment for projects in respective sectors. This is to ensure that NEMA does not approve projects that contradict sector policies and legislation. Given this mechanism for

managing environmental assessments, it can be concluded that NEMA has adequate capacity to assess the environmental management across the country.

Capacity of MoE: The MoE also retains policy making and strategic planning functions in the energy sector on behalf of GoK. For purposes of the REP, the MoE, through its executing Agency, the KPLC is the employer in the REP and is represented in the steering committee of the GoK / AFD funded REP project. For the purposes of this ESIA , the role of the MoE is purely oversight ensuring that project implementation is in conformity with GoK policy goals, aspirations and procurement procedures. In the view of this ESIA, MoE has adequate capacity to fully serve all inherent roles.

This ESIA further identifies the MoE as the public body charged with nurturing and facilitating research in other Renewable Energy Technologies (RETs) alongside extension of the electricity grid. Toward this, the MOE has a fully fledged department of RET that fosters such research. Among other RETs under trial include, research on potential of wind energy- (study ongoing in Marsabit), coal (local mining / sourcing, Solar Power, Biogas, Mini and Micro-Hydro, Biodiesel, etc. Alongside such initiatives, this ESIA recommends that MoE initiates a policy debate towards promoting research geared towards enhancing the technical appeal of other RETs as viable substitutes to grid power supply. The goal is to ensure that supply of grid electricity does not necessarily kill adoption of RETs.

Capacity of KPLC: KPLC is the distributor of electrical power through the national grid network. The main role of KPLC is the development of electricity distribution network, connecting and selling power to consumers and the maintenance of the network.

As the Employer in this project, the KPLC is responsible to the public to ensure that GOK investments are handled with diligence and that, the output is technically, socially and environmentally sound as per GoK Policy and strategies; a mandate that KPLC is best placed to serve given its established track record in handling similar assignments. The KPLC also has a fully fledged Environmental Department manned by professionally competent staff with adequate capacity to provide technical back-up to the Project Design Engineer in ensuring the technical and environmental soundness of outputs under the proposed project.

9.3: Over-all picture on availability of capacity

Based on the capacity Assessment undertaken in section 5.1 above, the ensuing picture is that, there is adequate capacity amongst the core stakeholders to fully execute roles as identified in this ESIA. Further, even where institutional capacity is found to be wanting, the design process pursued in respect of the REP has put in place safeguards to adequately bridge such deficiency to ensure technical soundness of outputs anticipated under the REP. In the impression of this ESIA, the capacity available is adequate to fully dispense with the all issues identified in this ESIA.

CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS

The subject of this ESIA Report is the proposed construction of 264 km of 132kV power transmission lines by the KPLC in sections between Nanyuki to Meru, Embu Ishiara and mwingi, Kitui-Wote Sultan Hamud.

The Report has been prepared for the KPLC by Repcon Associates in compliance with the Environmental Management and Coordination Act, 1999 and in line with Environmental Regulations (Guidelines for Impact Assessment and Audits) as borne by the Legal Notice No. 101 published in the Kenya Gazette Supplement No. 56 (Legislative Supplement No. 31) of June 2003. The report examines the project in terms of the proposed development, possible adverse impacts at both construction and operation phases and provides an Environmental and social management and Monitoring entailing (ESMMP) entailing both an Impact Mitigation and Monitoring Programme.

Baseline data on proposed development was generated through desktop studies, site visits and interviews with the proponent, potentially affected people. Stakeholder consultations were undertaken towards development of a Resettlement Action Plan (RAP) and as per requirements of EMCA. To identify, predict, analyze and evaluate the various impacts that may emanate from the project, diverse study methods and tools including use of checklists, matrices, expert opinion and observations were employed.

Development of the project has been justified on the basis that it will improve access to electric power in a country where current national coverage averages a low 14% with most connections being recorded in urban areas. Provision or additional and stable has potential to unlock the economic potential of rural areas and thus contribute to national economic growth.

This ESIA Study has identified diverse impacts both direct and indirect. Positive implications of the project emanate from its potential to create short-term business and employment opportunities to both professional staff and workers during the design phase while, at construction phase, traders will benefit from opportunities to supply construction material while locals will be employed in works. Upon commissioning, the project could supply electric power to up to 18000 households in Nanyuki and Eastern Kenya and unlock the business potential of powered areas. Through adoption of electricity and cutting down on use of fossil fuels, the project has potential to favor cutting down on Green House Gas emissions to the benefit of the global climate.

Development of the project will however introduce some adverse impacts the most drastic of which is acquisition of clearing of about 792ha of land from about 2064 farms to be traversed by the project. The clearing of physical assets and trees from within the 30m wide ROW corridor estimated at 264km long followed by erection of a 27m high permanent steel structure where none existed before has drastic

consequences in terms of opportunity costs for land, loss of biodiversity, loss of carbon sinks while powering of the transmission line will pose hazards of exposing people to electro-magnetic fields.

Of the 28 adverse impacts anticipated, 22 can be effectively mitigated but 6 are long-term in effect and will persist even after mitigation. Indeed, given the widely acknowledged deforestation which has seen forest cover in Kenya decreased from 3% in the 1980s to less than 2% currently, the clearing of trees in another 740ha to create the ROW certainly has cumulative effects. Similar long-term impacts are anticipated from powering of the transmission lines which will enhance existing electromagnetic field which are claimed to expose people to health hazards.

An ESMMP has been developed whose pursuit can greatly improve the overall net effect of the project. This ESIA observes that the bulk of adverse impacts will manifest at the Construction stage in which case, the core effort in mitigation will be concentrated in the contract for construction. This ESIA therefore requires that the ESMMP be integrated into the Design Report will appropriate allocation of funds in the Bills of Quantities. The contract for construction should bear clauses binding the contractor to implement impact mitigation as part of the civil works. The KPLC will hire a Competent supervisor of works through which compliance monitoring will be effected. As well, the KPLC in capacity of employer will mount own internal monitoring to ascertain environmental and social sensitivity at all stages of project development.

Development of the project will adhere to all applicable laws in Kenya and will also comply with World Bank's safeguard Policies. Towards this, this ESIA report will be disclosed both locally and at the World Bank Infoshop whereby accruing comments will be used to finalize the report. Thereafter, the project will be subject to statutory annual audits under EMCA 1999 and other statutes.

In the view of this study, the project as currently proposed project is environmentally sound. This report has disclosed all potential adverse impacts most of which have readily available means to effective mitigation as already disclosed, and to be implemented as part of the project design. Overall, the project enjoys a net positive regime which will greatly improve upon pursuit of the ESMMP as proposed. Our recommendation is for the implementation of this project to be supported at all levels.

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APPENDICES:

Appendix 1.1: Terms of Reference

Appendix 3.1: Maps for Routes of traverse

Appendix6.1: Copy of questionnaire

Appendix 6.2: Stakeholder sheets

Appendix 6.3: List of Documents reviewed

APPENDIX 1.1: TERMS OF REFERENCE

APPENDIX 3.1: MAPS FOR ROUTES OF TRAVERSE

APPENDIX 6.1: COPY OF QUESTIONNAIRE

APPENDIX 6.2: STAKEHOLDER CONSULTATION SHEETS

APPENDIX 6.3: LIST OF DOCUMENTS REVIEWED