REPUBLIC OF KENYA

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT STUDY REPORT

DRAFT FINAL REPORT

30TH JUNE 2020

FOR

GEOLOGICAL STUDY, FEASIBILITY STUDY, ENVIRONMENTAL AND SOCIAL IMPACT STUDY, PRELIMINARY AND DETAILED ENGINEERING DESIGN OF SUSWA - MAI MAHIU (B7) ROAD SECTION

TENDER NO: KeNHA/1969/ 2018

MOTI CONSULTANTS LTD.

Engineering. Management. Design.
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AUTHENTICATION PAGE

I John Githaiga Maina, the undersigned lead expert confirm that the contents of this report are a true representation of the Environmental and Social Impact Assessment project report for the 'Geological study, feasibility study, environmental and social impact study, preliminary and detailed engineering design of Suswa - Mai Mahiu (B7) road section' subsequently identified as the Suswa-Mai Mahiu Road project in the document.

Submitted by: John Githaiga Maina

Designation Lead Expert
NEMA Registration 0903
P.O. Box 30197 00100,
Nairobi

Signature
of authorized NEMA registered signatory

Date 30th June 2020

For:

Kenya National Highways Authority (KeNHA)
P.O Box 49712-00100
Nairobi
+254 (20) 8013842
dg@kenha.co.ke

LIST OF ABBREVIATIONS

AfDB	African Development Bank
AP	Aggrieved Party
EMU	Environmental Management Unit
CBOs	Community Based Organizations
CITES	Commission for International Trade in Endangered Species
CRC	Grievance Redress Committee
CREW	Centre for Rights, Education and aWareness
CSS	Construction Site Supervisor
DBM	Dense Bituminous Macadam
EA	Environmental assessment
EMCA	Environmental Management and Conservation Act
EMMP	Environmental Management and Monitoring Plan
ESMMP	Environmental and Social Management and Monitoring Plan
ESIA	Environmental and Social
ESMP	Environmental and Social Management and Monitoring Plan
ERT	Electrical Resistivity Tomography
EPRA	Energy and Petroleum Regulatory Authority
FGDs	Focus Group Discussions
FWD	Falling Weight Deflectometer
GoK	Government of Kenya
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunity Deficiency Syndrome
IUCN	International Union for Conservation of Nature
FGM	Female Genital Mutilation
GRM	Grievance Redress Mechanism
GCS	Gravel; Concrete and Soil
ICD	Inland Container Depot
IEC	Independent Environmental Consultant Team
IPP	Independent Power Producers
KenGen	Kenya Electricity Generating Company
KAG	Kenya Assembles of God
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority
KETRACO	Kenya Electricity Transmission Company
KFS	Kenya Forestry Service
KI	Key Informant
KPA	Kenya Ports Authority
KWS	Kenya Wildlife Service
KNASP	Kenya National Aids Strategic Plan
LHS	Left hand side
MASW	Multi-channel Analysis of Surface Waves
MDD	Maximum Dry Density
NCA	National Construction Authority
NEMA	National Environmental Management Authority
NLC	National Land Commission
NMK	National Museums of Kenya

NTSA	National Transport and Safety Authority
OHS	Occupational Health and Safety
OSHA	Occupational Health and Safety Act
NGO	Non-Governmental Organization
PAPs	Project Affected Persons
PD	Public Disclosure
PM	Particulate Matter
PPE	Personal Protective Equipment
RAP	Resettlement Action Plan
RE	Resident Engineer
SEP	Stakeholder Engagement Plan
SERC	Standards and Enforcement Review Committee
SGR	Standard Gauge Railway
SSO	Social Standards Officer
ToRs	Terms of Reference
TRL	Transport Research Laboratory
WHO	World Health Organization
WRMA	Water Resource and management Authority

EXECUTIVE SUMMARY

Project Description

The road B7section between Suswa and Mai-Mahiu has experienced recurrent closure incidences in the last 10 years. Runoff from Mount Longonot and Suswa areas overtops the road depositing silt and initiating subsidence at fault lines rendering the road impassable. The closures disrupt transport and economic activities dependent on the road. The redesign and reconstruction is aimed at eliminating the closure incidences and ensure smooth traffic operations.

Project Description

The road section under study is approximately 40 Kms from Mai Mahiu in Nakuru County to the Olasiti township environs in Narok County. The project ToRs include a geological study, a feasibility study and an environmental and social impact assessment (ESIA) to inform the preliminary and detailed engineering design of the Suswa –Mai Mahiu road. The resultant detailed engineering takes into account the studies' findings the road's reconstruction.

Objective of the road project

The proposed road project intends to eliminate the frequent road closures and ensure continued connectivity between Narok, Bomet, Kisii, Nyamira, Kisumu Counties and the rest of the Country. The road project objective is aligned to National infrastructure policies and to ensure undisrupted traffic flow through the affected road section. The project is being undertaken by the Kenya National Highways Authority (KeNHA), a state corporation in the Ministry of Transport, Infrastructure, Housing and Urban Development responsible for management, development, rehabilitation, and maintenance of Class B status roads.

ESIA Objectives

The ESIA study sought to identify impacts the road project would have on the biophysical and social environments and investigate other causes generating the impacts on the road and seek redress mechanisms for them. The findings were to identify and categorise impacts of the proposed road project, develop and propose mitigation interventions to prevent or ameliorate adverse impacts that may arise. The social aspect of the study investigated potential impacts of the road project on resident communities, their social-cultural fabric and livelihoods. Mitigation and interventions measures were developed to enhance positive impacts and minimize potentially negative outcomes. An environmental and social management and monitoring plan (ESMMP) for the proposed project was developed from the ESIA study.

Applicable Legislation and policies

The ESIA conformed to the spectrum of legislation and regulations that apply to Category A NEMA classified projects in Kenya that may have deleterious and unforeseen adverse impacts. It was conducted in accordance with Environmental Management and Coordination Act (EMCA) No 8 of 1999 requirements and fulfilled subsequent regulations enacted under it. The study took cognizance other relevant Acts

of Parliament and Legislation, policies and provisions of the Kenyan Constitution of 2010 with a bearing on environment, infrastructure development and public participation. International best practices as contained in treaties, protocols and guidelines domesticated in Kenya were also adopted in this ESIA.

ESIA methodology

The ESIA study was conducted between March 2019 and December 2019, spanning the wet and dry seasons in the project area. Baseline data was collected through and initial desk top study for secondary data and subsequent field studies for primary data collection. The environmental study documented the state of the environment, vegetation and wildlife distribution and composition, land use types, activities, and other processes that impact the road. Key informant interviews and consultations were conducted with stakeholders considered as resource users, owners, mandated regulatory authorities and those with activities that impact the road's landscape. Community consultations were held for awareness creation, information gathering and public disclosure of the project. Questionnaires administered at household levels generated data on demographic parameters, resource use and ownership, socio-economic profiles and other aspects.

Baseline conditions

The prevailing complex matrix of topography, geology, soil characteristics and climate render the road passage areas naturally prone to erosion and sedimentation processes. Inappropriate human activities and land use in the fragile environment combine with natural environmental drivers to trigger the processes that lead to subsidence, siltation, flooding road cuts, and road closure resulting in inconvenience and economic losses.

Biophysical environment

The road passage area is low lying relative to the rift valley escarpments bounding it to the east and west and Longonot and Suswa mountains. It is crossed by numerous lagas and gullies that track fault lines and has floodplain zones in several places. The road area has water catchments sourcing flows from Mt Suswa, Longonot and the Kijabe and Nairegia Enkare escarpment areas. The gullies manifest ongoing erosion and there are silt and pumice deposition sites upstream and downstream of the road. Their impacts are widespread and conspicuous along the road passage and downstream areas that include Lake Magadi.

The geology and topography of the road passage area is a complex outcome of Mt Longonot and Suswa volcanic and tectonic movements linked to the formation of the Eastern Rift valley. The area has fault lines related to the rift valley formation and eruptions of Mt Suswa and Longonot. There are lava tubes, fissures and pyroducts that cause soil subsidence. The soils are heterogeneous volcanic deposits and sediments with fine silt, silty-sandy particles and sand being prevalent. They are poorly consolidated, fragile and highly erodible.The climate of the area is dry with a mean annual rainfall of less than 800mm annually that falls in two seasons, March-May and October-November and frequently occurs as localized and intense storms that trigger flashfloods. The area is

devoid of permanent surface water bodies and waterways as the substrate composition and geology preclude retention of surface and underground water.

Flora and fauna

The vegetation consist of mixed or pure stands of *Tarchonanthus camphoratus* (Leleshwa) or *Acacia drepanolobium* woodlands. The vegetation stands are variable depending on terrain and drainage characteristics. Patches of *Acacia xanthophloea* occur in the lowlands where water temporally collects, while drier areas have *Acacia drepanolobium* and *Acacia kirkii* bushed grasslands. The herbaceous layer is dominated by various grass species that include *Themeda triadra, Sporobolus robusta* and patches of *Cenchrus ciliaris*. The area formerly supported a variety of mammalian species that included zebra, Grant's gazelle, Coke's and Masai giraffe among others but this has been exterminated by land use changes and poaching. There is a rich avian community and some 43 avian species were recorded in the landscape.

Land use

Land use consists of large scale ranching, agro-pastoralism, small scale subsistence agriculture and open range pastoral livestock production. Maize is grown in wetter areas with deep soils around Mai-Mahiu and near Suswa towns and the higher areas adjacent to Erekia Naikare escarpment and Mt Longonot. Soil and water conservation are poorly practiced. Livestock rearing is widespread comprising of cattle, sheep, goats and donkeys. The area is heavily overgrazed and bare ground patches and invasive species are widespread. Sand harvesting in the gullies and sand trucks movements loosen the soil enhancing subsequent erosion, gully banks collapse and widening. Widespread charcoal burning, overgrazing and sand harvesting has contributed to severe land degradation and soil erosion generating the silt deposited on the road.

Infrastructure

Geothermal power production in Olkaria Hill and outlying areas have created a large network of roads to drilling sites and well pads alongside the tourism circuit in Hell's gate and Mt Longonot National Parks. Runoff from the network and other structures flow into Njorowa Gorge and other lagas. This causes the massive flooding and siltation at the SGR crossing point at +35Km. The KETRACO Suswa station dykes impede the flow of this water leading to back ponding, flooding and silt deposition.

The current Suswa-Mai Mahiu road adversely impacts itself, its immediate environs and the downstream landscape. Drainage structures spout water and initiate gully formation in several places. The road forms a dam wall that causes siltation and overtopping and its orientation induces parallel flow that incises gullies, scour and undermine its foundation.

The Mai Mahiu-Naivasha Road storm water impacts the project road as its drainage systems channel water from the Kijabe escarpment and cause flooding at +4-+5Km from Mai Mahiu. Rural access roads networks in the road hinterland transform into gully forming water channels during rains and contribute to siltation and flooding along the road. Mai Mahiu, Suswa and Olasiti towns along the road have no sewerage structures or dumpsites.

Public consultation meetings, key informant interview and household survey

Public consultation meetings were held at Keekonyokie Location, Olasiti, Mai-Mahiu and Suswa townships and different population categories of gender, age and occupation were represented. The process created project awareness, enabled community participation and obtained feedback on issues of concerns.

Demographics

The road traverses part of Naivasha Sub-County in Nakuru County with a population of 295,000 people and Narok East sub-county with 43,000 people. Demographic analysis revealed growing populations requiring infrastructure expansion and establishment. Most of the respondents (75%) in the household survey were male from households with an average of 5 members. About 48% of the sampled population had primary and secondary school levels of education while 22.3% had no schooling. Most of the sampled population were farmers and livestock keepers with a small proportion of traders.

Land tenure and Land use

Most of the people are land owners with free hold titles and only a few are of lease holders or tenants. Livestock keeping and crop production are the main land use types, with maize and beans grown by the majority while livestock comprise of cattle, sheep and goats. Urban areas land was under residential, commercial buildings and temporary commercial structures.

Community utilities

In the households water was obtained from dug wells, piped water systems and vendors. Dug wells predominate in Narok East while in Naivasha water vendors supply the largest proportion of respondents while some had piped water. Pit latrines are the prevalent human waste repositories in most households in the road passage area. Firewood and charcoal are the main cooking fuels sourced between Satellite and Olasiti trading centres and only a small proportion use LPG. The community members associated cooking fuel with deforestation resulting in flooding, gulley erosion, and blockage of the road. Solar energy, electricity and paraffin are the main sources of lighting fuel. Most of the respondents frequently use the road for transport through various means.

Disease incidence

The commonly reported diseases included malaria, typhoid, common cold and HIV/AIDS. Narok East had the biggest disease burden with nearly 100% reporting predominance of malaria and typhoid. A majority of respondents noted HIV/AIDS to be of concern.

Current situation and post project road challenges

The road in its current state presented challenges to community users due to narrowness, flooding, accidents, absence of road signs, potholes, and road congestion and over speeding.

Environmental and social impact assessment

i) Positive impacts

Biophysical

The reconstruction of the road and its proposed management structures by stakeholders will have beneficial impacts on the biophysical environment that include:

- Enhanced catchment conservation through a community/multiagency management structure
- Reduced land degradation, soil erosion and silt deposition
- Increased water storage in catchment areas by coffer dams construction
- Better wildlife conservation natural habitat recovery

Socio-economic

- Improved and efficient transportation
- Increased economic opportunities , gender parity and social well being

ii) Negative impacts

Physical environment impacts

- Soil erosion and aesthetics disruption by excavations in borrow pits
- Noise and vibrations and reduced air quality through dust and pollutants
- Solid and liquid wastes pollution
- Fault lines erosion and fissures puncturing
- Proliferation of built up areas as infrastructure is established

Biological

- Vegetation removal during construction and demand for wood fuel and charcoal
- Conversion of productive land into industries and urban areas expansion
- Increased wildlife loss through road kills, poaching and migratory corridors loss

Socio-economic

Demography and Social Characteristics

- Changes in behavior and social norms
- Intrusion of incompatible cultural practices by job and opportunity seekers
- Poor labour relationship between project implementers and community
- Road construction accidents risks, livelihood and traffic diversion disruptions

Utilities and Health facility

- Competition between construction workers and communities for limited facilities
- Probability of increased sexually transmitted diseases including HIV/AIDS

Security and Public Safety

- Increased accident affecting people and livestock
- Increased livestock and property theft

Negative Impacts Mitigations

Physiographic and Geology

- Rehabilitation of borrow pits in accordance with ESMP after operations

- Landscaping and re-vegetating the road to reduce visual distortion
- Use of existing operational material borrow areas
- Use new technologies to span subsidence areas and divert runoff water

Soils

- Reduce dam wall effect of road and install adequate drainage structures
- Reduce water flow velocities upstream of the road described in the ESMP
- Enforce adherence to ESMP for upstream projects and activities

Climate

- Ensure that vehicles and machinery have low climate change foot prints
- Adopt strategies that reduce impacts of extreme weather on road structures

Air quality

- Adoption air pollution reduction and prevention measures
- Avoid dust generation and use of dust traps in residential areas near road works

Surface and Groundwater Resources

- Use adequate and numerous drainage structures that simulate natural water flow
- Implement the catchment management strategy detailed in the ESIA study

Terrestrial/ Aquatic Environment: Flora and Fauna

- Minimize vegetation removal
- Provision of wildlife corridors and crossing points
- Prominent placement of signage warning motorists on wildlife crossing

Land resources

- Locate all diversions within existing road reserve
- Preserve top soil for borrow areas rehabilitation and landscaping
- Use existing campsites and/or ensure they are fully rehabilitated

Archaeological, Historical and Cultural Sites

- Preserve sites where found and report to the National Museums of Kenya

Noise and Vibrations

- Use of vehicles fitted with mufflers to reduce noise
- Undertake blasting operations during daytime and away from residential areas
- Vehicles using the road are well serviced and adhere to NTSA regulations
- Use engineering technologies that absorb and dampen vibrations from vehicles

Solid and Liquid Wastes

- Dispose solids wastes through sanitary landfills
- Incineration in designed and licensed furnaces
- Composting of organic components, recycling and reusing components with residual economic value in road and other construction works
- Ensure efficient management of material supply chain

Socio-economic

- Awareness campaigns targeting all project stakeholders
- Community involvement in local labour sourcing and location of camp sites
- Community safety and risk reduction campaigns through appropriate methods

- Collaborate with security agencies on traffic management to enhance security
- Undertake social corporate responsibilities for community buy-in
- Install traffic calming measures near settlements

Alternatives considered

The no project alternative and project alternatives were considered and the former is unviable under the prevailing circumstances. To avoid flooding, the road will be elevated above the current level by 1.5m in flood zones and with numerous wide drainage structures to enable mass water passage. The enlarged drainage structures will provide passages for people, livestock and wildlife movements, reducing accidents and road kills. In areas with fault lines, fissures, pyroducts and lagas where cutting, subsidence and flooding occur, two engineering options using combinations of anchored reinforced concrete slabs and bridges are to be used.

Outcomes of community consultations

The community favors the road project implementation to ease transport, create new economic opportunities and spur development in the area and their concerns addressed. Rehabilitation of Karima primary school structures, water supply systems, the Mai Mahiu-Lari feeder road and a health facility establishment at Olasiti were cited as possible corporate social responsibility undertakings.

Monitoring plan

The formulated monitoring plan will ensure environmental and social mitigation measures contained in the Environmental and Social Management Plan (ESMP) are implemented. The ESMP and detailed specific plans will constitute part of contractor's guidelines and be embedded in the contract. Monitoring checklists will be prepared to ensure that set standards, targets, indicators and milestones are met.

Conclusions and recommendations

The ESIA study concludes that the road project is viable and all adverse environmental and social impacts can be satisfactorily mitigated. The adopted engineering design and proposed catchment area management plan can resolve recurring problems along the road. It is concluded that the road project is economically viable as it links to the Naivasha Inland Container Depot and the industrial park and is environmentally sustainable.

The road should be constructed and the proponent (KeNHA) and contractor to fully implement the ESMP recommendations in adherence to all legal and policy requirements.

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CHAPTER 1 INTRODUCTION

1.1 DEVELOPER IDENTIFICATION

The developer is KeNHA, the state corporation in charge of roads under the under the Ministry of Transport, Infrastructure, Housing and Urban Development located at at the following address who contracted Moti Consultants Limited to undertake the study.

DIRECTOR GENERAL	DIRECTOR HIGHWAY PLANNING AND DESIGN	MOTI CONSULTANTS LTD
DIRECTOR GENERAL KENYA NATIONAL HIGHWAYS AUTHORITY (KeNHA) P.O. BOX 49712 – 00100 NAIROBI BARABARA PLAZA, JKIA Tel: +254 (20) 8013842 dg@kenha.co.ke	KENYA NATIONAL HIGHWAYS AUTHORITY P.O. BOX 49712 – 00100 **NAIROBI** Barabara Plaza, JKIA	UPPER HILL KMA CENTRE APARTMENTS MARA & CHYULU ROADS JUNCTION BLOCK C - 2ND FLOOR SUITE 2.2 P.O BOX 27347 – 00100, NAIROBI Tel: 0792-651922/0737-426402

1.2 BRIEF REGIONAL DESCRIPTION

The Suswa-Mai Mahiu road section constitutes part of the B7 road located in Nakuru and Narok Counties and is approximately 41 Km long. It starts at the Mai Mahiu Centre junction with the Nairobi Naivasha road and is part of the Nairobi-Narok Road. The road section treads in a westerly direction and ends in Olasiti Centre environs at the bottom of the Enkare Nairegia Escarpment. Mai Mahiu; Suswa, and Olasiti shopping centers are located along the road. Road intersections along this section are the A8 South road junction to Naivasha and Rironi and with the B50 road junction to Ngong' Town. The project road location is shown in the Figure 1 below and defined as lying between Mai-Mahiu Centre and Syabei SGR Bridge at GPS locations S 00^{o} 18'000; E 35^{o} 46;000'' and S 01^{o} 06'292'' and E 036^{o} 12'812'' , respectively.

The Suswa-Mai Mahiu road section of B7 is part of a critical road enabling transportation of goods, people and tourists to the world famous Maasai Mara National Reserve. The road besides the local connectivity is part of the network that links Nairobi to the southwestern part of Kenya though Narok, Bomet, Kisii, Kisumu and Kericho. It also connects to the western region through the Mai-Mahiu- Naivasha section to Nakuru, Ksumu, Eldoret and to the Uganda border through Busia and Malava. Through the Mai-Mahiu to Nairobi junction, the road connects to the rest of the country through NAIROBI, the capital city of Kenya.

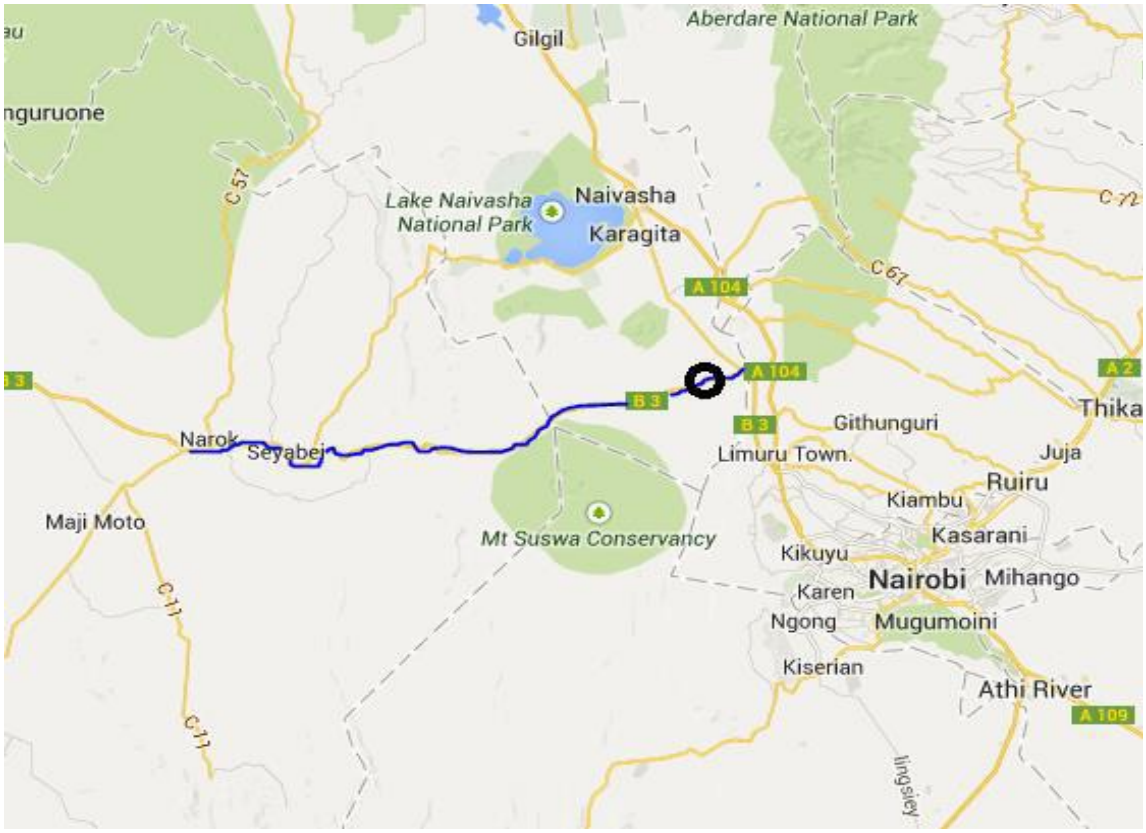

Figure 1: General regional location of the Suswa-Mai Mahiu Road

1.3 PROJECT BACKGROUND, OVERVIEW, JUSTIFICATION AND OBJECTIVES

1.3.1 Project Background

The road section between Suswa and Mai-Mahiu has had several closure incidences in the last 10 years arising from siltation, flooding and subsidence at areas where flood plains and fault lines are located. The closures are economically expensive and cause travel delays and inconveniences as traffic is rerouted to other roads. The stranding affects heavy commercial vehicles, tourists, local travelers and area residents disrupting trade, travel schedules and access to facilities. The redesign and reconstruction project is intended to ensure unhindered traffic movements along the road.

1.3.2 Overview of the Project

Project is the redesign and reconstruction of the B7 road section. Undertaking the project required provision of consultancy services for geological study, feasibility study, environmental and social study, preliminary and detailed engineering design of Suswa-Mai Mahiu (B7) Road section before commencement of construction activities. The project is to be achieved in the following two stages:

Stage 1 – Preliminary Design Study

The study is envisioned to include the following:

a) Review of the existing data on the proposed road project and social and economic activities in the project study area and producing an economic feasibility study report;
b) Collection of social, environmental, and physical data that is necessary to assist in the design of the project road;
c) Geological studies to inform on the best possible road alignment devoid of fault lines and other tectonic plate movements.
d) Preliminary materials investigations for pavement design using design standards including preliminary costs estimates and implementation schedule;
e) Preliminary engineering survey and design work for the optimum alignment and design standards including preliminary costs estimates and implementation schedule;
f) Carrying out an environmental and social impact assessment study of the project area in relation to the proposed project.

Stage 2 – Detailed Engineering Design

After comments and approval of the preliminary design by the Director (Highway Planning and Design), the Consultant has to carry out a detailed engineering survey and design including engineering cost estimates, materials investigations and tender documents for the selected alignment and design standards for the road and any town/market roads.

The Consultant, Moti Consultants Ltd, assigned different aspects of the study to different specialist teams to undertake. Where complimentary information was collected, it was shared between the teams attain the objectives of the project.

1.4 Project Purpose and Objectives

The project aims at ensuring uninterrupted passage through the B7 section between Suswa and Mai Mahiu. The study has to ensure that all factors that lead to the road closure are investigated in detail, remedial measures identified and included in the design to ensure unhindered passage through this section of B7 road.

1.4.1 Project Justification/Rationale

The purpose of the road project is to eliminate road closures and ensure continued connectivity to Narok, Bomet, Kisii, Nyamira, Kisumu Counties and the Northern parts of Tanzania to the rest of the Country as the road is a critical link between these areas.

Kenya's Development Agenda is anchored in the Kenya Vision 2030 that aims at creating "a globally competitive and prosperous country with a high quality of life by 2030". It intends to transform Kenya into "a newly–industrialized, middle-income country providing high quality of life to all its citizens in a clean and secure environment". The Vision also aspires to meet the Millennium Development Goals (MDGs) in Kenya.

The Vision is anchored on three key pillars that are economic, social, and political. The economic pillar aims to achieve an average economic growth rate of 10 per cent per annum by 2012 and sustain the same till 2030 to generate more resources to attain the MDGs and Vision 2030 goals. The social pillar seeks just, cohesive, and equitable social development in a clean and secure environment. The political pillar aims for a democratic, issue-based, people-centered, result-oriented, and accountable system. This development project falls under the first pillar of fostering economic growth while facilitating attainment of the others. It also encompasses a clean and secure environment through the conduct an ESIA study and adherence to the provisions of the ESMPs.

The Kenya National Highways Authority (KeNHA) is a State Corporation established under the Kenya Roads Act, 2007, under the Ministry of Transport, Infrastructure, Housing and Urban Development is the road project proponent. KeNHA is charged with the responsibility for management, development, rehabilitation, and maintenance of Class A, B and C national roads.

1.5 PURPOSE OF ESIA

The ESIA constitutes an assessment of potential impacts on the environment prior to the approval of investment proposals and provides a means of harmonizing and integrating the three pillars of sustainable development in Kenya. The ESIA is the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made (Wood 2003, IAIA 1999). It has become one of the preconditions for permitting investment projects prior to implementation.

The Kenya Government policy on all new projects requires that an Environmental and Social Impact Assessment (ESIA) study be carried out at the project-planning phase. This is to ensure that significant impacts on the environment are taken into consideration at the construction and operations stages. KeNHA has contracted Moti Consultants Limited to undertake the ESIA in compliance with Environmental Management and Conservation Act (EMCA, 1999) and the environmental and social obligations that ensue. The ESIA is in compliance with the EMCA regulations.

Table 1: Roles and responsibilities of ESIA team for the Suswa-Mai Mahiu road

Name	Role	Qualifications	Experience (years)
John Githaiga	Team leader, Vegetation and environmental profiling	Lead expert	Over 10 years
Robert Chira	Wildlife, livestock and key stakeholder interviews	Lead expert	Over 10 years
Kiemo Karatu	Socio-economic aspects		Over 10 years
Jane Wangare Mbuthia	Social aspects		Over 5 years

1.5.1 Objectives of ESIA

The overarching objective of the Environmental and Social Impact assessment study was to ensure that all environmental aspects of concerns were collected, collated and integrated into the design and implementation the Suswa-Mai Mahiu road project for its sustainability and contribution to Kenya's development.

The ESIA specific objectives were to:

- Identify potential impacts to the biophysical and human environment, both direct and indirect
- Align project activities with the National Social Protection Framework (policy, legal, regulatory and institutional) and best international practices
- Obtain public and stakeholder views and concerns with regard to the proposed road project through consultations
- Create project awareness and opportunity for participation to the stakeholders
- Determine the significance levels of the identified impacts and discuss the possible alternatives to the project;
- Generate baseline information for monitoring and evaluation of the effectiveness of mitigation measures implemented during the project cycle;
- Recommend preventive, and mitigate measures for the significant negative impacts of the project on human and biophysical environment;
- Develop an environmental and Socio-economic and Cultural Management and Monitoring Plan (ESMMP) for the proposed project;
- Prepare an ESIA report for the client through the project engineer

1.5.2 Terms of Reference

The scope of the work was to conduct detailed analyses of the positive and negative effects of the road project development on the environment and prepare an ESIA report recommending appropriate solutions to minimize any undesirable effects resulting from its implementation. Specifically this was to:

a) Determine the role of the project in the development plans at National and Regional levels;
b) Provide a description of the project baseline environment;
c) Ensure preservation of areas and land use of agricultural land, natural conservation areas, forests, natural resources, cultural and historic sites among others;
d) Asses the direct impacts on agriculture and forestry, particularly the utilization of fuel wood and water;

e) Asses disturbance of vegetation and plans for re-vegetation;
f) Ensure prevention of soil erosion and sedimentation;
g) Assist in prevention of health hazards arising from water ponding and pollution of watercourses and/or sources;
h) Prescribe measures for the rehabilitation of construction materials, borrow pits and quarries;
i) Advice on health and sanitation for the road construction labour units;
j) Asses the impacts on demographic factors including the prevention of undesirable roadside developments and recommend regulations and measures to limit negative impacts on adjacent communities and areas;
k) Identify potential environmental impacts that could result from the project;
l) Address issues of occupational Safety and Health concerns;
m) Conduct public participation and consultations on the positive and negative impacts of the project;
n) Propose Mitigation Measures to the identified environmental and social impacts
o) Develop an Environmental Management and Monitoring Plan (EMMP).

1.5.3 Conduct of the ESIA

a) ESIA General Approach

In accordance with the project ToRs the impacts of the proposed road project were identified and appropriate mitigation measures were developed to address adverse impacts that may arise. The design of the Environmental and Social Impact Assessment (ESIA) was intended to understand the relationship between the road project and its natural environment and social contexts. Linkages were established between principal environmental and socio-economic parameters which were correlated and interposed for linkages with the entire project implementation cycle and processes of design, tendering, construction, commissioning, operations and maintenance, and eventual decommissioning. In the ESIA study, information was collected on the road passage area baseline conditions (environmental and socio-economic), which was documented, analyzed, and evaluated for use during the project cycle.

The ESIA baseline for the Suswa-Mai Mahiu road project was premised on evident manifestations that the road:

- Has been affected by extraneous impacts and processes emanating from the catchments of the many gullies and seasonal waterways that cross it,
- Due to its location and its structures has negative effects on itself,
- Induces and precipitates adverse impacts on downstream landscapes, livelihoods and infrastructure

These conditions are incremental to those that will arise from its construction, operation and eventual decommissioning.

The identification of the anticipated impacts was based on preliminary assessment of existing baseline biophysical conditions, desktop review, community and key informants' informal consultations, and the proposed designs and works. The components and aspects for ESIA elaborated in Chapter 3 were subjected to screening against the nature of anticipated impacts, impact recipients or targets, and the magnitude and significance of the impacts. The process briefly documented below was used to identify obligatory ESIA tasks for the biophysical, socio-economic and cultural environments and aspects.

b) Bio-physical Environment

The biophysical studies were conducted to document the state of the ESIA study area and identify processes and factors that have resulted in conditions being experienced in the road section. The spatial distribution of the EIA study sites enabled derivation of the causes of ecological stress and helped in development of mitigation measures and the design of intervention strategies. The biological and physical environments studies documented the state of the vegetation cover, wildlife and livestock numbers and distribution, soils, drainage systems, natural resources and their superimposition with socio-economic activities and land use patterns. These aspects are interlinked and it was on their basis that probable drivers of adverse environmental impacts of the project were assessed, identified and evaluated.

The study was conducted as follows:

- Review of previous reports, published and unpublished works on the study area to identify hotspots and areas of special interest
- Field collection of baseline data using standard scientific and qualitative methodologies in the project area
- Qualitative and quantitative assessment of the current state of the environment
- Identification, prediction and evaluation of positive and negative environmental impacts
- Formulation of mitigation measures and interventions for adverse environmental impacts and drivers

Information collected contributed to the development of the environmental management and monitoring plans and the proposed prevention and mitigation measures during the project cycle and its processes. The monitoring plan contains relevant and quantitative and qualitative indicators and with achievable targets, timelines and designated responsible agencies.

c) Socio-Economic Environment

The Socio-economic Impact Assessment Study was conducted through an integrated participatory approach that also involved literature review. The study assessed the prevailing socio-economic, cultural and health situation under the prevailing road conditions and the impacts of the road's redesign and construction. The socio-economic impacts assessment focused on evaluation of the impacts of the road project on community social and economic health, opportunities creation and prevention of adverse outcomes on social, gender, health and

cultural attributes of the communities. To achieve this, the anticipated impacts were derived from the current social and economic baseline conditions, community consultations, key informant interviews and documents reviewed.
The social economic study and assessment focused on:

- Social and cultural issues, demographic aspects, land use and urbanization trends, modes of transport, education, labor force, poverty, income levels and streams, and compensation and resettlement issues where they may arise
- Health aspects and social well being indicators such as health access, safety, gender issues, poverty prevalence and HIV/AIDS
- Economic activities, resources control and ownership
- Administrative and institutional arrangements including state, and community governance structures

The steps undertaken to determine the socio-economic impacts of the road project included:

- Comparative method;
- Population multiplier methods,
- Scenarios;
- Experts Consultation;

A multi-disciplinary approach was adopted in this assessment to address holistically all pertinent impacts of the project (both avoidable and potential) on the biophysical, cultural and socio-economic setting of the area. The methods used in the SIA assessment are discussed Chapter 3.

d) Development of Social Management Plan

After project impacts identification, appropriate mitigation measures were designed. A social, cultural, economic and environmental management plan to guide the project implementation was developed. Mitigation measures, integration strategies, monitoring processes, indicators, processes and responsibilities are included in ESMP to guide the project implementation in all its phases.

e) Screening and Scoping

Screening was accomplished by reference to mandatory and discretionary provisions set out in the Environmental Management and Co-ordination Act (EMCA) No. 8 of 1999.
EMCA has made it mandatory for project proponents to carry out an Environmental Impact Assessment **(**EIA) of development projects and incorporate environmental and social mitigation actions as part of the project planning for projects likely to impact positively and negatively on

the environment. Section 58 of the EMCA requires that all projects listed under the Second Schedule be subjected to Environmental Impact Assessment (EIA).

f) Reporting

Reporting involved compilation of the field findings, documentary information and data, results from discussions and public consultations as well as harmonizing the monitoring and socio-environmental management plans. The reporting followed the following steps:

Step 1: Contribution to the Inception Report as part of the feasibility studies and design process;

Step 2: Preparation of a Project Report endorsed by the Client (KeNHA) and submitted to National Environment Management Authority (NEMA) for review and instruction to move to the next phase (preparation of Terms of Reference for a detailed ESIA study);

Step 3: Preparation of Terms of Reference for the detailed ESIA study and submission to NEMA for review and approval;

Step 4: Preparation of a detailed ESIA Study Report for review and approval by KeNHA and submission to NEMA and other relevant authorities

1.7 STRUCTURE OF REPORT-

The report has the following structure:

1) Executive Summary
2) Introduction
3) Project description and justification
4) Policy, legal and administrative framework
5) Environmental and social impact assessment methodology
6) Baseline environmental and social parameters
7) Analysis of project alternatives
8) Environmental and social impact assessment
9) Environmental, social management and monitoring plans
10) Conclusions and recommendations
11) References
12) Appendices

CHAPTER 2 PROJECT DESCRIPTION

2.1 INTRODUCTION

The Government of the Republic of Kenya (GoK) has earmarked funds through the Development Vote for use in engaging the services of a Consultancy Firm to undertake preliminary and detailed engineering design of Suswa - Mai Mahiu (B7) Road Section. The Government of Kenya, through its implementing agency, the Kenya National Highways Authority (KeNHA) shall require the Consultant to render all technical support services relevant to this exercise. The detailed descriptions of the consulting services to be performed were as described in the Terms of Reference (ToR). The study was scheduled to span 12 calendar months from January 2019 to July 2020. The design study includes all access roads to Government institutions, schools, colleges, District headquarters and other Government offices.

2.2 PROJECT LOCATION

The road section traverses the Counties of Narok and Nakuru. It measures approximately 41 kilometers and starts at Mai Mahiu and proceeds in a South Westerly direction ending in the Olasiti center.

The project road section is approximately 41 Km long and is part of the Narok-Nairobi road starting at the Mai Mahiu junction along the Nairobi - Naivasha Highway. The road passes through Mai Mahiu town with commercial and residential buildings (Photograph 1 and 2). The businesses in the town supported in part by the heavy commercial transit traffic. The road passes through small scale mixed agriculture land use system with maize as the main crop grown. The road then traverses an area with a mix of grazing fields and small scale farms (Photograph 3&4). The road passes through flat to gently undulating terrain and crosses several seasonal water courses and lagas posing risks to communities' wellbeing and livelihoods (Photograph 5a&b). The area is prone to flooding as evidenced by silt deposits and flood plains, road overtopping portions and gullies along the road passage. There were several places where flood water and silt had overtopped the road. A number of fault lines where the road had been previously cut were noted.

There were a number of junctions to institutions and other rural areas in the hinterland. Past the Karima KAG church, the land use is predominantly pastoralism with evidence of overgrazing and consequent land degrading and soil erosion. The road then passes through the Kendong and Akira Ranches, where flood plains were evident. An active sand harvesting enterprise is flourishing in the area potentially affecting water flows in channels that enhance erosion and gully formation.

After Suswa Township, the western Suswa Mountain has gullies running downhill that cross the road. The township has a well developed business infrastructure and a junction to the Suswa SGR station.

Photograph 1&2: Road start point and some of the structures likely to be affected in Mai Mahiu Town

Photograph 3&4: Small scale agriculture and livestock keeping along the road

Photograoh 5 a&b: Interface of degradation process risks and community wellbeing

The vegetation in the area is dominated by Acacia wooded grasslands and in pristine condition where undisturbed. Land use after Suswa town is predominantly agro-pastoral with fenced off grazing areas and small scale farming. Curio shops catering for the Masai Mara Tourism circuit are located along the road. The road section passes through Olasiti town, and ends near the second SGR Bridge at the bottom of the Enkare Nairegia escarpment.

2.3 OVERVIEW OF ROAD CONSTRUCTION

The ESIA constitutes part of the consultancy services contracted to Moti Consultants Ltd by KeNHA for Suswa-Mai Mahiu section road project. As part of the overall consultancy, the ESIA is also informed by the other concomitant studies and activities contributing to the achievement of the assignment. The ESIA took into consideration the following contemporaneous aspects of the project.

a) Materials Investigations and Pavement Design

The Consultant undertook the following in order to meet the requirements of the Terms of Reference for this aspect:

- Review of all documents and data available regarding the Project Road including original construction details, subsequent periodic maintenance/strengthening contracts and reviewed all available documents on soils/materials within the vicinity of the project road.
- Carried out soils and materials investigation through trial pitting and trenching, materials sampling, testing and analysis of the existing pavement, shoulders, alignment and materials sites as necessary to establish the following:
    - Existing pavement construction details, alignment logging, status of the existing pavement and/layers, nature and kind of alignment
    - Modes of failure
    - Material sites locations, nature and properties of the identified materials
    - Estimated available quantity of materials identified for potential use
    - Conducted detailed visual condition surveys of the existing project road
    - Carried out pavement strength analysis using Falling Weight Deflectometer (FWD) to establish the extent of:-
        - Pavement rehabilitation works if any.
        - Homogenous section for strengthening
- Carried out pavement design.

b) Traffic surveys

In view of the activities outlined above, the Consultant carried out traffic studies at strategic locations along the project road using the guidelines of the TRL Overseas Road Note 40. The aim was to establish the characteristics of traffic along different sections of the project road in terms of passenger and freight volumes, and composition of vehicular traffic. The project road was classified as being heavily trafficked with a range of between 50 and 400 vehicles per hour.

c) Geology

A geological mapping of the road corridor has been undertaken using ERT and MASW Seismic methods to detect fault lines and other subsurface structures such as fissures and pyroducts. These structures were found along the road passage and will have specific construction options that will be adopted at the detailed engineering stage.

d) Hydrology

The catchment hydrology has been documented and sources of flood water and silt estimated. Aquaveo® Watershed Modeling System was used to compute sub-basin parameters (area, lag-time and average curve number). The catchments contributing to the hot spot flooding areas on the project were identified on the ground and mapped for purposes of both vertical alignment and structures design. Multiple cell box culverts of 3x5x1.5-3m to cater for sheet flows will be designed with an approximate 200 structures of various sizes to handle the sheet flow, siltation and spread the water to prevent damming and erosion impacts of the road.

e) **Material survey**

The construction materials for the road will comprise of sand, gravel, hard stones (aggregates), reinforcement iron bars, water and bitumen. These materials shall be obtained locally and there are operational source areas within reach of the road project and along the road passage. Bitumen is imported into the country as there is no local production. Material investigations have identified suitable sites and sources for the construction materials.

Centre line survey, borrows pits survey were conducted as contained in the Preliminary Engineering Design Report. Construction sand is not available within the project area. Quarry sand from prospective quarries are proposed for the construction on this project. Suitability tests indicate compliance with the requirements of fine aggregates for construction purposes. There are two (2) existing and operational quarries along road project area. These are situated at Mai Mahiu, off Km 3+000 LHS and Suswa off Km 32+500 LHS.

Construction water will be sourced outside the alignment as there are no rivers crossing the project road. Possible sources will be explored during detailed design stage.

f) Construction Activities of Suswa-Mai Mahiu and Access Roads

The major works to be executed under the Contract comprises mainly of, but not limited to, the following:

Main road

i) Preliminary and General Items
ii) Decommissioning of the existing road and Site clearance
iii) Earthworks to formation levels using approved gravel from material sites and rock filling of sections along the alignment affected by sinkholes.

iv) Provision and processing of 300 mm fill from approved gravel sites of class S4 and compact as improved sub grade as per the cross section drawings or as instructed by the Engineer to be compacted to 100% MDD (T99)

v) Installation of concrete slab below sub grade layer as and where instructed by the Engineer

vi) Provision and processing of 225mm thick cement improved GCS as Sub base compacted to 95% MDD [T180] including shoulders.

vii) Provision, spreading and compaction of 150 mm Dense Bitumen Macadam (DBM) layer as Base layer including shoulders.

viii) Provision, spreading and compaction of 50 mm Asphalt Concrete Type 1 wearing course for carriageway.

ix) Two seal Surface dressing to shoulders with 6/10 and 14/20 chippings.

x) Construction of box culverts, pipe culverts and other drainage works.

xi) Construction of protection works including stone pitching/ lining of drains, scour protection and gabions as necessary.

xii) Provision and installation of road furniture including street lighting

xiii) Landscaping including top soiling and grassing.

xiv) Maintenance of passage of traffic through and around the works.

xv) Any other auxiliary works as may be instructed by the Engineer.

xvi) Maintenance of works during construction and during the defects liability period, which shall be 24 months

Access roads

xvii) Provision and processing of 150 mm of milled existing Base and Sub base class S6 and compact as improved sub grade as per the cross section drawings or as instructed by the Engineer to be compacted to 100% MDD (T99)

xviii) Installation of Geogrid below sub grade layer as and where instructed by the Engineer

xix) Provision and processing of 125 mm thick cement improved GCS as Sub base compacted to 95% MDD [T180] including shoulders.

xx) Provision, spreading and compaction of 150 mm Dense Bitumen Macadam (DBM) layer as Base layer including shoulders.

xxi) Provision, spreading and compaction of 50 mm Asphalt Concrete Type 1 wearing course for carriageway.

xxii) Two seal Surface dressing to shoulders with 6/10 and 14/20 chippings.

xxiii) Sourcing of sand and gravel from borrow pits

xxiv) Water sourcing

The proposed road cross section is as presented in Figure 2 with slopes that would easily allow passage of livestock and wildlife.

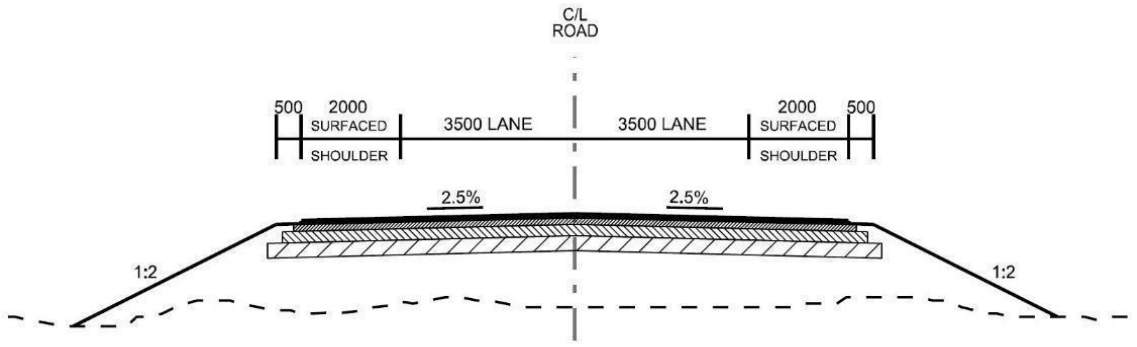

Figure 2: Road cross section and elevation

g) Ancillary facilities

i) Road signs and markings

Conventional road signs and markings complying with the Kenya Road Signs manual have been provided. Road signs will be erected in accordance with the KeNHA design guidelines and best international practice. Road markings will also be in accordance with National Standards. It is also envisaged that protective (raised) road markings may be implemented as a safety measure at the following locations:

- In the median- to alert motorists that they may be crossing over into the opposite lane;
- On the shoulder-to alert motorists that they may be on the verge of leaving the roadway.

Both situations are more likely to occur on the relatively long straights that have been necessary to stay within the defined corridor. The above measure has proven effective internationally and elsewhere in African countries and may therefore be a worthwhile safety measure to implement. Rumble strips suitable for the 120Km/h Design Speed will be placed in advance of proposed intersections and accesses, to alert drivers to the presence of these potentially hazardous locations.

ii) Foot paths

The design of the road includes construction of footpaths at all the highly settled trading centers on either side of the road. These will be at Mai Mahiu, Suswa and Olasiti,

iii) Pedestrian bridge requirements

Pedestrian footbridges are recommended at Mai Mahiu where the traffic volumes exceed 750veh/hr and the factor PV^2 exceeds 10^8. At the other trading centers and near all key institutions with high volumes of non-motorized traffic, the design shall instead make provisions for traffic calming features such as speed humps and rumble strips.

Provision of footbridges at Mai Mahiu shall also assist in further improving the pedestrian safety given the fact that the highest number of accidents were recorded in that centre according to accident records

iv) Trucks lay bys and bus bays

The road traverses an area with ongoing economic activities and will stimulate further economic development with the proposed ICD, Industrial Park and construction of other major roads. Changes in land use are anticipated and incursion of other economic activities. Existing town centers and other small shopping centers will require creation of trucks and bus stops. More bus stops will be created where rural access road are likely to bring pedestrian traffic to the road. The exact locations will be indicated n the detailed engineering plan.

Heavy trucks traffic will increase due to the Industrial Park and the ICD and parking bays will have to be created to cater for these along the road and shopping centers.

Interexchange

To ensure smooth and safe traffic flow near the ICD and Industrial park, an interchange is to be constructed on pieces land to be purchased on either side of the road by the proponent. It will also have pedestrian walkways to enable human traffic safely cross the road. The piece of land to be acquired will be adequate for construction of rest areas and a public park for truck drivers and other visitors awaiting clearance and cargo from the ICD.

v) Public toilets

Provision of public toilet facilities is a requirement in road construction by KeNHA. The facility will be constructed at the ICD exchange at +15Km on pieces of land to acquire for the interchange for travelers from Narok to Mai Mahiu. A second such facility will be constructed before the turnoff into the ICD at +14.8Km that will cater for travelers from Nairobi to Narok. It is recommend that small scale business people be allowed to operate facilities to offer refreshment to travelers adjacent these facilities.

vi) Landscaping and grassing

The road where cutting will be made and steep surfaces created will be grassed back using suitable perennial vegetation to prevent erosion and restore aesthetics.

vii) Safety Barriers

Safety barriers will be installed on fills where the height exceeds 3.6m and at the major structures along the project route. These will be in the form of standard W-Beam guardrails. A schedule of barrier locations has also been prepared

h) Road safety provisioning

i) Animal crossing

The area has substantial populations of livestock and remnant pockets of wildlife that frequently will cross the road. Animal crossing will need to be created and designated for livestock and signage installed for wildlife crossings.

ii) Pedestrian crossings

These will be installed in areas with schools, health facilities and utilities such as churches along the road.

iii) Service roads

Service roads are present along the either side of the road at Mai Mahiu and these may be need o be upgraded. New service roads will need to be created in Suswa and Olasiti to enhance road safety in view of increased traffic volumes with commissioning of the road.

iv) Street Lighting

There are three substantial centers traversed by the road and three minor ones at Mafuta Taa, Satellite, Karima and near the Kedong Police post. Appropriate street lighting will be erected but can comprise:

- Double arm lighting arrangement along proposed separator at service road and truck lay by locations.
- Single arm lighting arrangement at bus bays and wayside amenity locations.
- High Mast lighting at potentially hazardous locations like junctions, shopping centres and interchange

j) Anticipated Impacts of road construction activities

The road construction activities and operations are going to generate impacts on the environment and the social context as they involve physical works using equipment and operated personnel who may not be residents. The impacts will include but not be limited to:

- Sensitive areas: erosion (in the catchment area), flood prone areas (downstream)
- Vegetation removal and regrassing
- Wildlife distribution and migration
- Land use (distribution and intensity of use)
- Water supply, water quality and wastewater production
- Micro-climate effects
- Air quality and dust pollution
- Solid waste management
- Noise pollution and vibrations
- Natural environment through road topography impacts on local drainage at various sites
- Population and related socio-economic parameters: demography, population and family structures, labour force, economic activities, income, land ownership, health
- Potential release of hazardous materials during removal and transportation of contaminated materials
- Administrative and institutional arrangements

CHAPTER 3: ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT METHODOLOGY

3.1 APPROACH TAKEN IN THE ESIA

After award of the contract and consultations with the Proponent, the consultant visited the road to familiarize with issues that have ESIA considerations. The ESIA was conducted in three phases to identify issues that required ESIA considerations, collection of baseline conditions information and data analysis to inform the ESIA and derivation of impacts that may emanate from the road project implementation. The phases comprised of:

Phase 1: Preliminary survey

A preliminary survey was conducted in the road project area to determine the scaling, geographical and other boundaries for the ESIA in August 2018. The road traverse was analyzed with respect to aspects that would need or require ESIA considerations in view of the proposed redesign of the road and traffic management. The environmental and social settings observed near the road encompassed the following:

a) Sensitive habitats and environmental settings

- Seasonal rivers and streams
- Riverine vegetation
- Wildlife habitats
- Ephemeral wetlands
- Rocky and steep terrain
- Transient water bodies

b) Socio-economic settings

- Inland container depot and industrial park developments
- Junctions to Mai-Mahiu and Suswa railway stations
- Small scale agricultural areas
- Agro-pastoral areas
- Large scale ranch
- Shopping centers
- Commercial buildings, apartment blocks and homesteads
- Education institutions, primary schools, secondary schools
- Market Centers
- Churches
- Feeder roads junctions

c) ESIA considerations

From the preliminary survey it emerged that several factors revolving around geological issues, landscape aspects and processes, extreme climatic and weather events, land use types along the road and in the hinterlands, topography, and underlying soil types affect the area where the road

passes through. The ESIA was then found necessary to be extended from the immediate vicinity of the road to areas where phenomena impacting the road emanate from. The road was being extensively being impacted by phenomena arising from the wider catchment hinterland areas and processes initiated by the nature and structure of the road. From the landscape perspective, the road alignment initiated impacts on it and generated new ones on downstream areas and ecosystems. From the wider geographical considerations, the adverse impacts on the road have linkages with processes originating beyond the immediate road environs and the ESIA was then subsequently scaled up to the hinterland, the road passage and downstream areas impacted by road induced processes.

The ESIA expanded scope covered the following areas:

- Road passage area
- Mt Logonot and associated hydrological systems
- Olkaria and Hell's gate National Park area
- Kedong/Akira ranches
- Western Mt Suswa and community areas
- Nairegia Enkare Escarpment and community areas
- Kijabe escarpment and Mai Mahiu-Naivasha road area
- Downstream Ewaso to Lake Magadi areas

During the preliminary survey areas that needed to be targeted for ESIA considerations were identified along the road passage and its landscape. Table 2 shows the key aspects for the ESIA process.

Phase 2: Data collection

The preliminary Phase was used to identify aspects that could be addressed by secondary data mining and where field studies were needed to collect actual data on the existing environmental conditions. Consultations were conducted with other project team components to understand where complimentary data was being collected for other aspects such as traffic counts, geology, hydrology and materials.

a) Literature review

Literature review was conducted on:

- Past wildlife trends
- Soils and geology
- Hydrology
- Climate
- Physiography and topography

Table 2: Aspects requiring ESIA process for the Suswa-Mai Mahiu Road

Activity	ASPECT	Area	Concerns
Environmental impact assessment	Road junctions	Towns ships, junctions along other roads,	Safety, drainage, noise, dust, emissions, structures relocation, livelihoods disruptions
	Seasonal rivers	Numerous places	Pollution, siltation, flora and fauna, water quality, hydrology
	Land use types, vegetation cover in flood water source areas	Mount Longonot, Mount Suswa and outlying agricultural and pastoralism areas	Water and soil conservation, dams and water reservoirs, sand harvesting, erosion, vegetation cover
	Gullies and ravines	Numerous places	Erosion, hydrological disruptions, excavation
	Flood plains		
	Steep areas	Numerous places	Erosion, hydrological disruptions, excavation
	Underground water reservoirs, dams and springs	Several places	Pollution, siltation, flora and fauna, water quality, hydrology, underground flow systems disruption, potential livelihood impacts
	Termination points	Mai Mahiu	Safety, drainage, noise, dust, emissions, structures relocation, livelihoods disruptions
	Service roads	Within Townships and access to ICD	Safety, drainage, noise, dust, emissions, structures relocation, livelihoods disruptions
	Road construction material borrow areas	Several potential source areas	Baseline environmental profiling and rehabilitation target conditions bench marking, potential livelihood impacts profiling
	Infrastructure	Power and high voltage transmission lines, wireless masts	Safety, drainage, noise, dust, emissions, structures relocation, livelihoods disruptions
	SGR crossing points	Flood zone	Drainages, potential bottle neck in wet season, siltation, submersion, safety
Health and safety	Learning institutions	Several	Safety, noise, dust during construction, dust emissions
	Residential areas	Numerous	Safety, noise, dust during construction, dust emissions
	Health institutions	Few clinics in townships	Safety, noise, dust during construction, dust emissions
Socio-economic	Commercial areas and rural townships	Mai Mahiu, Mafuta Taa, Satellite, Suswa, Olasiti	Livelihoods disruptions, junctions, safety, noise, dust during construction, dust emissions, structures relocation

b) Field data collection

i) Biophysical environment

The preliminary survey of the project area was used to identify areas where fieldwork on biophysical environment, transects for vegetation studies, transects for road counts of wildlife and livestock and areas where land use activities were to be documented. The areas were selected with respect to impacts on the road and activities that may exacerbate them. Eight areas were identified for these activities:

- Mt Suswa western slopes
- Kedong valley/Ol Jorowa gorge discharge area
- Syabei catchment/Nairega Enkare Escarpment
- Mt Longonot area
- Western Suswa Lowlands
- Ewaso/Magadi depositional zones
- Mai Mahiu-Naivasha/Road Kijabe escarpment
- Olkaria geothermal production area

ii) Public Consultations

Depending on the prevailing economic activities and land use types, the road traverse area was divided into three sectors for the purposes of public consultations. These were:

- Mai-Mahiu to satellite zone
- Suswa Township and adjacent areas
- Olasiti-Nairegia Enkare zone

Public consultations were held at Mai Mahiu, Suswa, Olasiti and Keekonyokie Location with assistance of Administrators from the County Commissioners in the Office of the presidency.

iii) Key informants interviews

A review of the issues affecting the road was used to identify key informants to be interviewed for purposes of the ESIA. These were categorized as those with regulatory, proprietary or administrative roles in the project area.

Phase 3: Data analysis and development of the ESMP

This involved the analysis of the data collected and based issues obtained during the public consultations and key informant interviews.

Road project design and technologies

The ESIA approach with respect to the proposed road construction was as follows:

i. Scaling and work evaluation (determination of geographical and other boundaries; preliminary assessment);

ii. Detailed assessment based on: project design and technologies vis-à-vis environment, social, cultural and economic considerations of the project area; evaluation of pre-existing environmental, social, cultural and economic conditions, pressures and impacts; identification and evaluation of potential environmental, social, cultural and economic impacts that may arise from the proposed project; public consultations to explain what the proposed project is all about and to receive their views, perceptions, concerns and local expert knowledge and advice with respect to the proposed project;
iii. Determination/evaluation of the significance of the potential project impacts and recommendation of mitigation measures;
iv. Development of an Environmental and Social Management Plan and Monitoring Programme; and the decommissioning of project facilities.

3.2 COLLECTION OF BASELINE DATA

3.2.1 Overview of Methods

The ESIA study was conducted between March 2019 and June 2020. The baseline data collection within the study area involved a desk-based review of existing ecological information of the area. Field studies were subsequently conduced to collect information on vegetation analysis, wildlife resources assessment, and consultations with relevant wildlife experts in the field. An environmental profiling survey was undertaken to document the state of the environment, land use types, and activities and processes with a bearing on the adverse flooding and siltation of the road. Consultations were also held with other stakeholders who had vital data and information on wildlife trends, migratory routes, critical species, and habitats. Key informant interviews were conducted with various stakeholders who either were resource users, owners, had oversight or regulatory authority or had activities that impact the larger landscape. Consultations were held with communities for purposes of information collection and public disclosure of the intended road project.

A desktop review was made for information from journals and repositories of institutions with relevant reports on the road project zone. These organizations included the Kenya Wildlife Service, Kenya Electricity Generating Company (KenGen), National Museums of Kenya (NMK) and University of Nairobi. The information sought was on; wildlife population and distribution, composition, migration corridors and patterns. Fauna and flora species of special conservation concerns and their habitats needs were documented, and vegetation types and distribution in the study area.

The desk review also involved evaluation of geological, topographical, hydrological and climatic factors and processes contributing to adverse outcomes and impacts on the road. The interplay of these factors with economic activities, demographic trends, land cover and human settlements was also considered.

3.2.2 Physiography and Geology

The physiography and geology of the area were derived from existing studies of the project area. The area encompassed by the ESIA target zone has a detailed geological study history from the 1900 to date due to its unique geology and current interest in the geothermal energy resource. Satellite imageries were used to designate the key physiographic features, location and flow directions of the waterways and identify key water collection points in the study area. Field visits were subsequently made to these sites to document and record findings on the ground and relate them to other aspects of the study.

A detailed geological and hydrological study is part of the road project and exhaustive studies along the road alignment were undertaken and constitute the Geological and Hydrological report as part of the overall ToRs for the project consultancy. The ESIA benefitted from information shared by the geological and hydrological studies in triangulating critical intervention points and development of mitigation measures.

3.2.3 Soils

The data on soils were derived from literature review and field surveys conducted as part of the ESIA. Complimentary information was obtained from the cores made in the material engineering study of the project. The gullies that have incised deep trenches in the area were used to understand the nature of the soil profiles, pyroclastic deposits and stratification in the area.

3.2.4 Climate

The climate of the area was derived from literature and records obtained from farms located in the landscape that constitutes the catchment of flows that impact the road. The road passage area does not have a functioning meteorological station and proxy data was obtained from the locations a distance away from the road and at different altitudes. The climatic data is pertinent as climatic processes in the areas where it was recorded have hydrological linkages with the road passage area through generated runoff.

3.2.5 Air Quality

The air quality along the road was measured at designated points along the road. The selected points were urban centers, learning institutions and health centers, traffic concentration points or traffic speed control areas. Other measurements were conducted along the road to obtain background air quality under normal road use conditions. A hand held device was used to measure the PM 2.5 in $\mu g/m^3$. The PM 2.5 was selected as it is of concern to human health and is associated with other pollutants and therefore a useful indicator of air quality.

3.2.6 Surface and Groundwater Resources/ Water Quality

A reconnaissance of the project area was used to identify surface water resources and literature was used to document ground water resources in the study area. During the field surveys field observations were made and local residents were queried on the presence and location of surface water sources. These were only found in a few water pans near the road and small water ponds in homesteads a distance away from the road. One water pan near the road and some pools

where livestock was watered were sampled. A multi-parameter instrument (Hanna) was used to collect *in situ* water quality readings. The pools are temporary and not used as domestic water sources and no laboratory water quality parameters documentation was undertaken.

3.2.7 Biological

Woody species vegetation ground-truthing

The area was characterized by major and minor vegetation types which was consistent with Trapnell (1986) and Pratt, Greenway & Gwynne (1966) classifications. Major vegetation types were defined as areas of largely homogenous physiognomy and structure, as characterized by uniformity in topographic features, soils and altitude. Such vegetation types were large in coverage e.g. grasslands, shrub land, and woodlands and their intermediaries. The minor vegetation types were defined in terms of their limited coverage and uniqueness, i.e. dry river-beds, gorges and recent lava flow. Ground-truthing within the identified major vegetation types involved establishment of vegetation belt transects with dimensions measuring 10m x 100m. Data collected in transects comprised species number, height and ground cover for estimation of woody species density and vegetation cover.

Herbaceous Vegetation Sampling

Herbaceous layer assessment involved use of a 0.5m x 0.5m quadrat, used to sample between 5 and 10 replicate points within each of the woody vegetation areas. Data collected in each quadrat involved measuring the height of the vegetation with a meter rule at 5 points within each quadrat. These measurements were used to calculate the average height within the quadrat.

Mammalian and livestock counts

Mammalian wildlife species and livestock counts were conducted from road count transects whose width was varied depending on visibility (Sutherland, 1996). The variable transect width methodology was used and varied from 200m on both sides of the road in the open areas and was reduced to 100m or 50m depending on vegetation density. Mammalian and livestock count data was collected and recorded simultaneously with wildlife. The areas covered were Kedong and Akira Ranches road corridor environs and community settlements in the east and western parts of the road. The data was used to estimate wildlife and livestock species composition, densities and distribution.

Avifauna Counts

Avian species counts involved timed species count sampling (Sutherland, 1996). Data was collected by counting avian species seen or heard within each habitat for 10 minutes at each point before moving on to another. Several avifauna sampling points were established within each habitat within ranches and community areas. It was not possible to estimate avian densities owing to the undefined count area since the species were recorded through sighting or vocalization making it difficult to estimate their distances from the established points. The avian data was used to generate the avian species list of the area and their feeding categories.

3.2.8 Environmental profiling

The study area was surveyed with respect to land use types and human activities in the area. The land use was categorized as farming, grazing, and conservation or urban. Human activities were designated as resource extraction, communication infrastructure use or habitation. Environmental impacts emanating from the different aspects with potential impacts on the road were noted and quantified where possible.

The land resource was documented from field surveys and interviews with key informants. During the field survey the predominant land use was documented and nature of land resource extraction noted. The land resource use was categorized as agricultural, conservation, livestock production or resource extraction. Environmental impacts emanating from the different aspects with potential impacts on the road were recorded and quantified where possible.

3.2.9 Visual Aesthetics

The road passage area was surveyed from different vantage points and potential intrusion and visual disruption across the landscape adjudged. Comparisons of different design scenario such as elevation were projected and potential disruption scored on a scale of 1 to 3. The proposed road corridor modifications and associated infrastructure were envisioned and compared to existing landscape setups, built up areas, settlements and the recently constructed SGR.

3.2.10 Noise and Vibrations

Noise levels were recorded using the Digital Sound Level meter model GM 1357 CH -00 at trading centers, schools and other areas of special interest such as the ICD. Along the road in non-built up areas recordings were made at 4 Km intervals. The recordings were made at ambient traffic conditions, intervals without vehicle passage and instances when heavy trucks and congested traffic was transiting. The findings were compared to NEMA and WHO guidelines and regulations.

Ground vibrations were measured on a tri-axial arrangement of velocity transducers and air blasts by means of air blast microphone. Trigger levels were pre-programmed in the system to start the recording if any event is greater than the set level and it was set to trigger on ground vibration and/or air blast. The set levels were configured to minimize possibility of false triggers due to background noise/vibration generated in the vicinity of the monitor and to ensure accurate and effective monitoring of source related events.

The Instantel Micromate, a 4-channel unit, designed to monitor and transmit event data with one triaxial geophone and one air overpressure microphone was used for the vibration monitoring exercise.

3.2.11 Solid and Liquid Wastes

Surveys were undertaken in the market centers to document physically existing solid and liquid waste systems. Descriptions of the wastes and their disposal methods were made. During the public consultation sessions residents were queried on the liquid and waste management

strategies and procedures used in the area at urban centers and household levels. Traveler waste along the road corridor was documented during conduct of other activities.

3.2.12 Public Consultations and Socio-Economics

The County Commissioners offices in Naivasha and Narok East Sub counties assisted in the organization and conduct of public consultations and subsequent household level questionnaires administration. Representative cross sections of the society in terms of gender, age social class and livelihood systems were strived during the public consultation sessions. Special interest groups and opinion leaders were also included in these deliberations, which were held at Mai Mahiu, Suswa, Olasiti and Keekonyokie location.

3.2.13 Health and Public Safety

Information was gathered from key informant interviews at health facilities and police stations on health and public safety. More information on the same was sought from the public during consultations.

3.2.14 Key Informant Interviews

Key Informant interviews targeted KWS, KFS, NEMA, KenGen, County Commissioners, Orr Power, Kendog Ranch, Ministry of Agriculture and Tata Magadi Soda Company. The key informants were contacted and arrangements made for interviews using structured and open-ended questionnaires.

3.3 DEVELOPMENT OF THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

3.3.1 ESMP Methodology

Potential impacts associated with the proposed development were identified from their sources that comprised of the proposed project's activities; equipment to be deployed; processes to be adopted; and nature of proposed materials. These were aligned to their potential receptors in the biophysical environment, social, economic and cultural contexts to deduce the nature of their potential impacts. Information collected from field surveys, public consultations, literature review, and professional knowledge was used to inform the baseline characteristics of the road project area. The evaluation of baseline data informed the evaluation of resultant impacts from the project's implementation.

The baseline conditions further provided reference levels and states for impacts evaluation, rating and quantification and their projected effects on the biophysical and socio-economic environments. The impacts were subsequently classified as positive or negative and the phase of the project in which they could likely occur. The impact evaluation approach adopted in this study is the Receptor-Specific Analysis addressing the various sources of impacts from the project's different implementation phases, decommissioning of existing structures, project design, construction, operation, and eventual decommissioning phases. Subsequent to their

identification, the impacts were assessed for their significance, duration, reversibility, likelihood of occurrence and their geographical coverage. The list of criterion used to assess significance is shown in Table 3 and the rating of likelihood of occurrence and severity criteria is shown in Table 4. A juxtaposition of the two formed the criteria by which the severity of impacts was determined.

The impacts significance ratings and likelihood of occurrence were used in determining parameters to be included in the ESMP, target areas and aspects, relevant indicators, standards to achieved, responsibilities and time lines for execution.

Table 3: List of criteria used to assess significance of impacts

Impact nature	**Ranking**	**Designation**
Changes that result in a net positive impact to an ecosystem, environment or population.	1	Beneficial
Short term changes in an ecosystem unlikely to be noticeable as they fall within the scope of natural variation. Area of effect is restricted to the immediate vicinity of the source. Has no discernible effect on the environmental resource as a whole and likely to go unnoticed by those who already use it. Negligible impact to a site of social and/or cultural importance.	2	Negligible
Minor adverse changes in an ecosystem with changes that are noticeable but fall within the range of normal variation and are typically short-lived, with unassisted recovery possible in the near term. A low level of recognizable impact may remain. Medium term impact (1-5 yrs) in an area that does not encompass an ecosystem or whose impact is highly localized within it. Long term impact over a discrete, small area which does not support an ecosystem. May be noticeable but does not affect the livelihood of those utilizing a resource. Minor impact to a site of social and/or cultural importance.	3	Minor
Moderate adverse changes in area that supports a population or an ecosystem component with changes that exceed the natural variation range though potential for recovery within a few years without intervention is good. Effect encompasses an area supporting either a moderate or minor proportion of a population or ecosystem. Long term (> 5 yrs) changes over an area which is not considered to be an important part of the environment or ecosystem. Has a measurable effect on the livelihood of those using a resource over a short time frame or weeks. Moderate damage to a site of social and/or cultural importance.	4	Moderate
Long term or continuous impact resulting in substantial adverse changes in the environment beyond the range of natural variation. Unassisted recovery potentially protracted.	5	Significant

Affected area is extensive and/or encompasses an area that supports a significant proportion of an ecosystem or population or ecosystem. Measurable effect on the livelihood of those using natural resources over a period of months. Significant damage or impact to sites of social and/or cultural importance.		
Massive impact over a large area resulting in extensive, potentially irreparable damage Has a measurable effect on the livelihood resources over a long period Massive impact over a large area resulting in extensive, potentially irreparable damage to sites of social and/or cultural importance.	6	Catastrophic/ Critical

Table 4: Rating of likelihood and rank of impact criteria

Likelihood	**Definition**	**Ranking**
Extremely Unlikely	The event is very unlikely to occur under normal operating conditions but may occur in exceptional circumstances (i.e., the event is generally never heard of in industry).	A
Unlikely	The event is unlikely but may occur at some time during normal operating conditions (i.e., the event is heard of in industry).	B
Low Likelihood	The event is likely to occur at some time during normal operating conditions (i.e., incident has occurred in a similar company before)	C
Medium Likelihood	The event is very likely to occur during normal operating conditions, (i.e., the event occurs several times per year in the industry).	D
High Likelihood/ Inevitable	The event will occur during normal operating conditions and is inevitable, (i.e., the event happens several times per year at a road construction location).	E

3.3.2 Significance of impact

The significance of impacts and their likelihood of occurrence are shown in Table 5 below. From general practice, critical impacts are those not acceptable for planned operations, and can only be tolerated in the instance of unplanned or incidental events, and then only when the likelihood of occurrence has been reduced through project planning to at least low or unlikely. Impacts whose residual risks are evaluated as critical cannot be managed or mitigated, and selection of alternatives to eliminate the potential for their occurrence is mandatory.

Impacts assessed as negligible or minor do not require additional management or mitigation, because as the magnitude of the impact is sufficiently small or the receptor sensitivity is sufficiently low and adequate controls are included in the project design. Negligible and minor impacts are deemed to be insignificant, and do not require remedial action.

Impacts evaluated to be moderate or major require the implementation of management or mitigation measures and they are considered to be significant.
For potentially major impacts the mitigation objective is to reduce the residual risk to a moderate level.

Table 5: Determination of significance of impacts

		Impact Likelihood				
		Extremely Unlikely	Unlikely	Low Likelihood	Medium Likelihood	High Likelihood/ Inevitable
Impact Severity	Slight	Negligible	Negligible	Negligible	Negligible Minor	Minor
	Low	Negligible	Negligible	Negligible	Negligible-Minor	Minor
	Medium	Negligible	Minor	Minor	Minor moderate	Moderate
	High	Minor	Minor moderate	Moderate	Major	Major
	Critical/ Catastrophic	Minor moderate	Moderate - Major	Major	Major	Critical

CHAPTER 4 POLICY, LEGAL AND REGULATORY FRAMEWORK

4.0 INTRODUCTION

In 1994, the Kenyan Government developed the National Environment Action Plan (NEAP) and it was recognized that negative impacts on ecosystems were emanating from economic and social development programmes that disregarded environmental sustainability. This catalyzed the establishment of appropriate policies and legal guidelines and harmonization of those that existed or were in the process of development. The NEAP process introduced environmental impacts assessments in the country and culminated in formulation of a Policy on Environment and Development under the Sessional Paper No. 6 of 1999 and enactment of Environmental Management and Co-ordination Act (EMCA), 1999.

The Environmental Management and Co-ordination Act of 1999 govern the conduct of EIA studies that is a legal requirement in Kenya for all development projects. This project falls under the Second Schedule that lists the type of projects that are required to undergo ESIA studies in accordance with section 58 (1- 4) of the Act. Projects under the Second Schedule comprise those considered to pose potentially negative environmental impacts and designated as Category A. The National Environment Management Authority (NEMA), established under EMCA has the statutory mandate to supervise and coordinate all environmental activities in Kenya.

The Kenyan Constitution, policy frameworks and legislation ensure that development initiative are for the well-being of Kenyans and do not have negative or adverse impacts on people or the environments. The constitution and supportive policies, legislations and various acts of parliament ensure the rights to development and a clean and healthy environment. Kenya in addition is a signatory to international treaties and conventions on the environment intended to ensure a sustainable and healthy planet. In her engagement with various development partners, Kenya adopts the best practices that protect people and the environment and ensure that they are observed and adhered to. Appropriate remedial actions are undertaken if they triggered by projects undertaken in the country. Policies and legislation highlighting the legal and administrative requirements pertinent to this study are presented below.

4.1 THE CONSTITUTION OF KENYA 2010

The Kenyan Constitution

In Section 42 of the Constitution of Kenya (2010) states that every person has the right to a clean and healthy environment, which includes the right:

a) To have the environment protected for the benefit of present and future generations through legislative and other measures, particularly those contemplated in Article 69, and

b) To have obligations relating to the environment fulfilled under Article 70.

Chapter five of the constitution covers "Land and Environment" and includes articles 69 and 70. The Chapter seeks the elimination of processes and activities that are likely to endanger the environment. According to Article 69, the State shall:

a) Ensure sustainable exploitation, utilization, management and conservation of the environmental and natural resources, and ensure the equitable sharing of the accruing benefits;

b) Work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya;

c) Protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of the communities;

d) Encourage public participation in the management, protection and conservation of the environment;

e) Protect genetic resources and biological diversity;

f) Establish systems of environmental impact assessment, environmental audit and monitoring of the environment;

g) Eliminate processes and activities that are likely to endanger the environment; and

h) Utilize the environment and natural resources for the benefit of the people of Kenya.

In commissioning the Suswa-Mai Mahiu Road ESIA Study, KeNHA, the project proponent complies with the constitutional requirements as set out in the Constitution. During the project life cycle phases of construction; operation and decommissioning, the proponent will institute mitigation measures to address all adverse project effects.

4.2 THE POLICY FRAMEWORK

Kenya Government's environmental policy is aimed at integrating environmental aspects into national development plans. The objectives of the national environmental policy broadly include:

- The optimal use of natural land and water resources in improving the quality of human environment
- The sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations
- Conservation and management of the natural resources of Kenya including air, water, land, flora and fauna
- Promotion of environmental conservation through the sustainable use of natural resources to meet the needs of the present generations while preserving their ability to meet the needs of future generations

- Meeting national goals and international obligations by conserving bio-diversity, arresting desertification, mitigating effects of disasters, protecting the ozone layer, and maintaining an ecological balance on earth

In commissioning this ESIA for proposed development of the Suswa-Mai Mahiu Road, KeNHA commits to achieve the policy framework, in line with legislation and requirements that ensure the protection of the environment and human rights.

4.3 ADMINISTRATIVE FRAMEWORK

4.3.1 The National Environment Council

The National Environmental Council (the Council) is responsible for policy formulation and directions for the purposes of the Act. The Council also sets national goals and objectives, and determines policies and priorities for the protection of the environment.

4.3.2 The National Environment Management Authority

The responsibility of the National Environmental Management Authority (NEMA) is to exercise general supervision and co-ordination over all matters relating to the environment and to be the principal instrument of government in the implementation of all policies relating to the environment.

4.3.4 The Standards and Enforcement Review Committee

In addition to NEMA, EMCA 1999 provides for the establishment and enforcement of environmental quality standards to establish a technical committee of NEMA known as the Standards and Enforcement Review Committee (SERC). This drew up standards and regulations for various environmental aspects that include:

- Water Quality Regulations
- Waste Management Regulations
- Controlled Substances Regulations
- Conservation of Biological Diversity
- Noise Regulations
- Air Pollution Regulations

4.3.5 The Provincial and District Environment Committees

The Provincial and District Environmental Committees also contributed to decentralized environmental management and enabled the participation of local communities. These environmental committees consisted of the following:

- Representatives from all the ministries;
- Representatives from local authorities within the province/district;
- Two representatives from NGOs involved in environmental management in the
- Province/district;
- A representative of each regional development authority in the province/ district

4.3.6 The Public Complaints Committee

The Act (EMCA) has also established a Public Complaints Committee, which provides the administrative mechanism for addressing environmental harm. The Committee has the mandate to investigate complaints relating to environmental damage and degradation. Its members include representatives from the Law Society of Kenya, NGOs and the business community.

4.4 KENYA LEGISLATION AND REGULATIONS

The Suswa-Mai Mahiu road project is a Category A in the NEMA classification protocols and is likely to have significant adverse and sensitive environmental impacts that are diverse and unprecedented. The impacts may affect an area broader than the sites or facilities subject to the physical work. The ESIA for this project category examines its potential negative and positive environmental impacts. It compares them with feasible alternatives and recommends measures needed to prevent, minimize, mitigate or compensate for adverse impacts and improve environmental performance.

For projects of this nature, the Environmental Management and Conservation Act of 1999 that establishes NEMA as the principal coordinating is the main legislation that applies. The relevant legislation for the proposed road project is outlined below.

4.4.1 Environment Management and Conservation Act and Associated Regulations

Environmental Management and Coordination Act No 8 of 1999

This ESIA report was undertaken in accordance with Part VI of EMCA 1999 and its subsequent supplements. The act in Part II, states that every person is entitled to a clean and healthy environment and has the duty to safeguard the same and it further proposes that projects listed under the Second Schedule of the Act must undergo an Environmental and Social Impact Assessment. This Schedule includes the establishment of roads (No. 3(a).) as intended in the proposed road project. Relevant statutes that will guide the development and management of the road project to ensure environmental and socio-economic sustainability are presented below.

i) **Environmental (Impact Assessment and Audit) Regulations, 2003**

These regulations guide in the procedures for conducting an ESIA study by detailing the parameters to be evaluated during the Assessment. It also provides guidelines for conducting of environmental audits and development of project monitoring plans.

By commissioning an ESIA study, the project proponent is compliant with these regulations and during the project life (construction; operation and decommissioning phases) will fully implement the ESMP. The proponent will in addition undertake continuous monitoring and annual environmental and social audits after project commissioning.

ii) EMCA (Controlled Substances) Regulations, 2007

These regulations control the production, consumption, exports and imports of controlled ozone depleting substances that fall into three groups that are:

- Group 1: Halogenated flourochemicals

- Group 2: Hydrobromoflourocarbons
- Group 3: Bromochloromethane

Products that contain these controlled substances include air conditioners, air coolers, refrigerants, portable fire extinguishers, heat pump equipment, dehumidifiers, insulation boards, panels and pipe covers, and pre-polymers amongst others.

Equipment containing these controlled substances shall not be used in this road project.

iii) EMCA (Noise and Vibration Control) Regulation, 2009

The regulations provide guidelines for acceptable levels of noise and vibration for different environments during the construction and operation phase. Section 5 of the Regulations prohibits operating beyond the permissible noise levels and Section 6 has guidelines on control measures for managing excessive noise in designated silent zones that include hospitals, learning institutions, and places of worship, among others.

The Proponent shall observe requisite policy and regulatory guidelines and implement the measures proposed in this document to comply with these regulations.

iv) EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management), Regulations, 2009

The aim of these Regulations is to ensure conservation and sustainable use of wetlands in Kenya. The Environmental Management and Coordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009 is a supplementary legislation to EMCA and lays emphasis on management of wetlands and their resources, river banks, lake shores and sea shores. Sections 4 and 5 of Part II, 16, 17, 18 of part III provide guidelines for conservation and sustainable use and conservation of these environmental components, and enhance them where necessary when carrying out any in them.

The proposed road development traverses no significant wetlands but there are various lagas, seasonal streams and small water impoundments used for watering livestock. The lagas transport silt and floodwaters to Lake Magadi with adverse effects and it is recommended that KeNHA works with WRMA and Tata Chemical Magadi to ensure conservation of downstream wetlands, infrastructure and landscape.

v) EMCA (Waste Management) Regulations, 2006

These provide guidance on appropriate waste handling procedures and practices. The proposed project is anticipated to generate solid wastes during construction which shall be managed through applicable processes that include wastes generation reduction, reuse, and recycling or appropriate disposal. It is anticipated that deployment of the appropriate strategies will significantly reduce wastes during the project implementation cycle.

The road passage area has no approved waste dumpsites and the proponent will be required to make necessary transportation and disposal in designated waste handling facilities outside the project area. The contractor will adhere to the provided solid waste management plan in this ESIA.

vi) Environmental Management and Coordination (Water Quality) Regulations, 2006

Water quality regulations were gazetted in 2006 as legislative supplement to address the challenges of pollution of water resources as well as their conservation. The objective of the regulations is to prohibit discharge of effluent into the environment contrary to the established standards. The regulations further provides guidelines and standards for the discharge of poisons, toxins, noxious, radioactive waste or other pollutants into the environment in line with the Third Schedule of the regulations. The regulations have standards for discharge of effluent into the sewer and aquatic environment.

KeNHA and the Contractor will ensure that no wastewater is discharged into the environment and that water from works and workers camps is treated and disposed of using the prescribed procedures and processes in this ESIA.

vii) EMCA (Conservation of Biological Diversity and Resources, Access to Genetic, Resources and Benefit Sharing) Regulations, 2006

The regulation aims at increasing the coverage of protected areas and establishing new special status sites by providing guidelines for protecting endangered species.

The Act prohibits engagement in activities that may have adverse impact on any ecosystem, lead to the introduction of any exotic species, or lead to unsustainable use of natural resources, without an EIA license issued by the Authority under the Act. Roads act as corridors for movement of exotic plant or animal species and create disturbed areas that enable establishment of such species and the proposed project may facilitate this.

The Proponent has commissioned this environmental assessment study has a management on invasive species that will enable compliance with the Act; through guidelines for the mitigation of potentially adverse impacts on natural resources by such species.

viii) Environmental Management and Coordination, Fossil Fuel Emission, Control Regulation 2006

The regulation aims at eliminating or reducing emissions by internal combustion engines to acceptable standards and has guidelines on use of clean fuels, catalysts and inspection procedures for engines and generators. These regulations are triggered as the proponent will use vehicles and equipment powered by fossil fuels.

KeNHA and Contractors shall comply with the provisions of this Act. The environmental management plan included in this report provides guidelines on the management of air emissions from the combustion of petroleum products used.

4.4.2 Other Acts and Legislation

In addition to the EMCA enabled legislation, there are other Acts of parliament that have a bearing on aspects with a bearing on road project developments and attendant activities. These include:

i) The Occupational Health and Safety Act, 2007

This Act of Parliament ensures safety, health and welfare of workers and persons lawfully present at workplaces. It provides for the establishment of the National Council for Occupational Safety and Health and for these 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 & vapors, 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

Failure to comply with the OSHA, 2007 attracts penalties that include fines and jail terms.

The report Contains an OSHA plan with details on safety and health aspects, potential impacts, personnel responsible for implementation and monitoring, frequency of monitoring, and estimated cost, as a basic guideline for the management of Health and Safety issues in the proposed project.

ii) The Water Act 2002

The Act vests the water in the State and gives the provisions for the water management, including irrigation water, pollution, drainage, flood control and abstraction. It is the main legislation governing the use of water especially through water permit system.

The project Proponent shall adhere to the act and minimize impacts on the local water supply during construction phase. Water abstraction from selected sources will ensure that the supply is not polluted, over abstracted or drainages interfered with.

iii) Local Authority Act (Cap. 265)

Under this act, the Local Authority is the custodian of Trust Land and has to authorize acquisition of sites where road infrastructure could be passing.

The Proponent has commissioned a RAP study to identify such Trust Lands that may be affected by the construction of the road. The Proponent shall comply with the provisions of the Act in seeking the required authorizations from the Local Authorities as stipulated in the Act.

iv) Penal Code Act (Cap 63)

The Act states that if any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering unfit for use is guilty of an offence. Section 192 states that a person who makes or vitiates the atmosphere in any place to make it noxious to health of persons /institution is dwelling or business premises in the neighborhood or those passing along public way, commit an offence.

The Proponent shall observe the guidelines as set out in the environmental management and monitoring plan laid out in this report as well as the recommendation provided for mitigation/ minimization/ avoidance of adverse impacts arising from the project activities.

v) Energy Act, 2006

The provisions of this Act apply to every person or body of persons importing, exporting, generating, transmitting, distributing, supplying or using electrical energy; importing, exporting, transporting, refining, storing and selling petroleum or petroleum products; producing, transporting, distributing and supplying of any other form of energy, and to all works or apparatus for any or all of these purposes. Fuel will require transportation for generators, vehicles and ancillary equipment in this project.

The proponent will adhere to EPRA regulations on petroleum products transportation.

vi) The Wildlife Conservation and Management Act, 2013, Cap 376

The Act provides for the protection, conservation and management of wildlife in Kenya within and outside National Parks. The road project area has wildlife populations and the provisions of this Act shall be apply in the management of the project.

The Proponent shall implement the proposed measures in this document towards protection and conservation of wildlife in the project area.

vii) The Public Health Act (Cap. 242)

The Act Provides for the securing of public health and recognizes the important role of water. It provides for prevention of water pollution by stakeholders. It states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health.

The Proponent shall observe policy and regulatory requirements and implement measures to safeguard public health and safety.

viii) **Kenya National Aids Strategic Plan (KNASP III)**

The communication strategy aims at supporting KNASP III to achieve its results through advocacy, information dissemination and social mobilization. The strategy focuses on communicating KNASP III to stakeholders and providing guidelines for programmatic communication programmes. The communication strategy targets a wide range of audiences

including policy makers, development partners, implementing organizations, the media and key institutions coordinating the national response.

The proponent will ensure that a HIV/AIDS component is included in the execution of the project to minimize risks of infection and spread of HIV/AIDS

ix) Physical Planning Act (Cap 286)

The Act provides for the preparation and implementation of physical development plans and for related purposes. It gives provisions for the development of local physical development plan for guiding and coordinating development of infrastructure facilities and services within the area of authority of County, municipal and town council and for specific control of the use and development of land.

The site layout plan appended to this report shows the proposed route for the road. The Proponent shall secure all mandatory approvals and permits as required by the law where necessary.

x) 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.

The Proponent will remain within the existing road provided way leave. Where the construction of service roads and ancillary structures requires acquisition, the proponent shall acquire Way leave along the road corridor. The Proponent shall endeavor to ensure that the management of health and safety issues is of high priority during the construction and operational phases of the project.

xi) Way Leaves Act (Cap. 292)

The Act provides for certain facilities to be constructed such as roads, transmission lines, pipelines, canals, pathways etc., through, over or under any lands. This project falls 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.

In accordance with the Act (section 4), notice will be given before carrying out works with full description of the intended works and targeted place for inspection. Any acquisitions caused by the works will be compensated to the owner in accordance with the law. The proponent will liaise with Kenya Railways, Ketraco and other entities with infrastructure and land along the road passage when necessary.

xii) Land Acquisition Act (Cap. 295)

This Act provides for the compulsory or otherwise acquisition of land from private ownership for the benefit of the general public. Section 3 states that when the Minister is satisfied on the need for acquisition, notice will be issued through the Kenya Gazette and copies delivered to all the persons affected. Full compensation for any damage resulting from the entry onto land to things such as survey upon necessary authorization will be undertaken in accordance with section 5 of the Act. Where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to sections 8 and 10.

Land will be acquired for interchanges and public amenities around the ICD at +15Km area. The Proponent has undertaken a survey and developed the necessary designs for this area and they adhere to the requirements of the Act in the implementation of land acquisition.

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 to 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.

There are access roads to be constructed to schools and other government facilities and where necessary the proponent will adhere to the provisions of this Act.

xiv) The Registered Land Act Chapter 300 Laws of Kenya:

This Act provides for the absolute proprietorship over land (exclusive rights). Such land can be acquired by the state under the Land Acquisition Act in the project area.

The project traverses some areas with Registered Land especially in the townships along the road. The Proponent shall comply with the provisions of the Act in the acquisition of Registered Land.

xv) 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 connection with the construction, installation, testing, sampling, operation or use of any article, apparatus, instrument, device or process.

The Proponent shall ensure that commodities used in the project adhere to the provisions of this Act.

xvi) The Antiquities and Monuments Act, 1983 Cap 215

The Act aims to preserve Kenya's national heritage that include antiquities, monuments, and cultural sites in the country. The National Museums of Kenya is the mandated custodian of the country's cultural heritage through its mission.

Where aspects under this act are encountered, consultations will be held with the National Museums of Kenya for appropriate mitigation measures to protect such resources.

4.5 INTERNATIONAL BEST PRACTICES, STANDARDS AND CONVENTIONS

4.5.1 World Bank's Environmental and Social Framework

The objective of the World Bank's environmental and social safeguard frameworks (2018) sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity. The new Framework replaces Operational Policy (OP) and Bank Procedures (BP): OP/ BP4.00, Piloting the Use of Borrower Systems to Address Environmental and Social Safeguard Issues in Bank-Supported Projects; OP/BP4.01, Environmental Assessment; OP/BP4.04, Natural Habitats; OP4.09, Pest Management; OP/BP4.10, Indigenous Peoples; OP/BP4.11, Physical Cultural Resources; OP/ BP4.12, Involuntary Resettlement; OP/BP4.36, Forests; and OP/BP4.37, Safety of Dams.

The frameworks are to prevent and mitigate undue harm to people and their environment in the development process. They provide guidelines for bank and borrowers in the identification, preparation, and implementation of programs and projects. Safeguard policies provide a platform for the participation of stakeholders in project design, and are an important instrument for building ownership among local populations (World Bank, 1999-2006). The project may trigger the following safeguardstandards if funded by the World Bank.

- Environmental and Social Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Environmental and Social Standard 2: Labor and Working Conditions;
- Environmental and Social Standard 3: Resource Efficiency and Pollution Prevention and Management;
- Environmental and Social Standard 4: Community Health and Safety;
- Environmental and Social Standard 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement;
- Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Environmental and Social Standard 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities;
- Environmental and Social Standard 8: Cultural Heritage;
- Environmental and Social Standard 10: Stakeholder Engagement and Information Disclosure

The requirements of the framework are similar to those of EMCA, which aims to ensure sustainable project implementation. All aspects covered by tye safeguards are satisfied by the ESIA undertaken for this road project.

4.5.2 African Development Bank

The objective of the AfDB environmental and social safeguard policies is to prevent and mitigate undue harm to people and their environment in the development process. These policies provide guidelines for bank and borrower staff in the identification, preparation, and implementation of programs and projects.

AfDB policies on development projects are geared towards avoidance of adverse impacts of projects on the environment and affected people, while maximizing potential development benefits to the extent possible by mainstreaming participatory development.

There is emphasis, on the following:

- Operational safeguard 1 – Environmental and social assessment;
- Operational safeguard 2 – Involuntary resettlement land acquisition, population displacement and compensation;
- Operational safeguard 3 – Biodiversity, renewable resources and ecosystem services
- Operational safeguard 4 – Pollution prevention and control, hazardous materials and resource efficiency;
- Operational safeguard 5 – Labour conditions, health and safety;

The AfDB provides for the disadvantaged and marginalized members of the society:

Provisions 1,3,4 and 5 are adequately catered for by the ESIA and its ESMP while provision 2 does not apply to the road project.

4.5.3 International Environmental Guidelines

Kenya has ratified or acceded to numerous International treaties and conventions, as described below:

- Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol on Substances that Deplete the Ozone Layer
- The Basel Convention
- Kyoto Protocol
- Convention on Biological Diversity

Mitigation measures proposed for implementation in the ESMP address all aspects related to the protocols and conventions.

CHAPTER 5 BASELINE ENVIRONMENTAL AND SOCIAL PARAMETERS

5.1 INTRODUCTION

5.1.1 Road passage area description

The road pauses through the Counties of Narok and Nakuru and measures approximately 41 kilometers and starts at Suswa and proceeds in a southeasterly direction ending at 2nd SGR bridge after Olasiti Center. The general passage of the road is generally flat from Mai Mahiu to Suswa traversing gullies of various sizes. The road passes through a moderately undulating and flat to gently sloping. A large portion of the project road area is essentially a flood plain for runoff from the Mts Longonot and Suswa and other elevated areas. The road project area is located between the eastern and western escarpments of the Gregory Rift Valley. It has underlying fault lines and underground fissures associated with the rift valley formation overlain by sediments derived from the surrounding areas and past volcanic eruptions.

The area where the road passes is a rangeland that formerly hosted a rich wildlife population. The land use is diverse with a mix of small-scale faring, pastoralism and ranching. Over the decades, there have been changes in the land use from pastoralism and ranching to agro-pastoralism and small-scale subsistence farming. Where undisturbed the vegetation is dominated by Acacia wooded grasslands and bush lands.

The road is prone to frequent closures resulting from flooding, road cutting, subsidence, and silt deposition during rainy periods. The conditions arise from an interaction of factors and processes arising road passage alignment, land use, topography, climate, geology and hydrology that constitutes part of this study. KeNHA is in the process of rehabilitating the road section to eliminate the disruptions that affect traffic. This will require undertaking of environmental and social studies to map vegetation along the road corridor, fauna and flora and identify ecological receptors with the potential to be impacted by the proposed project. A social study on impacts on the social environment is to be undertaken in line with EMCA (1999) requirements.

Chapter layout

Major Sections in this Chapter	**Issues Addressed**
Introduction	• Layout of the Chapter • Geographical Aspects and Boundaries • Administrative Set-up • Communications and Transport • Government, Non-Governmental and Community • Based Organizations
Environmental Baseline Survey	• Physiography and Geology • Soils • Climate • Air Quality

Major Sections in this Chapter	Issues Addressed
	• Surface and Groundwater Resources • Water Quality • Terrestrial Environment • Aquatic Environment • Land Resources and Parks • Archaeological, Historical and Cultural Sites • Visual Aesthetics • Noise and Vibrations • Solid and Liquid Wastes
Environment-related Social and Economic Baseline	• Demography • Education • Housing • Land Tenure Systems • Labour Force • Livestock and Crop Production • Trade, Commerce and Industry • Health Settings • Security and Public Safety • Community Views and Concerns • Corporate Social Responsibility

5.1.2 Geographical Aspects and Boundaries

Mai-Mahiu Town from where the project road starts is 90Km from Nairobi. The road traverses through community land to the east of Mt. Longonot through parts Kedong and Akira Ranches in Nakuru County, before entering Narok County at Suswa center. The section set for rehabilitation ends at +Km41 after Olasiti near the second SGR Bridge.

The road passage area is bound to the north by Mt. Longonot and Olkaria Hill and to the east by Mt. Suswa. The section lies in the rift valley floor between the eastern and western escarpments and the drainage systems from these areas flow into it. The southeastern and Olkaria Hill water flows converge with that from western Suswa at a low point +35Km where the SGR crosses the road. Other water flows from Mt. Longonot and Kijabe crosses the road between Mai Mahiu and Satellite areas. The drainage from the western rift valley escarpment forms the Syabei drainage system and crosses the road after Olasiti.

5.1.3 Administrative Structure

The Suswa-Mai Mahiu (B7) road section being rehabilitated is part of the Mai Mahiu-Narok highway that traverses the Kenyan territory southwest of Nairobi. The road passes through the counties of Nakuru and Narok with boundary between the two at Suswa center. The Naivasha sub-County of Nakuru has three divisions with 12 locations and 20 sub-locations. The road passes through the Mai Mahiu administrative location with an area of 544 Km^2, and a population of 33,662. The road starts at Mai Mahiu town 50 Km North West of Nairobi. The Narok East sub-county has four (4) wards comprising of Keekonyokie and Suswa through which the road section passes and Mosiro and Ildamat. The sub-county has an area of 1685.8.Km^2 and a

population of about 43,000. The population in both the sub-counties indicates the need for infrastructure upgrading including the current road project.

5.1.4 Government, Non-Governmental and Community Based Organizations

The lower levels of national government structures are the sub locations and locations through which the road traverses. In Naivasha the road starts at Mai Mahiu township sub location passes through Karima sub location, enters Narok east through Enosupukia location and terminates at Suswa location. The road, however is interlinked with hinterlands of Longonot location where most siltation is thought to come from and is a major area for sand harvesting, and Keekonyokie location (Nairegia Enkare) which is past Olasiti and is also part of the source of flash floods. The implication is that any community based intervention to rehabilitate the road would require collaboration and coordination among these structures.

There are also Non-governmental organizations working in the area of which the conspicuous ones are concerned with mitigating early marriages and female genital mutilation (FGM) while promoting education. Among them is the Suswa Soila Girls Rescue Centre established in 2005 that collaborates with local Chiefs and community elders to provide girls with a safe environment to live in and receive a high quality education as an alternative path in life to FGM and early marriage. The field visits as well as the public consultation meeting revealed the existence of centre for rights, education and awareness (CREW) promoting girls' education and combating harmful traditions such as early marriages and FGM. The Safaricom Foundation is involved in a solar lighting project and partly finances community members to install solar system.

The project area has an array of Government, non-governmental and Community Based Organizations operating there (Table 6). They have operations that impact or can be impacted by the road project. For the purposes of the ESIA, the project area has been expanded to cover the entire catchment as it is the source of water and silt that negatively affects the road. The Suswa-Mai Mahiu road due to its location and associated structures have impacts within and beyond its immediate environs and will potentially impact on existing and proposed infrastructure, community areas and other downstream investments.

Table 6: Government agencies and other stakeholders with important roles on the road construction and sustainability

a) Government agencies with activities in the area

	Government Agencies	Activities	Area
1	KeNHA	Road Construction, maintenance and operation Weigh Bridge management at satellite	Suswa-Mai Mahiu Mai Mahiu-Naivasha Proposed Greater Mombasa bypass
2	KERA	Road Construction and maintenance	Ngong-Suswa Road Various rural access roads
3	Kenya Railways	Construction, Maintenance and	Railways crossings,

		operations of the Standard Gauge Railway (SGR)	Railway stations
4	KETRACO	Construction and maintenance of high voltage electric transmission lines, Operation of KETRACO substation at Suswa	Three points across the road Substation at Suswa
5	KenGen	Geothermal power production and transmission, Drilling of geothermal wells, Construction of well pads and access roads	Hell's Gate National Park, Olkaria and Mt Longonot areas
6	Kenya Wildlife Service	Wildlife management and conservation in Hell's Gate National Park and Mt Longonot National Park, Infrastructure management and development in the conservation areas	
7	NEMA	Environment management and oversight	Entire area
8	KFS	Catchment protection	Entire area
9	Nakuru County Government	Management of rural urban centers, Solid waste management Maintenance and development of rural access roads	Mai- Mahiu Centre, Satellite Olkaria-Suswa road, other minor roads
10	Narok County Government	Management of rural urban centers, Solid waste management Maintenance and development of rural access roads	Suswa Township, Olasiti, Access roads in the Nairegia Enkare area

b) Non Government agencies

1	Kedong Ranch Ltd	Large proportion of catchment	Kedong ranch stretching between Suswa-Mai-Mahiu and Moi South Lake Road
2	Akira Ranch	Large proportion of catchment	Akira ranch stretching between Suswa-Mai-Mahiu and Hell's Gate National park
3	Sand Harvesters Associations	Sand harvesting in the gullies found in the catchment	Entire catchment area
4	Tata Chemicals Magadi	Catchment rehabilitation in the area around Olasiti	Lake Magadi and its surface runoff catchment

5.2 ENVIRONMENTAL BASELINE SURVEY

5.2.1 Physiography and Geology

The processes impacting on the road result from the synergy of physiographic and geological contexts that interact with rainfall and soil to precipitate the hydrological features that characterize the area. Subsequent overlay of human activities on these unstable geophysical climatic and settings set off the subsequent dynamics that affect the road.

i) Physiography

The road passage area is part of the Kedong Valley that lies between the Eastern Rift Valley from Kijabe Hill to the East and the Western Escarpment that forms part of the Eastern Mau Forest. The general road passage area is at an altitude of around 1900m asl and is topographically dominated by Mt Longonot at an elevation of 2,716 m asl, Suswa at 2,357 m asl and Olkaria Hill at 2,434 m asl. The bounding escarpments of the rift valley rise above 2,500 m asl in the areas with hydrological influence on the road passage area. The road passage is part of the larger landscape that encompasses Lake Magadi at an altitude of 600m asl and the gullies and waterways creates a hydrological connectivity. The altitudinal range precipitates devastating consequences downstream.

The road passage area has ravines and gullies that in places track fault lines with depositional zones in several places. The road passage area has three major catchments that include the Ewaso Ng'iro that collects water from the Mai-Mahiu, Kijabe and the Longonot sections, the Kedong valley between Suswa and Pipeline road and Syabei after Olasiti that drains the western rift valley escarpment and adjoining areas. The drainage systems along the road and hinterlands have depositional areas covered in silt or with pumiceous debris. The depositional points form fan structures or simulate inland deltas and have different vegetation types depending on the nature of overlying sediments. Where sediments are soil or clay-soil, the dominant vegetation type is *Cassia didimyobotris, Ricinus cumunis* interspersed with *Aspilia mazambicensis* (Photograph 6.). Where pumice deposits or sandy soil predominates, *Solanum nicotiana* with little or no undergrowth dominates (Photograph 7).

The location of gullies and deposition zones are important due to their impacts on the road and are shown in Table 7. The size and state of the gully or depositional zones are also indicated. The active gullies are those where bottom scouring is ongoing, healed ones are those covered with vegetation at the bottom and reactivated are those that show evidence of past healing with current resurgent down cutting. In recent sand and pumice material depositional zones there is poor or no vegetation establishment. In road downstream areas, such barren areas are extensive engulfing huge swathes of grasslands (Photograph 7).

Photograph 6: Ol Jorowa Gorge discharge into the lowlands and invasive plants in the flood plain

Photograph 7: Pumice deposits smothering vegetation establishment downstream of the road

The conspicuous physiographic features that contribute and result form physiographic driven processes in the road passage road include gullies and flood plains depositional zones. These include:

a) Gullies in road catchment area

The environmental survey of the area revealed several widespread gullies in the area with their origins from elevated areas comprising of Mt Longonot and Suswaa and the bounding

escarpments to the east and west of the road project area. In the lowlands, there a mix of silt deposition fans, flood plains and new gullies where water collected and the gradient was favorable for erosion processes resumption. The major features encountered are shown in Table 7 below.

Table 7: Key physiographic features in the road catchment area that have implications on the Suswa-Mai Mahiu road

Gullies

Kedong/Ol Jorowa/Longonot area, north of the road				
Area	**GPS point**	**Depth (m)**	**Width**	**Status**
Suswa lowlands	37M 0197342 UTM 9886122	5	85	Not active Acacia fringing zone, charcoal burning in area
Silt Deposition	Start 37M 0198887 UTM 9890368 End	500 m x 900 m		Silt deposition from East Mau escarpment Growth of Cassia and *Solanum nicotiana*
Oloruruwa valley (exit from Jorowa gorge discharge	Start 37M0199279 UTM 9891432 End 37M 0199870 UTM 9891933	3 m flood water mark	200	Very active, pumice depositions, sand harvesting, rocky debris
Police post	37M0210315 UTM 9886795	7	50	Very active with sand harvesting, bank cave-ins
Depositional zone	37M0214220 UTM 9888271	200 m x 35 m		Triangular deposition zone with healing and 10 m tall trees
Termination point End of road	37M 0214059 9889074	5	10	Young very active gully, cave-in episode observed.
Safaricom Booster	37M 0216565 UTM 9886368	1.5	8	Terminates in a woodland of *A. xanthophloea* near road
	37M 0216348 UTM 9887296	8	25	Gully deepens and widens upstream, flat floor with pumice deposits, very active
In land delta	37M 02166261 UTM 9887617	200m wide		Rechanneling caused by sand harvesters activities. Sand and pumice deposits, *S. nicotiana*. Acacia trees cut.
	37M 0215800 UTM 9888512	7	21	Confluence of three lagas draining cedar felled area for charcoal production.
Upland *Tarconanthus* bush land zone	37M 0215896 UTM 9890245			Active and past charcoal kilns. Area completely devoid of trees, stumps uprooted and piled for charcoal burning
Leon Curio shop	37M 0227538	First road		Submerged farms and curio

Deposition zone	UTM 9889989	topping over point		shops
Olkaria area	37M 0203960 UTM 9897969	Geothermal well pads		Hills with small gullies that coalesce into a gully running down hill
RAP land Estate are	37M 0206043 UTM 9894106	4	14	Gully parallel to rural access road
Deposition zone	37M 0203604 UTM 9890985	2 hectares		Inland deposition zone, no gullies, deep soils
Longonot Mountain gully	37M 0221081 UTM 9898612	3	9	Gully with well healed, motorable

Erekia Nairegia area				
Area	**GPS point**	**Depth (m)**	**Width**	**Status**
Mwalimu Farm Valley	37M 0185281 UTM 9882674	0.3	15	Mass flow drainage in farmed areas
Surrum 1 Valley	37M 0185592 UTM 9881961	2	35	Drainage valley
Surrum 2 valley	37M 01852911 UTM 9681867	3	10	Discharge point from farms
Sink hole	37M 0185304 UTM 9881095	20	50x25 m	Disappearance of massive amount of water into a sink hole, no flow beyond point

Mt Suswa area				
Area	**GPS point**	**Depth (m)**	**Width**	**Status**
Suswa Resort entrance	37M 0196046 UTM 9876590	8	14	Active, contributor of massive silt dyke along the road
	GPS 0196871 UTM 9875459	9	30	Low bed load, collapsing banks, overland flow, knick points
Deposition zone	37M 0194928 UTM 9876536	200x100 m		Growth of *S nigrans, S. incanum*, healing
Ewaso bridge	37M 0218515 UTM 9877704	1	10	Gully well formed, converged flow towards Magadi

Syabei Catchment				
Area	**GPS point**	**Depth (m)**	**Width**	**Status**
Main Gully	37M 0189001 UTM 9879627	8	6	Previously healed gully with active sub gullies
Ravine Knick point	37M 0187552 UTM 9880016	18	10	Gully depth increases from 3 m wide and 5 m deep to 18 m after 12 m distance. Fault line suspected

Deposition zones

Ketraco Station	M37 0206652 UTM 9882585	Former deposition zone, dykes built around station, area filled up an compacted
SGR Bridge	37M 0208492 UTM 9885054	Open area with pumice and sand deposition
Kitet Deposition	37M 0213998 UTM 9881148	Pumice and sand deposits, grass smothered, *S. nigrans* bushes
Maisonda area Inland drainage basin	37M 0215011 UTM 9870777	Suswa and Longonot drainage systems convergence
Ewaso flood plain	37M 0219449 UTM 0994308	10 Km^2 flood plain, pumice

The impacts of silt deposition on the road and farms are shown in photographs 8, 9, and 10. Bank cave-ins widen the gullies and generate more material for downstream deposition. The intertwined of erosion and siltation are widespread and span agricultural and grazing areas, established infrastructure, roads, and built up areas. The loss of topsoil manifests severe environmental degradation that has social and economic consequences in the source and impacts areas.

Photograph 8&9: Silt removed from the road and silted up maize farm

Photograph 10: Gully bank cave-in and accompanying widening process

b) Nairegia Enkare escarpment

This is an upland area whose surface features indicate water flows to the lowlands from several places including Enosupukia farther inland. In the Nairegia Enkare area, three small valleys with recent water flow were observed to converge into a single channel where fresh water marks at 35m width and 2 meters depth were documented. The water then flows into a ravine with an incised cleft at the bottom leading to a swallow hole with a diameter of 35 m and unknown depth (Photograph 11). Two other subsidence sinkholes were found 50 m further down the valley but without evident surface water inflows (Photograph 12). There are no visible surface outflows from this sink hole implying drainage into the subsurface axial flow system along faultiness. There are fissure lines on the southern bank 1 m in diameter and of indeterminate depth that formed recently according to local residents. The valley directly overlooks the Syabei Bridge near the SGR Camp at Olasiti. The sinkhole prevents the formation of an enormous gorge that would have crossed the road and posed serious engineering and washout challenges. The hydro-geological structures and dynamics underpinning the sinkholes and their future are unknown in an area with widespread erosion and poor land husbandry practices.

Photograph 11: Swallow hole into which massive surface water flows in the Nairegia Enkare escarpment disappear into underground fissures

Photograph12: View of road passage area below from the valley with sinkholes with vegetation established in subsidence points

c) Syabei headwaters gullies

The gully is located along the bottom Nairegia Enkare escarpment in an agricultural area. It was well healed in the past with a well established bushland and woodland vegetation but erosion has resumed with sub gullies forming within the old vegetated main gully. There is evidence of a fault line within the gully at 37M 187552, UTM 9880016 transforming from a 3 m deep and 5 m wide to an of 18 m deep and 10m wide trench over a 12 m stretch. The gully is fed by other smaller ones that drain areas with over 85% cultivation and several homesteads. This forms the headwater of the Syabei drainage that combines with flows from other Suswa gullies to deposit

the enormous silt loads smothering Lake Magadi. Two gullies cross the road near the SGR Camp where two separate discharges merge after discharge form culverts to form one that is over 10 m deep (Photograph 13). The silt in the Syabei flow is eventually deposited in Lake Magadi and has covered 20% of the lake surface and an estimated 8,000 tones are deposited during flash flood events (Photograph 14).

Photograph 13: Confluence point of two gullies at the Syabei crossing point that are over 10 m deep draining into Lake Magadi

Photograph 14: Siltation of Lake Magadi by water from the Syabei drainage system

The siltation is exacerbated by poor land in the steep escarpment area with the land stripped of vegetation through overgrazing, deforestation and cultivation. The land has mini-gully frills that merge to form larger gullies transporting sediments downstream (Phonograph 15).

Photograph 15: Conditions in hinterland areas contributing headwaters to the Suswa-Mai Mahiu road

ix) Kijabe/Kinale escarpment

This is the eastern boundary of the catchment basin that affects the Suswa Mai Mahiu road. The flows coalesce into channels that cross the Mai-Mahiu-Naivasha road at three points and initiate gully formation on the lower side of the road. These transport silt and water to the Suswa-Mai Mahiu road. The main gully is manifest at 37M 0226840, UTM 9895637 and runs along the Mai Mahiu-Naivasha Road at a depth of 1.5 m and 5.5 m width east of the road. This joins a laga crossed by the bridge just after Mai Mahiu town. The second gully is initiated by drainage from the Kinale area and is incised by the culvert spill creating a gully that is 5 m deep and 8 m wide, located at 37M 0225067, UTM 9897575 with some fringing *Acacia xanthophloea* trees. The last gully along the road originates from the area between Mirera and Flyover areas with sub valleys that merge before crossing the road and is 5 m wide and 6 m deep. The gullies crossing the Mai Mahiu-Naivasha Road join those draining the northeastern slopes of Longonot contributing to the extensive siltation and flooding from +3 Km to +5.7 Km. The subsequent discharge from culverts results in damages downstream and road structures (Photograph 16).

Photograph 16: Box culvert damaged by discharged floodwater

x) Road downstream area

The areas downstream of the road are largely flat and undulating areas but have been scoured by erosion caused by culverts discharge. The road acts as a dam wall, holding back and spreading water and silt in the upper areas and discharging it below the culverts or through overtopping. Silt and sand are left in the upper part of the road and water and the light pumice stones are deposited on the lower side. The pumice is strewn over grasslands, smothering vegetation and creating deposition zones devoid of vegetation. The water flowing water initiates a new cycle of gully formation, transforms roads into rivers that inundate and cutoff the Magadi road.

Detailed hydrological conditions are presented in the Geology and Hydrology Section of the road project report.

ii) Geology

Geology of the road passage area is dominated by Mt Longonot and Suswa volcanoes that form part of the Kenya Dome, an elevated area rising above 2500 m asl. The Kenya Dome is located in the axial graben of the Kenya Rift formed during the Late Miocene, and continued to be active in Early Pliocene (Baker et al., 1972). Volcanoes in the area are associated with fissure eruptions of mafic lavas and caldera products of felsic rocks (Baker *et al.*, 1972). Volcanism is prominent along the rift axis but also in its flanks (Davies and Macdonald, 1987; Omenda, 1997).

The Kenya Dome area has three caldera volcanoes–Menengai, Longonot, and Suswa. Menengai caldera volcano is a trachytic composition; Longonot is composed by trachyte and mixed (trachyte/basalt) lava flows, while Suswa has a composition of trachytic-phonolitic lava flows

and pyroclastic rocks (Clarke et al., 1990). The Olkaria volcanic complex is also found in this area but has no caldera. There is evidence of magma mixing at Olkaria complex, Menengai, Longonot and Suswa (Rogers *et al*., 2004).

There are several fault lines associated with the formation of the rift valley. A full geological study of the road passage area is contained in the Geology and Hydrology section of the main report.

5.2.2 Soils

The Maai Mahiu area soils are derived from volcanic material and sediments of various ages and origins. The Mai Mahiu Basin is covered by Pleistocene Volcanics overlain by younger Pleistocene and Holocene sediments, laid down during moist periods (pluvials) when a lake of varying size, covered much of the Rift floor. Lacustrine sediments are found on the surface of the entire Mai Mahiu Basin area except where erosion had removed them and also occur below and between the older volcanics. They are described from borehole cores as being principally obsidic and trachytic, but more likely to be water lain ash and other pyroclastic material intercalated within these formations. Geological formations at the site have been identified as the Olkaria comendites with intercalated pyroclastics and sediments at depth; pantellerite laval flows, Akira pumice and lacustrine sediments.

The soils are generally heterogeneous with fine silt and silty sandy particles (silt 70%, sand 25%, organics/others 5%). In past studies of rock density they were documented to float on water due to their low specific gravity. This material is easily eroded by heavy downpour with mass movement that explains the presence of reworked sediments and re-depositions in the area.

Underlying soil and geological conditions in the upper areas have bearing on the road deriving from their characteristics. Volcanic rocks that dominate the upper elevation Longonot area comprise of tephrites, trachytes, phonolites, basalts, tiffs agglomerates and acid lava such as rhyolites, commendite and obsidian where various areas have faults including the Njorowa Gorge in Hell's Gate National Park (Anon, 1990). Soils around Mt. Longonot reflect the geology of underlying rock, with main soil types including ash and friable clay and loamy soils. The soils are very porous with reduced water holding capacity, which contributes to physical weathering creating the characteristic deep valleys running down the mountain. The soils are friable, highly erodible and unconsolidated, rendering them susceptible to scouring and thus generating large quantities of soil that are deposited along the road. The resultant deep gullies and ravines have near vertical banks, with under cutting and bank cave-ins. In the ravines, the erosion process reveals banding and differential deposition of different materials with varying texture and composition in the area (Photograph 17).

5.2.3 Climate

The climate is generally dry and hot. The low rainfall combined with the lavas that form the bedrock, produce a semi-arid landscape. Rainfall in the study area is concentrated in two rainy seasons from March-May and October–November. The mean annual temperature is 8 °C and an average annual potential evaporation of 1650 and 2300 mm.

Photograph 17: A gully adjacent to the road, showing the stratified soil profile and bank collapse in the road passage area

Rainfall in the eastern Mau area of Nairegia Enkare is about 1400 mm with a temperature range of 5 ^{o}C in July to 28 ^{o}C in December to February.

The rainfall sometimes falls as localized and intense thunderstorms triggering flashfloods in the area. The southeast facing slopes receive more rainfall due to their orientation relative to prevailing winds. The rapid descent of the flashfloods downstream is due to the steep sloppy terrain compounded by the thin soils that are rapidly saturated and shallow rocks in some areas. During the dry season, the landscape manifests as semiarid area with frequent dust storms. Figure 3 shows the rainfall patterns in the area traversed by the road and Table 8 the attributes of the data stations.

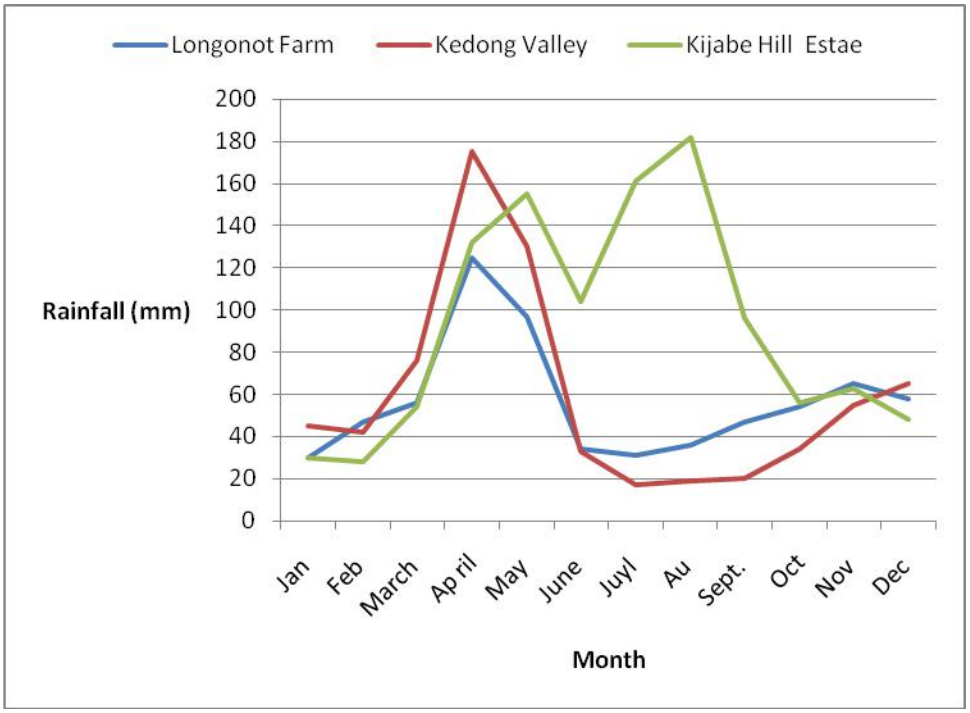

Figure 3: Rainfall (in mm) distribution of Kedong Valley, Longonot Farm and Kijabe Hill Estate in the road hinterland area

Table 8: Attributes of meteorological stations where data on rainfall in the road traverse area was obtained

Station	Station ID	Altitude (m asl)	Mean Annual rainfall (mm)
Kedong Valley	9036214	1890	680
Longonot Farm	9036011	1890	710
Kijabe Hill Estate	9036000	2057	1108

Source: Farm Management Handbook of Kenya, vol. II, Part B, Central Kenya, p. 382.

As cited in : Environmental and social impact assessment (ESIA) study report Suswa Geothermal Development project in Narok and Kajiado counties (undated) website: https://www.gitpa.org/web/rapport%20esi%20suwa%20.pdf

5.2.4 Air Quality

The air quality was measured along selected stations along the road that took into account towns, schools, open areas and areas with new infrastructure construction. Figure 4 shows the readings of PM 2.5 at selected areas along the road on 1st August 2019 while the values are shown in Table 9.

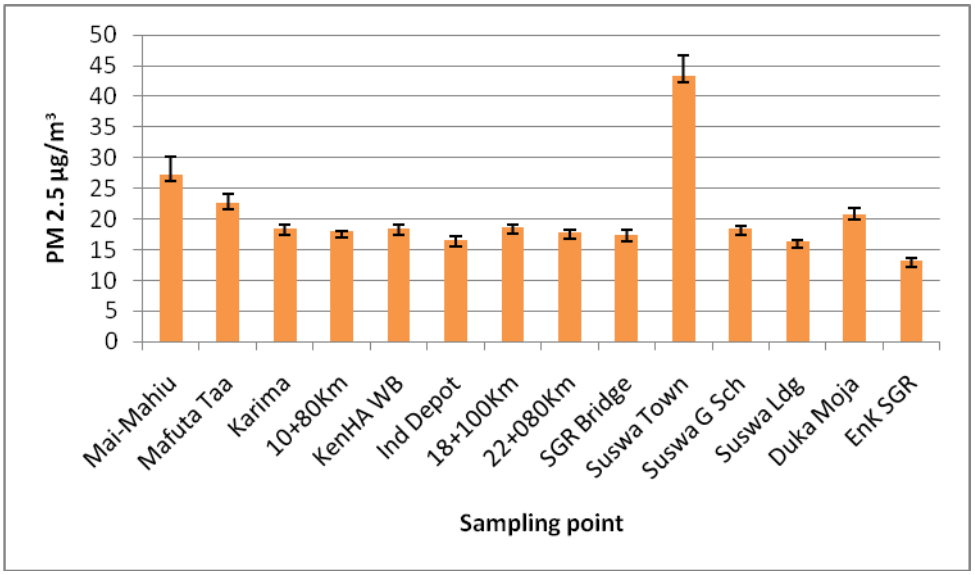

Figure 4: Mean recorded PM 2.5 (µg/m$^{3)}$ along the Suswa-Mai Mahiu road

Table 9: PM 2.5 (µg/m$^{3)}$ recordings at sampling locations along the Suswa-Mai Mahiu Road and the mean, minimum and maximum values obtained

Location	Mean	Minimum	Maximum
Mai-Mahiu	27.2	19	45
Mafuta Taa	22.7	20	25
Karima	18.5	17	20
10+80 Km	18.0	18	18
KeNHA Weigh Bridge	18.5	17	20
Inland Depot	16.5	15	18
18+100 Km	18.6	17	20
22+080 Km	17.8	17	19
SGR Bridge	17.4	16	20
Suswa Town	43.3	27	64
Suswa Girls Sec. School	18.5	18	19
Suswa Lodge entry	16.4	16	17
Olasiti	20.8	18	25
Enkare Nairegia SGR Bridge	13.3	12	14

The mean values are below NEMA annual average guidelines of PM 2.5 Annual Average , 35 µg/m^3 and 24 hours 75 µg/m^3 but the maximum values are in excess at some locations. The peaks are of concern as they coincided with passage of heavy trucks and buses.

5.2.5 Surface and Groundwater Resources

The road passage area is devoid of permanent surface water bodies with the exception of seasonal streams near Suswa and Mai Mahiu towns. The largest amount of water is runoff from

Suswa and Longonot Mountains encountered during heavy storms and lead to overtopping, road cuts, and closure as silt and boulders are deposited on the road (Photograph 18). Driving conditions are hazardous along the road after rains as dry weather conditions and vehicle passage grinds the silt into dust particles that reduce visibility considerably placing road users' lives at risk (Photograph 19). The dynamics of the flows is captured in the Hydrology Section of main study where it informs on the amounts of discharge and design of structures.

From literature, all boreholes drilled in the area have failed to yield water and only steam in some instances. The failed boreholes indicate that the area is deficient in ground water sources.

Photograph 18: Boulders deposited rock along the Suswa-Mai Mahiu road by flood water

Photograph 19: Hazardous driving conditions due to dust from soil deposited on the road

5.2.6 Water Quality

The road project area is water deficit and has no permanent rivers or springs but crosses many lagas with flash flow during rains that cease soon after. Running water was not encountered during filed visits and a determination of the water quality was not undertaken. Samples were collected from roadside pools and a pan dam near the SGR used for livestock watering. Samples were collected for *in situ* water quality analysis as shown in Table 10 below: A full water quality analysis parameter was not considered necessary as the pools are temporary and hold water only after rains or in the wet season. Domestic use water is either rain harvested or trucked using water bowsers for the residents and restaurants in the towns (Photograph 20).

Table 10: In situ water quality parameters for pools encountered along the Suswa-Mai Mahiu road: (ORP- Oxidation Reduction Potential, TDS- Total Dissolved Solids, and DO- Dissolved Oxygen)

Source	pH	Conductivity	Salinity	ORP	TDS	Visibility	DO
Karima pool	7.49	759	0.37	-41	380	2.2	1.5
SGR Bridge pan	6.5	211	0.10	10.5	103	3	3
Suswa +32.2 Km	7.35	46	0.02	37.5	23	4	5

5.2.7 Terrestrial/Aquatic Environment: Flora and Fauna

i) Flora

The vegetation is characterized by mixed or pure stands of the shrub and small trees species of *Tarchonanthus camphoratus* and *Acacia drepanolobium* interspersed with *Digitaria sp, Themeda traindra and Cymbopogon sp* grasses in flat and laga areas and with *Erica arborea, Dodonaea* and *Merella salicifolia* woody species on the mountaintops.

In the lowlands with water courses, there are stands of *Acacia xanthophloea* indicative of wetter soil conditions and the upper parts of the road with overtopping and siltation have similar stands. Where farming and overgrazing has not interfered with the natural vegetation, there are *Acacia drepanolobium* and *A. kirkii* grasslands. The herbaceous layer is dominated by *Themeda triadra, Penisetum mezianum* in poorly drained areas and *Cynodon dactlyon*, *Sporobolus robusta* and patches of *Cenchrus ciliaris* are encountered.

Photograph 20 (a&b): “Opportunity” for livestock watering and “cost” in road side water pans and grazing areas along the Suswa-Mai Mahiu road

The silt pans formed at terminal points of gullies and depositional zones support luscious growth of *Solanum nicotiana* bushes reaching 3 m high in older pans and 1 to 1.5 m in recent depositions. Under these bushes, there is poor establishment of herbaceous plants. Such vegetation is found in the hinterland of the SGR crossing area that has a thick bush of castor oil seed plants (*Ricinus communis*) interspersed with stinging nettles *(Uttica masaica)* shown in photograph 21.

Photograph 21: Thick bushes of woody shrubs in the fertile deposition zones along water courses

Well-developed woodlands occur along the Kendong river valley and around the Ketraco power station at Suswa. Patches of these woodlands occur upstream along the Ol Jorowa Gorge discharge with remnant fig trees (*Ficus capensis*).

ii) Fauna

The larger landscape supports a variety of mammals and avifauna that were until recently common along the road. Mammalian species in the area include zebra (*Equus burchelli*), Grant's gazelle (*Gazella granti*), Coke's hartebeest (*Alcelaphalus buselaphus*), Thompson's gazelle (*Gazella thomsoni*), Maasai giraffe (*Giraffa camelopardalis*), Steinbok (*Raphicerus campestris*), Common duiker (*Cephalopus grimmia*), Bushbuck (*Tragelaphus scriptus*), Eland (*Tragelaphus oryx*), Impala (*Aepyceros melampus*), warthog (*Phacochoerus aethiopicus*) and Cape buffalo (*Syncerus caffer*). Predator species include leopard (*Panthera pardus*), Silver backed jackal (*Canis mesomelas*), Bat eared fox (*Otocyon megalotis*) and spotted hyena (*Crocuta crocuta*). However, they have largely been exterminated by land use changes outside protected areas and subsistence poaching. There were approximately 43 avian species recorded in the landscape comprising of raptors, carnivores, omnivores, frugivores, nectarivores and insectivores.

iii) Wildlife and Livestock continuum

Wildlife and livestock count data was collected in different census zones in the study area (Figure 5). The study area was divided into zones comprising of split grazing west of Suswa

Town, Suswa Resort area and Mai Mahiu traverse through Kedong Ranch, split into Kedong West and Kedong East. The last zone was the Longonot-Satellite settlement area.

In the split grazing area livestock paddocks were interspersed with crop fields. Suswa Resort census zone was a free grazing area with few settlements while Kedong West and East were within Kedong and Akira Ranches. The Longonot-Satellite census zone was principally under small scale mixed farming.

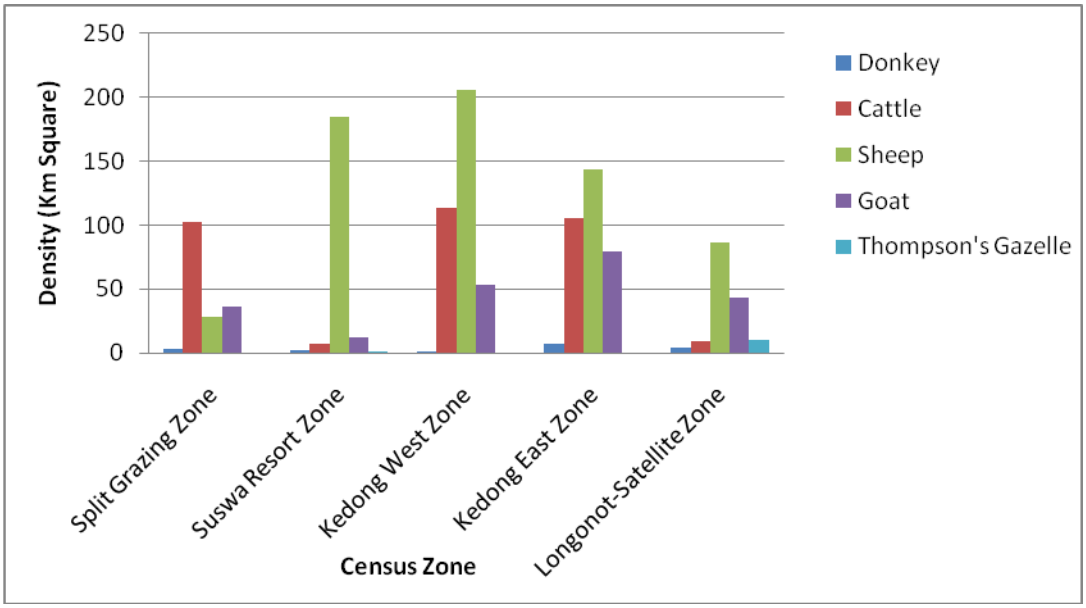

Figure 5: Livestock and wildlife density in the study area

Kedong West and East census zones had the highest density of livestock with cattle numbers highest in Kedong West. Sheep were also numerous especially in the Suswa Resort zone. Overall Kedong Ranch had the highest livestock density. Wildlife was absent in all other zones except in Longonot-Satellite where Thompson's gazelles were encountered at low density of 10 Km^{-2}. A lone gazelle was encountered in the Suswa Resort census zone.

The incursions of human activities livestock into rangelands leading to overgrazing, clearing of woody vegetation for charcoaling, and sand harvesting and trucking have had negative impacts on wildlife populations.

iv) Aquatic natural Resources

Aquatic resources are lacking as the area is devoid of permanently flowing or standing water bodies. Dams dug by SGR in the catchment had not collected water during the field survey.

5.2.8 Land Resources

i) Conservation areas

The project area is not adjacent to any protected or conservation areas but is contiguous with Hell's Gate and Mt Longonot National Parks whose boundaries are at least 15 Km by road. The road traverse areas historically had high densities of wildlife species that is no longer present. Livestock intrusion, sand harvesting activities and charcoal burning has made it hostile to wildlife. Poaching for bush meat for the nearby market centers is rampant according to key informants and community members interviewed. Kedong Ranch has a substantive wildlife presence in the upper parts near the Ranch headquarters. Measures will be incorporated into the design to allow for migrations if wildlife population increases with better protection and conservation with drainage structures height between 1.5 and 2 m. Gently sloping road banks will be created to enable passage of taller species such as giraffes.

ii) Land use

The main land us types in the project area are dominated by ranching, agro-pastoralism, small scale holder agriculture and open range pastoral livestock production. Maize is the predominant crop in the area in wetter areas with deep soils. Maize farms are observed around Mai Mahiu Town, Suswa and the vicinity of Olasiti Township. The higher elevated in the Nairegia Enkare escarpment and Mt Longonot slopes are farming areas. The farmers comprise of local landowners and lease farmers. Soil and water conservation is poorly practiced in the area with few structures for soil and water conservation.

iii) Agro-pastoralism

From Suswa to Olasiti a mix of open range and paddock livestock production system is in place with well fenced and padlocked land parcels being observed. Pasture conservation is practiced and some farmers have Boma Rhode fodder grass parcels on their farms. A large portion of the range in the northern slopes of Mt Suswa is under free-range community grazing with signs of overgrazing and land denudation. Erosion has occurred, creating deep gullies and exposing bare rocks soils are shallow. This generates the silt and floods that overtop the road after Suswa Town at +Km 35 near the entrance to Mt Suswa Resort. The erosion hazard in the Mount Suswa area is magnified by the steep gradient, shallow unconsolidated soils, shallow sheet rock just below surfaces and numerous small valleys in water collects.

In the mixed farming area west of Suswa, the farms are well conserved with good land cover and soil conservation. There is extensive water harvesting and storage in water ponds for watering livestock and domestic use has reduced runoff and ensured water availability.

iv) Ranching and open grazing areas

The area between Satellite and Suswa Town falls within Akira, Kedong and Utheri wa Lari ranches. There are activities by livestock farmers, sand harvesters, and charcoal burners. The combination of their activities has resulted in massive land degradation, opening up of gullies and generation of massive silt loads and runoff water that floods and cuts off the road. Similar

activities in the southern slopes of Mt Longonot and Kedong Plains partly generate the runoff between the SGR Bridge and Satellite rural centre.

v) Olkaria Geothermal Fields

Geothermal power generation is undertaken in the Olkaria Hill and outlying areas with a network of bituminous and earth roads to access the established infrastructure. The roads, well pads and built-up areas generate runoff that flows into the Ol Jorowa Gorge as flash floods that has had fatal consequences in the recent past with loss of life. The gorge discharge combines with runoff from other degraded areas largely contributes to the massive flooding and siltation at the SGR crossing point. The flow dislodges rocks from the Gorge and scours pumice from the mountain sides that are deposited along the road (Photograph 22). Uncontrolled grazing in the Olkaria Hill loosens unconsolidated soils and initiates rill erosion points that conglomerate into deep gullies downhill.

Photograph 22: Erosion initiated by runoff water from a geothermal well pad

vi) Sand harvesting

Large scale sand harvesting occurs in the gullies and other areas with silt deposits over the 24 hour cycle but is most intense during the day. All gullies are exploited with the Kedong and Ol Jorowa Gorge deposits being heavily excavated (Photograph 22). The movement of the sand trucks loosens soil within the gullies, enhancing subsequent erosion and bank cave-ins that widen the size of the gullies. The removal of freshly deposited sand prevents gully healing, precipitating a cycle of erosion, bank cave-ins and gully widening, scarring the land further. An estimated 1,000 people directly depend on the sand mining with an estimated 30,000 indirect beneficiaries. The sand harvesting extends from gullies with fresh deposits to older areas with established vegetation (Photograph 23). The removal of the sand, vegetation, and scouring of the ground initiates erosion and widening.

Photograph 23&24: Sand harvesting trucks access excavation of old and vegetated deposits exacerbating siltation on along the road

The sand harvesting has intensified after it was banned in Makueni, Kitui and Machakos Counties. Data from the weigh bridge indicate that 800-1,000 trucks transport sand weekly, a minimum of 100 lorry loads of sand harvested daily. Approximately 70% are 18 tones trucks while the others are 26-30 tonners. At the minimum, 2,100 tons of sand are removed every day and transported along the road. Overloaded and road unworthy trucks avoid the weighbridge, others operate in the northern sector along the Mai Mahiu-Naivasha road or the Moi South Lake Road. Deliberate avoidance of the weighbridge accounts for a huge undocumented sand off take.

Sand harvesting shifts to the road after siltation and top-over events. The industry is multi layered with various interests groups comprising of locals who are paid for access to sand harvesting sites, the sand miners and loaders, the lorry owners, sand harvesting associations officials, local leaders and county toll station operations.

vii) Charcoal burning

Uncontrolled charcoal burning is occurring in Kedong and Akira ranches with large swathes of *Acacia-Tarchonanthus* woodlands being cleared. The charcoal burners after exhausting the mature trees are currently uprooting the remaining stumps for charcoal burning, leaving the soils bare (Photographs 25&26). The wasteful traditional kiln method uses undergrowth and twigs in the charcoaling process leading to clearing that and leave the bare land prone to erosion. The combination of overgrazing, charcoal burning and rutted access tracks accelerates erosion and availability of the sand resource attracting more sand harvesters into the area. The vicious cycle lead to a downward spiral of environmental deterioration.

Photograph 25&26: Charcoal burning and land clearance leading to soil erosion

iii) Transport infrastructure development

a) Existing Suswa-Mai Mahiu road

The existing road set for decommissioning has adverse impacts on itself, its immediate environs and downstream landscapes and watercourses. The orientation of the road and elevation creates a dam wall structure that accumulates silt on the upper side and trap the water causing overtopping in several places. The damming effect results in silt accumulation clogging culverts and extensively spreading the floodwater. The pumice in the bed load float on the water with deposition downstream of the road where it smoothers grass and prevent vegetation growth. The flood water then flows onwards and where the local topography enabling channeling down cut and form gullies. Functional drainage structures spout water out of culverts eroding the soils and creating gullies in the immediate vicinity of the road, as back ripples undermine the road and drainage structures foundations. Where fault lines form the drainage system, precipitous and gullies with overhung banks form as infilling material is washed away. The impacts of the road on downstream landscapes is demonstrated in the Ewaso and Utheri wa Lari areas.

The orientation of the road relative to the inflows causes water to flow parallel to the road (Photograph 27). The parallel flow incises gullies that run parallel to the road and join inflows from other areas causing extensive flood zones such as at the SGR crossing point.

Photograph 27: Road foundation undermining by water in road parallel gully

b) Standard Gauge Railway (SGR), ICD and Industrial Park infrastructure

The SGR is now a prominent feature of the landscape traversed by the road due to its elevation, size of embanKments and associated infrastructure. At the crossing point at +35 Km, the railway storm water drainage is parallel to the road, channeling runoff water and other gullies' discharge to the low point. The railway embanKment wall also channels water to the crossing point, increasing the amount of water, silt and rocks deposited along the road (Photograph 28&29). The point is a flow convergence low point for water from Suswa, Ol Jorowa Gorge and parts of Longonot. The dykes for the KETRACO station further impede flow and result in back ponding.

Photograph 28&29: SGR drainage structures interference with water flows and with impacts on the Suswa-Mai Mahiu Road

The old narrow gauge railway bridge upstream of the low point discharges more runoff from the catchment, compounding the problem at low point, In the Syabei area below the Nairegia Enkare escarpment, SGR works have also initiated erosion and destruction of a preexisting road. The Suswa station is likely to increase the extent of impermeable surfaces, enhancing the amount of runoff and more flooding.

The SGR stations at Mai Maju and Suswa, the Inland Container depot, Industrial, expanded weigh bridge/toll station and interchange at +15 Km will increase impermeable surfaces increasing the water flow in the road and lower lying areas. The interchange at the inland container turnoff will have toilet facilities, business points and other facilities that will also increase floodwater, solid and liquid waste generation.

c) Mai Mahiu-Naivasha Road

The road is part of the land use in the catchment and its presence and structures have a bearing on the Suswa-Mai Mahiu road. The road has storm water drainage systems and culverts that channel water from the Ihindu and Viewpoint areas. The water on exiting the culverts initiate gullies that are immediately located on the lower part of the road, increasing the silt load that tops the Suswa-Mai Mahiu road around +4Km (Photograph 30). The drainage from the road also contributes to water flowing from Mt Longonot valleys and enhances the siltation at topping over at the Karima Church where a fault line with sinkholes is located. Management of the storm water drainage and prevention of gullies formation is important.

Photograph 30: Sand harvesting in gullies formed by runoff water from Mai Mahiu-Naivasha road

d) Rural access roads

The rural access roads network contributes to siltation and flooding along the road. Storm water flowing in the unpaved roads collects and forms small rills that merge to form gullies. In several areas, the road network transforms into impassable gullies that cut off the road links (Photograph 31). Motorists avoiding the patches drive off road rutting the surface and widening the gullies. The new rural road under construction by Nakuru County Government from Olkaria to Suswa is already initiating soil erosion and gully formation below the KenGen RAP land. Roads in Nairegia Enkare area are essentially trenches that transform into rivers during rains. Small rural tracks and cattle tracks are erosion gully formation foci.

Photograph 31: Rural access road transforming into a gully due to poor drainage structure

5.2.9 Archaeological, Historical and Cultural Sites

There are no archeological, historical, or cultural sites in the road passage areas from literature and key informants. Care will be taken for their documentation, inventorying, and conservation if any finds occur during the road construction.

5.2.10 Visual Aesthetics

The road trends across the bottom of the valley between Southeast Mau escarpment from Nairegia Enkare and the Kikuyu escarpment that form part of the Eastern Rift valley. The road traverses the terrain at an elevation of about a meter in most palaces and does not disrupt the skyline or have a visual intrusion when viewed from elevated areas. From the road, Mt Longonot, Mt Suswa, cones, and the western and eastern escarpments are clearly visible. Redevelopment of the road will not incorporate elevated structures that would visually pollute the passage landscape aesthetics.

5.2.11 Noise and Vibrations

The ambient noise levels along the road were recorded at 4 Km intervals and special interest areas on 31st August 2019. The main sources of noise were vehicular, birds' calls, wind in the vegetation, human communication and other activities in the built up areas. The noise levels

obtained varied with nature of activities at a given area, the type of vehicle passing and crowd size. The minimum, maximum and mean sound levels are shown in Figure 6 and Table 11 against NEMA standards in Table 12 below.

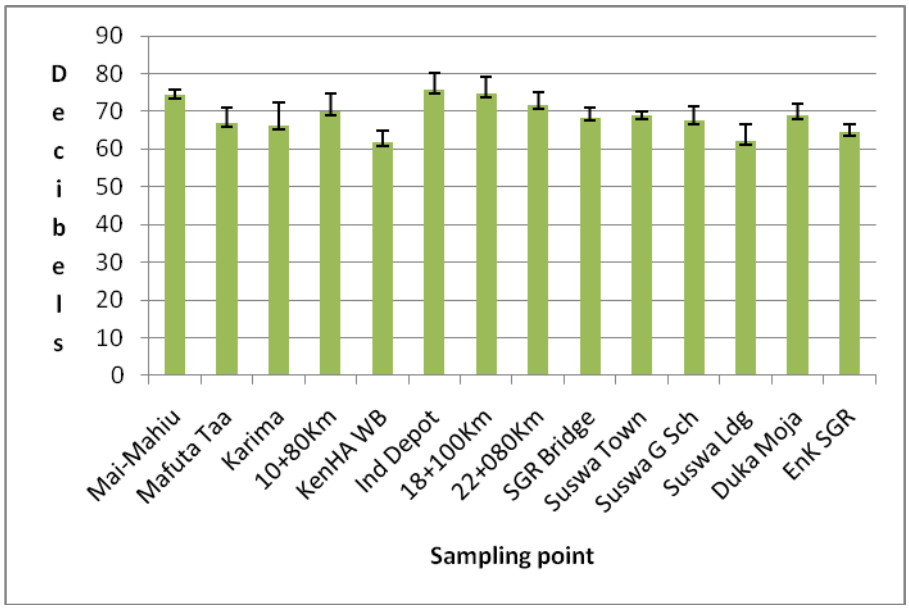

Figure 6: Noise levels recorded at selected points along the Suswa-Mai Mahiu Road

Table 11: Noise levels recorded at various sampling point along the Mai-Mahiu Road with the mean, minimum and maximum levels on the sampling day

Location	Mean	Minimum	Maximum
Mai-Mahiu	74.4	69	81
Mafuta Taa	66.8	51	89
Karima	66.3	41	84
10+80 Km	70.1	52	93
KenHA WB	61.8	50.7	78
Ind Depot	75.7	53	92
18+100 Km	74.7	51	93
22+080 Km	71.7	53	89
SGR Bridge	68.4	48	91
Suswa Town	68.8	60	75
Suswa G Sch	67.7	47	90
Suswa Ldg	62.0	45	82
Olasiti	68.9	45	84
EnK SGR	64.6	51	85

Table 12: NEMA ambient noise levels criteria guidelines

Receptor		Maximum allowable noise in decibels	
		Day Time	Night Time
A	Silent Zone	40	35
B	Places of worship	40	35
C	Residential	45	35
	Indoor		35
	Outdoor	50	35
D	Mixed residential/commercial	55	35
E	Commercial	60	35

Source: NEMA Environmental Management and Coordination Act (Noise and Excessive Vibration Pollution Control) Regulations, 2009

The recorded levels near the road exceed the NEMA regulatory standards and hence pose a danger to the people in nearby businesses and pedestrians along the road.

5.2.12 Vibrations and noise levels

Ground vibration was measured on a tri-axial arrangement of velocity transducers and air blast by means of air blast microphone using the Instantel Micromate. The system was set to trigger on ground vibration and/or air blast and configured to minimize false triggers due to noise or vibrations generated in the vicinity of the monitor. This was to ensure accurate and effective monitoring of any blast related event. The areas selected for monitoring were selected on the basis of nearness to urban centres, schools or institutions, planned developments and rural aspects. The results are presented in table 13.

During the vibrations, monitoring exercise conducted on 10th August 2019, traffic was the only source of vibrations and noise. The recorded vibration levels within the recommended limit of 5 mm/s set by the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009.

5.2.13 Solid and Liquid Wastes

The towns along the road fall under the of Nakuru and Narok Counties jurisdictions whose waste management systems are applicable. In Mai Mahiu Town, the County Government collects garbage infrequently but at least once in every one in 30 days according to the residents. The residents rely largely on private waste collectors such as CTC or manage their own waste through burning. When collected, the waste is taken to a dumpsite at Karima. In Suswa and Olasiti a formal system for waste collection and disposal does not exist. Residents gather their waste and burn it with evidence of waste burn sites outside business premises and residences common in the streets.

The centers have no sewerage reticulation and residents use pit latrines and sceptic tanks in hotels and restaurants. The stormwater drainage trenches along the highway are the preferred waste management sites with attendant potential problems for blockage and overflow. The

roadsides are along the stretch of the road are littered with traveler waste which accumulates at culverts and restricted flow points along the road.

Table 13: Vvibrations and noise level measurement selected points along the Suswa-Mai Mahiu road

Location	**T- PPV (mm/s)**	**V- PPV (mm/s)**	**L- PPV (mm/s)**	**NEMA limits (mm/s)**	**T- Freq (Hz)**	**V- Freq (Hz)**	**L- Freq (Hz)**	**Peak Sound Pressure (dB)**
Mai Mahiu Junction	0.158	<0.127	0.150	**5**	42.7	3.0	51.2	104.5
Mafuta Taa	1.127	0.623	3.271	**5**	28.4	2.6	12.5	102.2
Fault line	0.166	0.725	0.418	**5**	24.4	36.6	28.4	102.9
10+080 Km	0.307	0.489	0.504	**5**	23.3	24.4	17.1	110.6
KeNHA weigh bridge	0.181	0.465	0.260	**5**	51.2	24.4	51.2	99.3
14+220 Km	0.410	0.796	0.694	**5**	85.3	34.1	85.3	95.4
20+020 Km	0.497	1.253	0.615	**5**	36.6	23.3	>100	106.0
SGR Bridge 24+940 Km	0.236	0.520	0.339	**5**	28.4	28.4	24.4	100.4
Suswa Market	0.497	0.646	0.363	**5**	32.0	18.3	21.3	122.7
Suswa Girls High School	0.607	0.489	0.654	**5**	>100	20.5	>100	102.0
Suswa Ranch Resort	0.150	0.260	<0.127	**5**	12.5	9.3	39.4	94.9
Olasiti	0.205	0.244	0.213	**5**	13.1	21.3	19.0	88.2
45+060 SGR Camp	0.260	0.276	0.386	**5**	24.4	16.0	85.3	95.7
SGR Enkare Bridge	0.410	0.804	0.575	**5**	36.6	32.0	24.4	103.6
SGR Low traffic interval	0.181	0.465	0.260	**5**	51.2	24.4	51.2	96.2

Explanation of Column Headings in the table above:
L, T & V-PPV: Longitudinal, Transverse & Vertical Peak Particle Velocities (mm/s)
L, T & V-Freq: Longitudinal, Transverse & Vertical Dominate Frequencies (Hz)
dB: Peak Air Blast Recorded (dB)
*: Geophone/Microphone Limit Exceeded

5.3 SOCIAL-ECONOMIC BASELINE SURVEY

5.3.1 Social Characteristics

a) Demography

The demographic characteristics assessed were population size and density and their change over time, as well household size, age and gender structures. Population size and density are important because they indicate the population served by the road and who might be affected positively or negatively by the road construction works. A change in population size and density also has implications on the capacity of the road to serve the population. On the other hand, household size and its age and gender structure are important variables for assessment because they not only show the population groups that will be impacted by the road but also the population pool from which local labour may be sourced and a potential source of conflict should their expectations from the road project not be met.

The general demographic profile was determined for Naivasha and Narok East sub-counties based on data and information drawn from the Nakuru and Narok counties' Integrated Development Plans for the year 2018 (Table 14). The Naivasha sub-county covers an area of 2059.5 Km^2, has a population estimate of 295,000 in 2018 and which is projected to increase to about 334,000 by the year 2022. The Naivasha population change from 2009 to 2018 was 70,800 inhabitants, which translates into a cumulative change of 31.6% and an annual increase of 2.8%. In the Mai Mahiu town, the population change from 2009 to 2018 was 31.6% and an average increase of 2.8%. The population change in both Naivasha sub-county and Mai-Mahiu town is only slightly higher than the Kenya national population growth of 2.5%. The population increase demonstrates the need for infrastructure upgrading including the current road project. The population density is estimated at 174 Km^{-2} by 2018 and 19 Km^{-2} in 2022, and which is likely to increase given the proposed and on-going infrastructural developments in the area.

Table 24 Population Distribution in the sub-counties the road Project Traverses

	Population size			Population density			Area in sq. Km
Sub-county	2009	2018	2022	2009	2018	2022	
Naivasha	224,141	294,941	333,211	132	174	197	2059.5
Mai-Mahiu[a]	11,230	14,777	16,695				
Narok East	82,956	110,232	124,991	37	50	56	1685.8
Notes: [a] as part of Naivasha							

The Narok East sub-county covers an area of 1685.8 Km^2, has a population estimate of 110,000 in 2018 and projected to increase to about 125,000 by 2022 (i.e., an increase of 15,000 for the five year period, and of 43,000 from 2009). The Narok East population change from 2009 to 2018 was 27,276 inhabitants, which translates to 32.9%, and an average increase of 2.9%, which is slightly higher than the national population growth rate of 2.5%. The population increase in the sub-counties indicates the need for

infrastructure upgrading including the current road project. The population density is estimated at 50 Km^{-2} by 2018 and 5 Km^{-2} in 2022. Like the Naivasha case, the density is likely to increase given the proposed and on-going infrastructural developments in the area.

The household size, age and gender structure were determined from the household survey data is as shown in Table 15. Among the 80 respondents studied, the number of household members was 494 of whom 51.6% (n=255) were male 48.4% (n=239) were female. This translates to a sex ratio (number of men in every 100 women) of 1.1, which is slightly higher than the national sex ratio of .99. Across age and gender groups, males were appreciably more in the 35-64 age group (22.7%) compared to females (18.4%); while females (24.3%) were appreciably more in the 25 -34 age group compared to the males (19.6%)

Of great significance for this study is the proportion of the youth (15 – 34 age groups) who might seek employment in the construction works; and, according to the results they comprised about 40% among males, and 43.5% among females. The relatively large proportion of the youth indicates a potential or opportunity to be tapped, for example, as a source of labour, but also a risk, for example, if there would be not enough job opportunities for them (even though it cannot be assumed that everyone in this age category will be in need or seeking employment). Notably, the household survey showed that 42% of the respondents cited youth employment as a main positive impact of the road project, 7.5% noted that lack of employment could cause hostility from the local community and 11% of the respondents cited employment as a mitigation measure against the hostility. Further, demand for youth employment for both genders was echoed in the public consultation meetings.

Table 15: Age distribution of household members in road project area

	Male		Female	
Age group (years)	Frequency	Percent	Frequency	Percent
0-14	63	24.7	60	25.1
15-24	50	19.6	46	19.2
25-34	50	19.6	58	24.3
35-64	58	22.7	44	18.4
65+	34	13.3	31	13.0
Total	255	100	239	100

b) Education

The significance of education vis-à-vis the road project is primarily in relation to the distribution of education institutions in an area, as well as in the related variables such as enrolment and achievement. The distribution of schools has relevance in terms of use of the road to access the utilities and the related issue of road safety. Educational enrolment

and achievement are indicators of the nature (or extent) of human resource capacity that can be exploited as local labour in the road project.

c) Distribution and access to educational facilities

The household survey found out that the distance from the road to respondents' nearest primary and secondary schools ranged from 0.1 – 9 Km (mean – 1.3 Km) and 0.1 – 6 Km (mean – 1.3 Km) respectively. The households that used the road to access the primary schools were 53.8% while 46.3% had no primary school attending members or were located on the same side of the road as the school. The corresponding figures for those who used the road to access secondary schools were 77.5%. The results demonstrate significance of the road as an access to the educational facilities.

The results further showed that in Narok East, there were 12 primary schools reported to be proximal to the road project while in Naivasha there were 10 primary schools (See table 16). In Narok East, the primary schools proximal to fairly large number of households were Suswa (22.5%), Olasiti (17.5%) and Empaash (15%) while in Naivasha the corresponding primary schools were Karima (32.5%), Ngeya (22.5%) and PCEA (15%). On the other hand, the proximal secondary schools were Olasiti (45%) and Suswa (55%) in Narok East; and Karima mixed (70%) in Naivasha. The high number of primary and secondary schools along the road project is important as it can guide the project implementers in determining at what points to erect safety features.

Table 16: Proximal primary and secondary schools by sub-county for questionnaire respondents

Narok East			**Naivasha**		
School	Frequency	Per cent	School	Frequency	Per cent
Suswa	9	22.5	Karima	13	32.5
Olasiti	7	17.5	Ngeya	9	22.5
Empaash	6	15	PCEA Jeremiah Gitau	6	15
Ole Sharo	4	10	Satellite	4	10
Olokarere	4	10	Zadwa	3	7.5
7 Other schools (1&2 households)	10	22.5	5 Other schools (1 & 2 households)	5	12.5
Secondary school					
Suswa Girls	22	55	Karima secondary	28	70
Olasiti Mixed	18	45	PCEA Jeremiah Gitau	6	15
			Mustard seed	3	7.5
			Others	2	5

d) Means of transport to access primary and secondary schools

The results showed that among the means used by households to access primary schools, walking was the most dominant (86.5%) followed by motorcycle (69.4%) and PSV (34.8%) as in Table 17. To access secondary schools, the most dominant means were PSV (72.5%), motorcycle (59.2%) and walking (58.6%). A key feature of the primary and secondary schools in the area is that there are a big number of day schools; hence, there is great tendency of children (and youth) walking along and crossing the road which is a safety risk factor. In this regard, a "random" conversation with a resident of Karima village revealed that he had actually lost a child to a road accident that occurred at the exit at Karima Mixed Secondary School where he was a form two (2) student. Other related risk factors were (are), the phenomenon of school children using motorcycles, PSVs, and indeed as observed during the study, hitching (i.e., travelling with free lifts) from personal vehicles. These are risks that from a social impact assessment point of view need to be taken seriously by the road project implementer such as for inclusion in a community risk reduction campaign.

Table 17: Means of transport used to access primary and secondary schools

Primary	Percent	Secondary
Walking	86.5	58.6
Motorcycle	69.4	59.2
Public service vehicle	34.8	72.5
Personal vehicle	25	31
School bus	-	40

e) Educational Attainment

The education level of the respondents was skewed with the majority having low education; notably, 70.1% ranged from having no education at all to having completed secondary school. Indeed, an appreciably high 22.5% had no education at all or had not completed primary school. The educational level varied by sub-county such that of those without any education, 100% were from Narok East. However, educational attainment was also low in Naivasha given that 62.5% of the respondents had only primary and secondary education. The low level of education infers the population under study is generally of low socioeconomic status. It may also mean that for those who might seek for employment in the road works, most of them may qualify only for unskilled or semi-skilled jobs.

f) Housing

Housing is a factor of socioeconomic status of an area and therefore an important indicator for setting a baseline and for impact assessment. Information about housing was drawn from county integrated development plans, observation during the household survey and field visits. In Narok East, rural housing types are mainly temporary structures made of mud and cow dung while in urban areas there are more permanent

structures made of stone and bricks. In Naivasha, most of the residential dwellings were of the permanent characteristics.

g) Land tenure systems

Land tenure is important in SIA because it shows the type of land occupancy, ownership, and legal recognition which are paramount consideration in understanding the community land ownership profile and serves as an input in the event of land acquisition and compensation related to the road project. The median size of land was five (5) acres while the minimum size was 0.25 and the maximum 30 acres. In Narok East, land size ranged from one (1) – 30 acres with a median (and mode) of 30 acres and a mean of 19.6 acres. In Naivasha, the land size ranged from one quarter of an acre to 20 acres with a median of one acre (mode - 1 acre; mean - 3.1 acres).

The results of the household survey showed that majority of the respondents were household members (89%) compared to businesses operators (11%). In terms of more specific type of land occupancy, owner occupiers, who would have the greatest stake in land acquisition and compensation, constituted a large majority of 75%, compared to residential tenants (12.5%), business operators (10%) and land lease tenants (2.5%). Corresponding to the large proportion of owner occupiers, those who reported to be freeholders were 72.5% while 12.5% were on leasehold and 15% were residential/business commercial tenants as in Table 18.

Table 18: Land tenure characteristics in the Suswa-Mai Mahiu area

Variable	Category	Frequency	Percent
General type of land occupancy	Household	71	89
	Business	9	11
Specific type of land occupancy	Owner occupier	60	75
	Residential tenant	10	12.5
	Business tenant	8	10
	Land lease tenant	2	2.5
Type of land ownership	Freehold	54	67.5
	Leasehold	11	13.8
	Tenancy	13	16.3
	Do not know	2	2.5
Type record/document for land ownership (n=61)[b]	Title deed	44	55
	Allotment letter	13	16
	Lease agreement	21	27
	Sale agreement	1	1
	Temporary occupation licence	1	1
Notes: [a] one respondent's premise doubled as household and business [b] only applies to those who reported any other type of occupancy excluding tenancy.			

In terms of legal documents of land ownership, most of the respondents reported that their households had title deed (72%) and allotment letters (21%) while only two (2) households possessed lease agreements, and one each possessed a sale agreement and a Temporary Occupancy License. Disaggregating for the two sub counties, the results showed that in Narok East the main legal documents for land ownership were title deeds (67%) and allotment letters (33%) while such documents as lease agreement and sale agreements were not in existence (Figure 7). In Naivasha the only main legal document for land ownership was title deed (81.8%) while there were few lease agreements (9.1%), sale agreement (1%) and temporary occupancy license (1%).

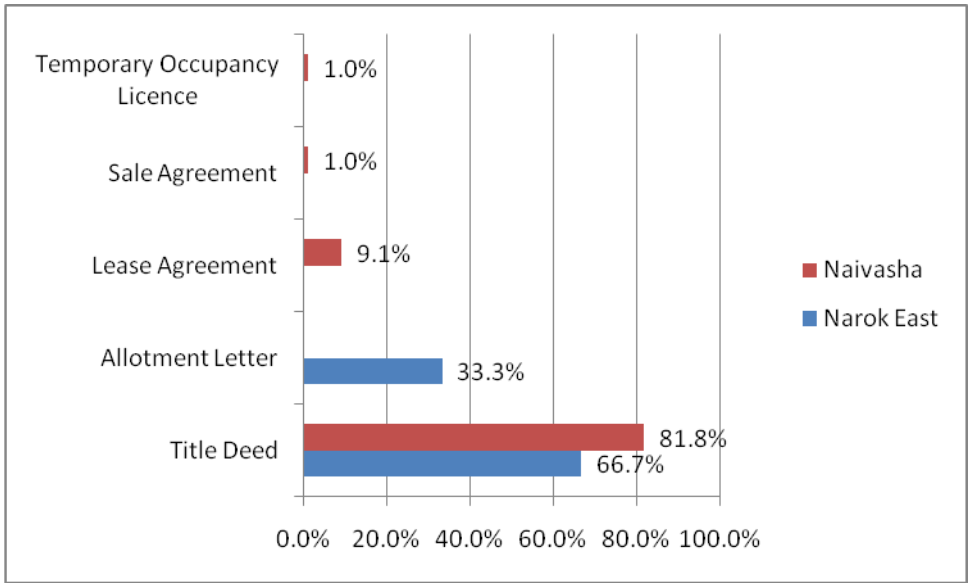

Figure 7: Type of land legal documents by Sub-County

5.3.2 Economic Settings

a) Industry, trade and commerce, and tourism

Based on observations, community interviews and CIDPs the common non-agricultural industries in Naivasha sub-county are quarrying around Karima, sand harvesting around Mt Longonot and along the project road, flour milling factory at Mai Mahiu. In Narok east there is significant mining of sand, ballast, Talek decorative stone and building stones. The CIDP reports that there is an on-going exploration for geothermal reserves in the Mt Suswa area and is expected to yield promising results.

b) Distribution and access to market/trading centres

The distribution and access to market centres from the road are important to project implementers as they would guide planning of construction works; for example, to avoid such works on market days to minimize disruptions. The information would also guide on road positions to erect such safety features as foot bridges, bumps and road signs.

The household survey results showed that the distance from the road to the main market centres ranged from 0.1 (i.e., those residing in the towns) to 5 Km with a mean distance of 1.2 Km (median – 1 Km). All the respondents (100%) reported that members of their households used the road project to access the markets. The results further showed that in Naivasha, Mai Mahiu was the nearest main market for all (100%) the households studied (while there are smaller trading centres, i.e., Mafuta Taa, Karima and Satellite). The Mai Mahiu trading centre has a vibrant farm produce, retail and wholesale businesses, restaurants, lodges and petrol stations. There is also a tourist curio shop between Karima and Satellite. In Narok East, Suswa and Olasiti are the main market centres with 52.5 % of households using the road to access Suswa, and 47.5% to access Olasiti. In both towns there are livestock markets, and Suswa is particularly dotted with meat outlets.

In terms of the means of transport used to access the market centres, the most common were motorcycle (51.3%), public service vehicles (46%), walking (38.8%) and to some extent personal vehicle (13.8%) as in Table 19. The high use of motorcycles may require designated motorbike lanes or at least well marked "lanes" on the main road. At the market centres, the high conglomeration of motorcycles, pedestrians and PSVs would require absolute pedestrian sidewalks (i.e., out of bound for motorcycles), designated motorcycle sheds (i.e., parking lot), and designated bus stops to enhance safety and convenience.

Table 19: Distribution of means of transport used to access market centres by sub-county

Means	**Narok East**	**Naivasha**	**Mean**
Motorcycle	72.5	30	51.3
Public service vehicle	57.5	35	46
Walking	40	37.5	38.8
Personal vehicle	10	17.5	13.8
Bicycle	-	5	2.5

c) Farming and livestock rearing

The results showed that the common forms of land use were livestock (56.3%) and crop production (51.3%), and to some extent tree farming. Livestock and crop production were more common in Narok East (85% and 76% respectively) compared to Naivasha (27.5% and 25% respectively) reflecting the larger size of land and rural nature of the former (and the contrast is true for the latter). In crop production maize was the most common (48%, median acreage of 4 acres), followed by beans (47.5%, median acreage of 3 acres) and hay (2.5%, i.e., two farmers with 5 and 10 acres each). These are basically seasonal crops and there was no observation of any perennial crop in the project area.

In livestock production, the most common animals were cattle (47.5%; median -10); sheep (51.3%, median -30) and goats (26.3%, median - 10); and poultry (37.5%; median

- 8) while pigs were reared by only one household. It is noteworthy that herds of cattle, sheep and goats are occasionally seen grazing along, and crossing, the road either as routine husbandry or as being transported to and from the livestock markets specifically located in Suswa and Olasiti trading centers.

d) Labour Force

The labour force is the sum of persons in the working age population in the 15 to 64 years (operationally, this excludes those serving in the armed forces and in prison) and indicates the potential for human resource capacity. The household survey data showed that the proportion of those aged 15-64 years was 62% for each of the male and female groups. Secondary data for Nakuru and Narok Counties (there were no data for the sub-counties), showed that there has been an increasing trend of the labour force in both counties. Notably, the labour force in Nakuru was 55.2% in 2009 which rose to 60.3% in 2018 and projected to 65% in 2030 (Figure 8). In Narok, the corresponding increase is from 47.2% in 2009 to 51.6% in 2018 and projected to 55.7% in 2030 (Figure 8).

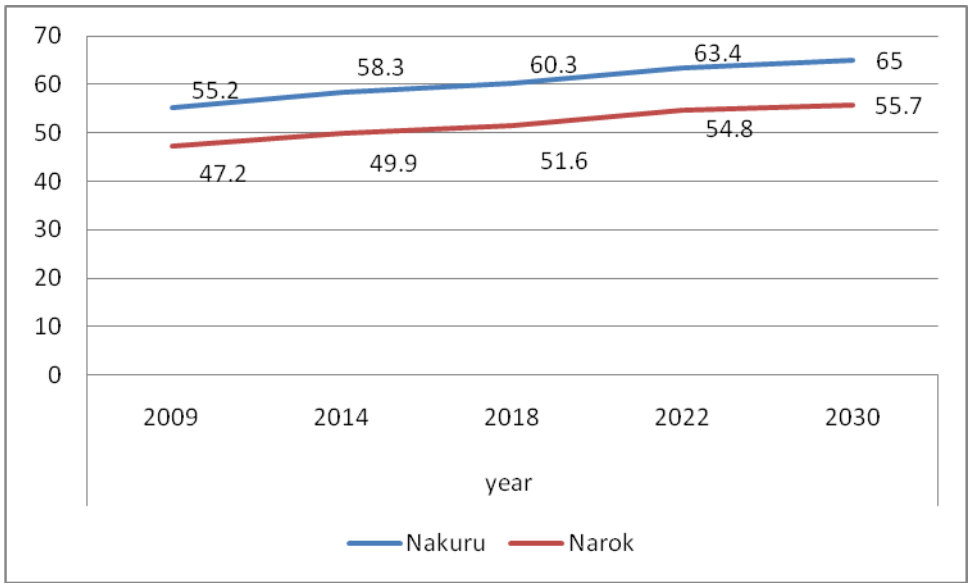

Figure 8: Percentage of labour force in Nakuru and Narok Counties

5.3.3 Health Settings

a) Distribution and access to health facilities

The distance of the health facilities accessed by the households from the project road ranged from 0.1 to 10 Km, with a mean of 1.4 Km (median – 1.3 Km). A large majority of the respondents (91.3%) reported that they use the road project access health facilities while the remainder (8.7%) reported that they do not use the road because their households were located on the same side as the facilities. In Narok East, most of the

respondents (45%) were accessing Olasiti health centre which is located about 3 Km from the project road at Olasiti. The other commonly accessed facilities were Olubwani (situated at Suswa Market centre) (17.5%), Kijabe Mission Hospital (17.5%) and Oloikarere (12.5%) public dispensary in Suswa location (9 %) as in Table 20. Among Naivasha respondents, majority (95%) reported that their households access Mai Mahiu Public Health Centre, which is located within the Mai Mahiu trading centre while a minority of 5% accessed Faith Medical Centre, a private owned facility also located at the Mai Mahiu town. A surprising observation is that none of the Mai Mahiu respondents reported Kijabe Mission Hospital as the main health facility they accessed, despite the facility being nearer to them than to those in Narok East.

Table 20: Health facilities by sub-counties in road passage area

Narok East	Frequency	Percent
Olasiti (AIC mission) health centre	17	42.5
Olubwani (private clinic)	8	20
Kijabe (mission referral & teaching hospital)	7	17.5
Oloikarere (public dispensary)	5	12.5
Nairegia Enkare (public health centre)	2	5
Kedong (private clinic)	1	2.5
Naivasha		
Mai Mahiu (public health centre)	38	95
Faith medical (private clinic)	2	5

The results showed that the most common means of transport to the health facilities were PSV (52.5%), motorcycle (47.5%), walking (32.5%) and personal vehicle (27.5%) (Table 21). Some key findings are the considerable high use of motorcycles in Narok East (65%), high use of all other means of transport to the health facilities which shows the need to have well-designed and clearly marked exits from the road project. At the time of the study, there was no road sign at the exit to Olasiti health centre despite it being the most accessed facility.

Table 21: Means of transport used to access health facilities by sub-county

	Narok East	Naivasha	Mean
Means	Percent	Percent	Percent
Public service vehicle	62.5	42.5	52.5
Motorcycle	65	30	47.5
Walking	30	35	32.5
Personal vehicle	40	15	27.5

b) Disease incidence in the project area

The results indicated that the most commonly reported diseases that affect people in the study area were malaria (68.8%), typhoid (63.8%), common cold (i.e., influenza) (71.%) and HIV/AIDS (27.5%) as in Table 22. Disaggregating by sub-counties, Narok East had the biggest disease burden – that is, nearly 100% reporting predominance of malaria and typhoid. The predominance of typhoid was further reinforced in the public consultation meetings in both sub-counties whereby the disease was reported to be rampant especially during rainy seasons owing the tendency of people to defecate in bushes, and rain water washing the excrement into shallow wells which are, as discussed earlier, main water sources. Malaria is also rampant as water pans dug to collect rain water offer a breeding ground for mosquitoes.

Table 22: Percentage of respondents reporting disease incidence in the area

	Narok East	Naivasha	Mean
Malaria	97.5	40	68.8
Typhoid	97.5	30	63.8
Respiratory diseases	72.5	70	71.3
HIV/AIDS	37.5	17.5	27.5

c) Respondents concern over HIV/AIDS

A large majority of the respondents agreed that HIV/AIDS is a concern in the project area. In Narok East, all respondents (100%) reported HIV/AIDS is a concern while in Naivasha those reporting it as a concern were an equally large 87.5%. This is important as it calls for an awareness campaign among the construction workers and the community in line with the Kenya Roads Board HIV/AIDS policy of 2010.

5.3.4 Security and Public Safety

As concepts, security is related to crime and conflict while public safety is related to welfare or normal functioning of a community. Security is relevant to the road rehabilitation project in relation to protection of lives of construction workers and constructors' property such as machinery and dwellings. It also has relevance to the protection of community members' lives and property. With respect to Narok East, while there is no specific data and information about the sub-county the Narok County Integrated Development Plans (CIDPs) notes that at the county level, the most common types of crime are burglary, theft related to mobile money services, sexual offences, and homicide. The report, however, adds that number of crimes reported to police by command stations has been declining over the years since 2014 when it was 1,626 to 1,308 in 2016 (citation from KNBS 2017) which translates to an annual decline of 7.2%. The CIDP attributes the decline to increase number of police officers in the area, and high uptake of community policing.

The Nakuru CIDP does not have data and information specific to Naivasha sub-county not about specific types of crime. The report, however, notes that crime has generally been on a declining trend notably from 6046 in 2014 to 1418 in 2017 translating to an annual decline of 30%. The report attributes the decline to better coordination between security agencies and to community policing.

The household survey revealed that the only criminal offence associated with the road construction phase was theft of livestock reported by 23.8% (n=19) of the respondents, of which 89% (n=17) were from Narok East and only two (2) respondents from Naivasha (Table 23). Other notable security and public safety concerns during the construction phase were transmission of sexual diseases (32.5%), accidents with human and livestock casualties (22.5%), teenage sexuality and pregnancy – in the context that sex intercourse of persons under 18 years in an offence under the sexual offences Act 2006 (18.8%), hostility related to demand for employment (7.5%), and one case of xenophobia who argued that "when "foreigners" remain in the area and exhaust their monies, they begin engaging in crime such as theft and prostitution and therefore they should be encouraged to leave once the construction works are over". The survey also revealed that after the construction works, the key issues were over speeding (67.5%) and increased crime (11.3%) which was associated with the ease of transport of stolen property by motorbikes and other means of transport.

Table 23: Security and public safety issues as reported household questionnaire respondents

	Frequency	**Percent**
Expected challenges during rehabilitation		
Sexually transmitted infections	26	32.5
Theft of livestock	19	23.8
Accidents with human and livestock casualties	18	22.5
Teenage sexuality and pregnancy	15	18.8
Hostility from local people demanding employment	6	7.5
Xenophobia (dislike of foreigners)	1	1.3
Expected challenges after rehabilitation		
Over speeding	54	67.5
Increased crime	9	11.3

5.3.5 Community Views and Concerns

The household survey showed that the main anticipated positive impacts of rehabilitating of the road were, in rank order of number/proportion of respondents citing them: Enhanced ease of transport and communication (56.3%), increase in employment and business opportunities (42.5%), reduced transport costs (35%), reduced accidents

(21.3%) and enhancement of tourism (6.3%). The potential of the road in promoting the socioeconomic welfare of the community is exemplified by the experience with SGR works whereby some of the youth employed in the works used their income to acquire motorcycles which they use for transport business. In an area where people mainly eke out living from low return activities such as seasonal farming, livestock herding, small businesses and sand harvesting, engaging the local youth in hired labour has great potential to lead to livelihood diversification into trading activities and betterment of livelihoods.

The negative concerns associated with the implementation phase of the road as determined in the household survey and public consultation meetings, from an analytical point of view, based on community members experience with the recent construction works of the SGR and the previous construction of the same Suswa–Mai-Mahiu road in 2009. Thematically, the concerns can be grouped into:

a) Community behavioral problems: These included increased illicit sexuality not only among the unmarried but also the married. The sexuality concerns were stated as "luring school girls into sex" with anticipated impacts as premature (early sex), pregnancies, school drop-outs, early marriages, illicit abortions, and exposure to sexually transmitted diseases including HIV/AIDS. Other behavioral concerns were increased alcohol consumption, poor management of "new found" finances, domestic conflict over control of women's income (assuming the women are employed in the construction works, or earn income from selling produce to construction workers), domestic conflict arising from men's control over any compensation money, domestic conflict over illicit marital affairs, prostitution, divorce, and illicit abortions.

b) Road works (operational) issues: These included the generation of dust and the fear of causing respiratory diseases, noise pollution, traffic diversions into private farm land with the fear that it may lead to soil compaction rending it difficult for farming, and traffic disruptions with the likelihood of causing delays and accidents.

c) Migrant issues: These concerns were essentially raised among inhabitants of Suswa and Olasiti twofold: First, diffusion of "new" behaviors such as dressing code, commercial sex (e.g., it was reported that during SGR works, commercial sex workers flocked from Mai-Mahiu and Narok into Suswa and Olasiti and got into conflict with the "regulars" (i.e., those who were already practicing) commercial workers. Another concern was that once migrant populations came into the area, some remained and were associated with: "competing for employment with the local population", "engaging in theft and commercial sex once their monies were exhausted".

5.3.6 Corporate Social Responsibility (CSR)

CSR refers to a program or project through which an organization promotes the social economic welfare of a community within which it operates. Public consultation meetings in Naivasha proposed rehabilitation of Karima primary school toilets and classrooms, a water supply systems such as a borehole, land to build an elderly people's home and rehabilitation of a feeder road connecting Mai Mahiu to Lari constituency (Photograph 32 and 33). On the other hand, the projects consultation meetings in Narok East proposed building of a health facility at Olasiti since there is no public health facility along the road.

Photograph 32&33: Community consultation sessions during focussed group discussions

Based on the household survey, it was apparent that lack of access to water was a major challenge in Narok East where the main sources of water were reported as protected dug wells (79.5%) and water vendors (20.5%) with the implication that a sustainable water supply system would be a most appropriate CSR project. This, however, requires a multi-agency approach given that water supply is the responsibility of the Ministry of Water and Sanitation. In Naivasha, around Mai Mahiu the most appropriate CSR project that would serve most of the inhabitants would be the rehabilitation of the Karima, or any other public school, in the community.

CHAPTER 6 ANALYSIS OF PROJECT ALTERNATIVES

The analysis of the project alternatives consisted of no project, current project and a new road traverse away from the current passage.

6.1 No project alternative

This would imply that the status remains and the road is not redesigned and reconstructed. If the situation were to prevail, the siltation, subsidence and flooding will continue and the frequency of closures is likely to increase. This would result from accumulation of more silt, continued blockage of culverts, erosion of the road base and widening of the gullies running parallel to the road. Consequently delays, inconvenience, expensive longer routes and poor reputation of the country as passage to the world famous Maasai Mara would continue to be blocked. Missed fights, hotel accommodation and airlifting of foreigners would increase cost of tourism and potential diversion to neighboring countries. The vast agricultural potential of Narok, Bomet, Trans Mara would also be diminished as products become more expensive to ferry and uneconomical in the local market.

Environmentally, the adverse activities and impacts will magnify, as remedial action will not be taken. Livelihoods in the area will be disrupted and communities frequently cut off from the rest of the country and denied access to facilities and institutions. Deposition and near complete siltation of Magadi with its important economic contribution will be lost. The flamingos will lose an important feeding ground and the only alternative breeding site in East Africa after Lake Natron. This will have serious implications on flamingo based tourism in Lake Elementaita, Nakuru and Bogoria.

Socially, communities living in the road passage will be isolated from the rest of Kenya and a sense of alienation would ensue. The towns of Mai Mahiu, Suswa, Olasiti and their adjacent dependent communities would be imp oversized.

Economic losses would also be considerable given the construction of the SGR and its current termination point is in the road's hinterland. The Naivasha Inland Container Depot would operate at suboptimal levels, rendering investments in it unviable. The proposed Industrial Park would also be affected with loss of revenue, job opportunities and spinoff benefits. In its current state, the road would be unable to handle the new heavy traffic generated by the ICD and the Industrial Park. The road has alleviated traffic congestion on the Naiarobi-Nakuru-Kisumu Highway as traffic to Bomet, Kisii, Kuria Counties and other parts of Nyanza diverts to this road. No road option will increase congestion on the other highways during closure periods and reduce frequency of use especially in the rainy seasons due to uncertainty.

6.2 New road away from the current passage option

Alternative road corridors in the area will traverse areas with similar problems as afflicts the current road. From the topographic analysis and geological considerations, the extent and magnitudes of the challenges are unknown. The areas away from the current alignment are steeper, have easily erodible and unconsolidated soils and the valleys are

deeper and steeper. Building bridges will increase costs and fault lines, fissures and pyroducts will have to be mapped. The soils are incidentally less consolidated as documented in the baseline environmental report, the gullies are deeper with numerous smaller ravines and unmapped sink holes risks.

6.3 Proposed project option

Retaining the current traverse, redesigning, and reconstructing will lead to expansion of the road to accommodate larger vehicles and increased traffic volumes. The reconstruction will eliminate the current issues affecting the road and mitigate socio-economic and environmental challenges that arise from the closures. The road project will ensure economic viability of the new infrastructure investments at the SGR stations; Industrial Park and the ICD and enhance the existing operational undertakings. Linked with proposed Greater Mombasa bypass and the Ngong-Suswa link road, it will ease movement of goods and passengers and spur economic development in the area and the Country. Retaining the current alignment will reduce construction overheads for a new alternative and retain a proven passage. Incorporation of environmental and socio-economic mitigations contained in this ESIA will reduce the adverse impacts and enhance the positive outcomes of the project.

6.4 Adopted option

The adopted option is the proposed road that retains the current alignment with a provision for dual carriageway in future, as traffic volumes increase with economic growth. Intersections with other proposed developments and road networks are incorporated in the design.

To make the road sustainable, the following engineering considerations and environemtal aspects have been adopted:

- Larger and more numerous drainage dtrcures with heights of 2m
- Elevation of roa above flood plain levels
- Reiforced concrete slabs where road crosses fissure, pyroducts and fault lines

CHAPTER 7 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

7.1 INTRODUCTION

Projects undertakings always spawn off impacts in their biophysical and socioeconomic environments. Where the impacts are positive interventions for their enhancements should be undertaken to ensure sustainability and ensure that project objectives are realized. In some cases the impacts may be delirious to the environments inducing undesirable and adverse outcomes. In such situations, a detailed analysis is required to unambiguously identify them, their genesis and possible evolution pathways and eventual impacts. From the analysis, mitigation measures and interventions to eliminate, minimize or ameliorate the impacts were designed. For the Suswa-Mai Mahiu Road project, the impacts arising from its implementation were identified, predicted for various activities and their significance rated. This enabled the design of appropriate mitigation strategies and interventions to be applied in the projects through engineering aspects, environmental management and corporate social responsibility undertakings to enable the project blend with the biophysical and socio-economic settings with minimal disruptions.

7.1.1 Impacts identification, prediction and evaluation/analysis

The ESIA study has identified several significant environmental, social and-economic impacts that need to be addressed to make the proposed road project viable and minimize adverse effects that are transient, long-term or residual. The impacts emanate from proposed road project activities during the construction, operation, maintenance and decommissioning phases. These are based on the baseline studies conducted and the projected impacts that will arise and affect the physical and biological environment, the social and economic matrices as they currently exist in the road project area. The purpose of this ESIA report is to ensure that the right decisions are made and that the road construction leads to a sustainable investment that delivers on its implementation objectives. The ESIA identifies and prescribes interventions aimed at improving the road project environmentally and socially by preventing, minimizing, mitigating or compensating for adverse impacts that may arise in all the phases of the project. The interventions are aimed at ensuring the long-term viability of the road, protection of downstream infrastructure and landscapes and prevention of adverse road impacts from activities in the hinterland.

The Suswa-Mai Mahiu Road project implementation will inevitably have impacts that may be positive or negative with varying levels of magnitude and likelihood of occurrence. The impacts have different longevity periods and varying geographical extents. The purpose of the ESIA is to predict and identify the impacts that may arise, develop mitigation measures and develop environmental and social management plans with clearly set indicators, apportion responsibilities and provide estimates of

implementation costs. The environmental and social impacts will be outcomes of the project implementation process that include:

- Decommissioning of existing Suswa-Mai Mahiu Road and associated structures
- Construction phase
- Operation and maintenance phase
- Decommissioning phase

7.1.2 IMPACT MATRICES

The impact matrices for decommissioning the existing road, site preparation and construction, operation and maintenance, and decommissioning phases are as elaborated in Table 5 in Chapter 3. The listed project activities and their potential impacts were rated based on the following criteria:

a) Magnitude of Impact: This is defined by the severity of each potential impact and indicates whether the impact is reversible or irreversible with the estimated potential rate of recovery. The magnitude of an impact is not considered high if an adverse impact can be mitigated.

b) Extent of Impact: The spatial extent or the zone of influence of the impact is always extrapolated. An impact can be site-specific or limited to the project area; a locally occurring impact within the locality of the proposed project; a regional impact that may extend beyond the local area and a national impact affecting resources on a national scale and sometimes trans-boundary impacts, which might be international.

c) Duration of impact: Environmental impacts have temporal dimensions and need to be considered in an ESIA. Impacts arising in different phases of the project cycle need to be contemplated.

d) Significance of the impact: This refers to the value or amount of the impact. Once an impact has been predicted, its significance has to be evaluated using an appropriate criterion. The most important forms of criteria are:

- Specific legal requirements e.g. national laws, standards, international agreements and conventions, relevant policies, etc.
- Public views and complaints
- Threat to sensitive ecosystems and resources, e.g., can lead to extinction of species and depletion of resources, which can result into conflicts.
- Geographical extent of the impact, e.g., has landscape wide or trans-boundary implications.
- Cost of mitigation
- Duration (time period over which they will occur)
- Likelihood or probability of occurrence (very likely, unlikely, etc.)
- Reversibility of impact (natural recovery or aided by human intervention)

- Number (and characteristics) of people likely to be affected and their locations
- Cumulative impacts, e.g., compounding or adding more impacts to existing ones
- Uncertainty in prediction due to lack of accurate data or complex systems

The precautionary principle is advocated in the geologically and environmentally complex scenario that obtains for the Suswa-Mai Mahiu Raod.

e) Type of impact

- Predictable: Those that are bound to arise and are unavoidable
- Temporary: Transient in nature and will disappear naturally or through human intervention
- Permanent
- Direct impact
- Indirect
- Cumulative

Cumulative Impact: The addition of many small impacts to create one larger, more significant impact

'Do-Nothing Impact': The environment as it would be in the future should no development of any kind be carried out

Indeterminable Impact: When the full consequences of a change in the environment cannot be described

Irreversible Impact: When the character, distinctiveness, diversity or reproductive capacity of an environment is permanently lost

Residual Impact: The degree of environmental change that will occur after the proposed mitigation measures have taken effect

Synergistic Impact: Where the resultant impact is of greater significance than the sum of its constituents

'Worst Case' Impact: The impacts arising from a development in the case where mitigation measures substantially fail

QUALITY OF IMPACTS

- **Positive Impact:** A change which improves the quality of the environment (for example by increasing species diversity; or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities).
- **Neutral Impact:** A change which does not affect the quality of the environment.

- **Negative Impact:** A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem, or Damaging health or property or by causing nuisance).

7.2 PROJECT ENVIRONMENTAL AND SOCIAL POTENTIAL IMPACTS

7.2.1-Positive impacts (environmental, social and economic)

i) Biophysical environment

The reconstruction of the road and its proposed management structures by stakeholders will have beneficial impacts on the biophysical environment. Some of the positive impacts that will include:

a) Enhanced catchment conservation through a multiagency management structure

The road corridor area is impacted by activities upstream, which generate large volumes of water and silt that leads to road closures. The velocities are high due to steep gradient in altitude over short distances and resultant channeling of the water in an area where the soil is highly erodible exacerbates generation of the massive silt loads deposited on the road. The reworking and removal of sand deposits by sand harvesters in gullies and depositional areas prevent gully healings, induce gully banks cave-ins, and create off road tracks that turn into gullies that churn and infuse more silt into runoff water. Charcoal burning denudes the land cover exposing the shallow and erodible soils to the elements enhancing weathering and erosion processes. The road structure acts as dam wall and the impermeable surface generates floodwater that flows to the lower side of the road. The culverts and the road alignment creates water channels convergence points that create new gullies and erosion points replicating the processes upstream of the road with devastating impacts on downstream areas, especially community lands, Magadi road and Lake Magadi. A joint management structure that includes KWS, KenGen, KeNHA, Kenya Railways, Kedong Ranch, Akira Ranch, Independent Power Producers in Olkaria area, County Councils of Nakuru, Narok and Kajiado, Local Communities and other new entrants such as KPA through the Inland Container Depot and Industrial Park will ensure a sustainable catchment area conservation outcome. Incorporation of oversight agencies such as The Presidency through County Commissioners, NEMA and KFS will further strengthen the catchment management committee. This would protect the road in future, downstream resources and investments and ensure sustainability of operations and land resources upstream.

b) Protection of downstream ecosystems and wetlands

Construction of the water management structures as proposed in the design will minimize water channeling by reducing differences between upstream and downstream road areas. Their ability to pass large water volumes without channeling will protect downstream ecosystems and infrastructure and enable recovery of eroded areas naturally or with targeted interventions.

c) Reduced soil erosion and pumice depositions wastelands

Soil erosion is a major problem in the road corridor area and the hinterland. The soil erosion is caused by poor land use practices that leaves the land bare, enabling accumulation of large volumes of water as the top soils get rapidly saturated. The water then collects on the soil surface, flows and forms channels that initiate down cutting as the soils are unconsolidated and are easily eroded. The top soil layer is thin (< 30cm in many places) and is underlain by volcanic ash deposits and other conglomerates that are easily washed away and facilitate under scouring. These create gullies that deepen with time with over hung banks whose collapse contributes more soil material washed downstream during subsequent rains. The deepening and widening initiates a vicious cycle that generates more soil, engulfs adjacent areas and increases the bed load and erosive power over time. Conservation of the area and better-informed land use practices will arrest the soil erosion and enable habitat recovery.

The slopes of Mt Suswa and Mt Longonot have layers of pumice that are easily dislodged during rainstorms. The pumice, dislodged rocks and silt form slurry that is transported downstream by runoff water. Pumice floats on water and is deposited in downstream flat areas smother the grasslands and creates wastelands where vegetation is unable to establish. This renders the areas unusable as grazing or cultivation areas. Management of the floodwater and soil erosion will reduce the amount of pumice generated and enable recovery of the affected areas.

d) Reduced large scale silt deposition

The flood water sorts eroded materials and create a differentiated deposition sequence with heavier silt deposited in areas of water flow obstruction and velocity impediment by flat topography, riverine vegetation or structures such as the road. The silt sediments and pumice debris floats away to be deposited where the flow tapers off. The sorting and segregation of the bed load accounts for the mass silt deposition along the upper parts of the road and other structures. Construction of the road as is being designed and catchment management will eventuate silt load generation and deposition.

e) Recovery of ravines and gullies

Reduction in floodwaters through catchment management and restoration will faceplate gully healing, increase habitats and grazing resources for both livestock and wildlife. Healed gullies were documented as effective runoff water and silt traps.

f) Invasive species reduction

Silted areas are infested by Castor oil pants bushes (*Ricinus communis), Sena didimyobotri* and *Solanum nicotiana* that prevent growth of other plants underneath. These plants are poisonous and exclude large areas from use by livestock and wildlife and reduced erosion and silting will significantly reduce their infestation.

g) Increased water storage in catchment areas by coffer dams construction

Construction of cofferdams upstream as initiated by Kenya Railways through the SGR construction will significantly reduce downstream flows. Similar floodwater attenuation has been observed in community areas where road runoff is channeled into ponds used for livestock watering and as domestic water sources.

h) Better wildlife conservation through assisted interventions and natural habitat recovery

Where inland deltas and deposition areas form, the floodwaters are dissipated and silt loads retained with beneficial vegetation establishment. Replication of such natural systems will benefit water retention and expansion of wildlife habitats and livestock grazing areas.

i) Reduced land degradation and overgrazing near watering points

Creation of several water ponds and cofferdams will relieve pressure, trampling and over grazing near the few water pans retaining runoff water for long periods. Dispersal of such systems in the area will immensely reduce erosion associated with livestock tracks and loosening of the soil that exposes it to wind and water erosion.

j) Increased wildlife populations in potential conservancies

The two major ranches and community are potentially wildlife rich areas that can conserve wildlife and generate income through tourism. Creation of conservancies and attendant wildlife and habitat projection will increase biodiversity and diversify the income streams in the area.

k) Road structures habitats and wildlife corridors creation

The proposed size of drainage structures along the road will be ideal for cave nesting organism such as bats and birds. Their size will enable movement of livestock and act as wildlife migration corridors and thus reduce frequency of road kills and accidents.

II Socio-economic

The communities along the project area have their existing socio-economic environment with its livelihood systems and social-cultural norms. The road project may have catalytic impacts that will potentiate them and this will include:

- Improved and efficient transportation
- Increased opportunities for business and livelihood diversification
- Improved service delivery by the National and County Governments
- Increased employment opportunities
- Enhanced land value
- Enhanced gender parity
- Improved social well being

7.2.2. Negative Impacts and Mitigation Measures

Intrusions of project activities into existing biophysical and socio-economic settings are bound to induce perturbations in processes and structures that are operational. The disturbances may results in outcomes that can be adjudged as inherently negative. The project activities are expected to generate negative impacts during the project cycle phases. Some of these are bound to negatively impact upon the biophysical and socio-economic environments. These were identified, their mitigations derived, residual impacts extrapolated and appropriate recommendations made.

a) Physical environment impacts

- Aesthetics and physiographic through borrow pits establishment and operation
- Air quality through dust and pollutants emissions
- Noise and vibrations
- Soil erosion

- Soil compaction
- Soil pollution through accidental spillages and incidents in construction, operation and decommissioning phases
- Water abstraction
- Solid and liquid wastes
- Hazardous substances contamination
- Increased sand harvesting business as road accommodates more trucks
- Fissures puncturing through overburden removal
- Fault lines erosion through infill material removal by increased flows.

b) Biological

- Vegetation removal during construction
- Demand for wood fuel and charcoal during construction and expansion of existing centers
- Conversion of fallow and rangelands into industries and urban expansion
- Increased road kills through accidents
- Increased poaching to supply subsistence bush meat
- Blockage of existing wildlife migratory corridors
- Habitat disruption and reduced recovery of decimated wildlife populations
- Increased incidence of alien and invasive species as road corridor becomes disturbed enabling their proliferation
- Vegetation cover reduction as more pastoralists get sedenterized as socio-economic opportunities increase in the area

7.2.3 Physiographic and Geology

i) Physiography

Impacts i. Aesthetics disruptions through establishment of borrows pits for sand, gravel, and rocks ii. Road structures visual disruption of the landscape iii. Dumpsites creation for soil and materials storage iv. Elevation of road above surrounding areas
Mitigation Measures **i.** Rehabilitation of borrow pits after operations ii. Landscaping and re-vegetating the road to reduce visual distortions **iii.** Use existing and operational material borrow areas for sand, rocks and gravel iv. Rehabilitate any new borrow sources in accordance with ESMP
Residual Impacts i. Continued artisanal operations of borrow areas at reduced scales for building

materials, rehabilitation and construction of access roads in community areas. ii. Road systems structures presence in the landscape
Recommendations Maintain the road's visual and physiographic profile proportionately to other structures and landscape features Re-vegetate and landscape road to blend with its environmental contexts

ii) Geology

Impacts i. Puncturing of fissures and pyroducts during earth works, blasting or compaction in construction phase ii. Exposure of fault lines through infill material removal by scooping or water erosion iii. Compaction sealing of pyroducts and other subsurface drainages during compaction leading to underground water accumulation and road foundation fialure
Mitigation Measures i. Use new technologies in road construction that enable road foundation span fissures and pyroducts ii. Use concrete slabs as road basement and divert runoff water from identified fault lines iii. Use water permeable fabrics to allow water passage to dam wall effects
Residual Impact i. Road passage devoid of closure incidences from washouts and subsidence
Recommendations Implement geological report findings and interventions when constructing in areas with pyroducts, heterogeneous strata, unstable soils and fault lines

7.2.4 Soils

Impacts i. Soil erosion at road storm water drainage and culverts discharge points ii. Removal of topsoil during construction and road diversion establishment iii. Exposure of unconsolidated and highly erodible soil layers during earth works and road bank cutting iv. Compaction in areas with alluvial soils hindering underground water flows **v.** Increased erosion leading to sediment transportation to downstream landscapes and water bodies such as Lake Magdi
Mitigation Measures i. Reduce dam wall effect of road with adequate water drainage structures ii. Reduce water flow velocities upstream of road through use of gabions, check dams and natural dissipation systems as described in the ESMP

iii.	Use topsoil from earthworks in rehabilitating gullies in the road environs
iv.	Adopt catchment management strategies to reduce volumes of flood water reaching the road
v.	Adopt erosion prevention strategies in upstream areas that generate storm water
vi.	Adherence to ESMP for all upstream projects and activities to prevent flashflood events
Residual Impact	
i.	Impermeable road surface will continue generating manageable flood waters
ii.	The road dam effect will continue due to its elevation relative to the immediate ground levels in environs
iii.	The topography and soil types combinations pose a persistent soil erosion risk
Recommendations	
The holistic catchment management strategy and structures in the ESMP be adopted and implemented	

7.2.5 Climate

Impacts	
i.	Construction and operation of the road will contribute to emissions of green house gases causing global climate change and variability
ii.	The immediate road vicinity microclimate will be affected by the road presence and use due to its heat absorbing and radiating nature
iii.	Due to its placement in the landscape, the road will be impacted by extreme climatic events in the area and its catchment and will amplify the effects on downstream areas
Mitigation Measures	
i.	Ensure that vehicles and heavy machinery equipment used during construction are well serviced, have catalytic converters and minimized climate change foot prints in their operations
ii.	Rules and regulation on greenhouse gases emissions for vehicle using the road are enforced by regulatory authorities
iii.	The construction of the road shall adopt engineering and management strategies that reduce impacts of extreme weather events on its structures and operations
iv.	The road drainage structures construction and elevation shall not allow damming and channeling of storm water that surge downstream as flash floods
Residual Impacts	
i.	Greenhouse gases will be generated in all phases of the project as it is for use by internal combustion vehicles that use fossil fuels
ii.	The microclimate impacts will continue being unavoidable outcomes of the road's presence and operations
Recommendations	
i.	Climate changes mitigations in vehicle operations be instituted and adhered to as set out in the National Climate Change guidelines.

ii. The road reserve is free of illegal constructions encroachment to avoid heat islands effects and enable wind flow to prevent localized buildup of heat trapping greenhouse gases pollutants and aerosols. **iii.** Construction and operations be pegged on climate change scenarios modeled for area by the Kenyan Meteorological Services for long term sustainability.

7.2.6 Air Quality

Impacts i. Increased air pollution by vehicles and equipment during operations and construction **ii.** Dust creation from earthworks and heavy vehicle movements in unpaved areas **iii.** Dust emissions by vehicles using unpaved road diversions **iv.** Particulate matter ejection from rock crushers and other ancillary plants
Mitigation Measures i. Adopt air pollution reduction and prevention measures during construction and operation phases ii. Wet road and avoid dust creation by avoiding working during severe windy conditions in the area iii. Reduce exposed areas where gusty winds can whip dust swirls and form dust devils **iv.** Use dust traps in vicinity of dust generating equipment and residential areas near road works
Residual Impacts i. Pollution by vehicles emissions will continue in the area during the entire project cycle. **ii.** The windy conditions, exposed soils and earth road junctions will continue creating localized dust clouds and storms in future
Recommendations Maintenance of adequate land cover and stabilization of earth road junctions will ameliorate the dust generation potential in the area. Adoption of land management strategies contained in the ESMP

7.2.7 Surface and Groundwater Resources

Impacts i. Pollution of water pans by road runoff ii. Concentration of overland water sheet flows in culverts and discharge through directional spouts that initiate erosion and formation of gullies at the lower parts of the discharge points iii. New settlements and land use changes due to road improvement that result in more surface water generation iv. Increased water injection into pyroducts potentially enhancing subsurface water erosion in fissures and collapse resulting in sink holes formation and subsidence

along fault lines v. Reconfigured landforms resulting in changed hydrologic regimes (e.g. interrupted groundwater flow diverted to surface systems; changes in the timing of runoff; unintentional water ponding by road and restricted or altered channels which can result in increased gully formation and soil erosion)
Mitigation Measures i. Construction of drainage structures able to pass larger volumes of water ii. Erection of adequate and numerous drainage structures that enable sheet flow and prevent accumulation and channeling effects iii. Implementing rehabilitation strategies that dissipate water near source points before it reaches the road **iv.** Implementing the catchment management strategy detailed in the ESIA study
Residual Impacts i. New road structures will allow water passage to lower lying areas without forming a dam wall that precipitates adverse effects ii. With adoption and implementation of suggested strategies, road closures resulting from the interplay of flash floods and soil erosion will not be reoccurring events **iii.** Protection of downstream landscapes, community lands, water bodies and infrastructure from road generated and enhanced destructive flooding episodes
Recommendations The impacts on the road by surface water and its silt loads are preventable by catchment areas rehabilitation, management of surface flood water and cessation of activities that lead to land degradation and reactivation of the gullies.

7.2.8 Terrestrial and Aquatic Environment: Flora and Fauna

i) **Fauna**

Impacts i. Habitat fragmentation for wide ranging and mobile wildlife species ii. Migration corridors blockage iii. Increased poaching during the works period iv. Increased road kills due to accidents involving wildlife **v.** Increased road-kill carrion from wildlife and livestock that attracts scavengers and result in more road kills **vi.** Disturbance of sensitive habitats such as riverinne woodlands **vii.** Diminished habitat suitability adjacent to road from edge effects
Mitigation Measures i. Creation of wildlife conducive crossing points with gentle gradients on roadsides ii. Surveillance for detection of commercial bush meat trade iii. Prominent signage warnings on wildlife and livestock crossing and presence iv. Provision of wildlife corridors especially along the Akira and Kedong road passage areas **v.** Avoidance of extensive clearing of the riverine woodland habitats such as at Ketraco and Satellite areas
Residual Impacts i. The road has been a permanents feature of the landscape and wildlife crossed it in the past and will continue crossing it **ii.** The habitat will recover naturally or with interventions to a wildlife safe status
Recommendations Appropriate road structure placement be made taking into account wildlife needs and welfare. The road reserve is kept cleared of thick vegetation of invasive species such as *Ricinus communis, Solanum nicotiana* and *Aspilia mosambicensis* to improve visibility and reduce wildlife related accidents and incidents**.**

ii) **Flora**

Impacts i. Clearing of vegetation in the road reserve to create road diversion during construction phase ii. Increased invasive alien plants establishment along the colonization corridors provided by the road such as *Parthenium hypoestris, Datura stramenium* and *Heliotropium kongiflorum* iii. Land use changes leading to clearing of natural vegetation for the establishment of industrial and urban environments due to economic opportunities offered by

the road and other upcoming infrastructure iv. Increased destruction of catchment area's woody vegetation for charcoal and wood fuel provisioning for an increased population
Mitigation Measures i. Avoid clearing of vegetation unless it interferes with road construction and affects traffic ii. Road diversions to be retained within road reserve or through works and avoid dense tree groves where they exist **iii.** Appropraite control of newly establishing invasive plant species
Residual Impacts i. The vegetation would revert to normal within road vicinity **ii.** The road edge effect will alter vegetation composition with tree establishment on the upper side and denser herbaceous vegetation on the lower side due to water retention by road base on the upper side and increased water discharge from the road if remedial measures not implemented
Recommendations Avoid unnecessary removal of vegetation and activities that would alter plant communities' structure and characteristics in the project area**.**

7.2.9 Land Resources

Impacts i. Loss of land in areas where road diversions are created ii. Loss of top soil in borrow pit areas iii. Loss of land resources where camp sites and material dumps are located iv. Conversion of land to other land use types v. Topographical modifications resulting in enhanced downstream erosion and road banks slippage vi. Accumulation of waste materials from construction and decommissioning of current road
Mitigation Measures i. Ensure that all diversions are located within existing road reserve ii. Preserve top soil from dumpsite areas and road cutting for use in borrow pit rehabilitation iii. Ensure that campsites are satisfactorily rehabilitated after project completion or are located in former campsites iv. Undertake landscaping to avoid formation of erosion foci and knick points **v.** Reuse and recycle/recoverable material from existing road in construction
Residual impacts i. Land use changes are inevitable due to operations of the ICD, Industrial park and emergent economic opportunities linked to the improved road and infrastructure

being constructed ii. The impermeable road surface will continue generating flood water as well as upstream and road environs installations that will need to be managed to eliminate cumulative impacts.
Recommendations An integrated catchment area management plan for the road, its hinterland and road environ infrastructure be developed and adopted by stakeholders with clear responsibilities to avoid future catastrophic events.

7.2.10 Archaeological, Historical and Cultural Sites

Impacts i. Possible destruction of buried archeological and historical sites in the road passage area during earthworks
Mitigation Measures i. Preservation of sites where items of archeological and historical items may be uncovered during construction. **ii.** Reporting of any such findings to the National Museums of Kenya for action
Residual Impacts i. None
Recommendations An expert knowledgeable in archeological and historical sites and artifacts is recruited during the earthworks stage on the road project.

7.2.11 Visual Aesthetics

Impacts i. Disruptive impact of the road outline in the landscape as viewed from vantage points above and below road level. ii. Modified relief and topography of material borrow areas especially where they are situated in elevated areas in the landscape **iii.** Night time light pollution ribbon by traffic headlights to viewers (receptors) in the upland areas
Mitigation Measures i. Avoid construction of structures that disrupt the skyline as part of the road **ii.** Plant trees along road passage for road to blend with the landscape
Residual Impacts i. The road will continue being a part of the landscape and its aesthetic impacts will not differ significantly from those of the existing road ii. Rehabilitation of the borrow sites will result in low profile residual impact that will mellow with time as natural vegetation succession occurs.

Recommendations
Reducing the visual signature of the road in the landscape can be achieved through interventions suggested in the ESMP

7.2.12 Noise and Vibrations

Impacts

i. Noise emissions by construction equipment and heavy vehicles operations
ii. Noise and vibrations from blasting in quarries and compaction
iii. Road background traffic hum from vehicles during operation phase
iv. Continuous low level vibrations due to heavy trucks movement on the road pavement

Mitigation Measures

i. Use vehicles fitted with mufflers to reduce noise
ii. Ensure that blasting areas are far from residential areas and such operations are carried out in the daytime
iii. Ensure vehicles using the road are in good conditions and adhere to NTSA regulations
iv. Avoid encroachment of residential areas close to the road reserve
v. Ensure that engineering technologies used on the road pavement absorb and damp vibrations from vehicle movements

Residual Impacts

i. Noise and traffic hum from the road will be a constant feature from its operations
ii. Low level vibrations will persist as the unconsolidated nature and differential densities of the soils underlying the road pavement have existing differential vibration absorbance characteristics

Recommendations
Ensure mitigation strategies recommended in the ESMP are implemented**.**

7.2.13 Solid and Liquid Wastes

i) **Solid wastes**

Impacts

i. Surface and underground water pollutions by leachates from solid waste dumps
ii. Health risks from vermin and disease vectors breeding in solid waste dumpsites
iii. Choking of drains leading to flooding, sewerage blockages with health risks
iv. Health risks from fumes emissions by dumpsites and during burning of solid wastes
v. Odors and aesthetic pollution from dumpsites
vi. Injury and disease risks to waste miners and recyclers and scavengers

Mitigation Measures

i. Disposal through sanitary landfills

ii.	Incineration by burning solid waste in properly designed furnaces at suitable temperature and operating conditions
iii.	Composting of organic components
iv.	Recycling and reusing some components of the waste that may have residual economic value in road and other constructions
v.	Waste reduction at source by procuring only required quantities during construction to avoid materials accumulation
vi.	Reducing packaging to minimize quantities
Residual Impacts	
i.	Traveler waste will continuously be generated during operation phase
ii.	Accidents will continue introducing solid wastes along the road passage corridor
Recommendations The ESMP guidelines on waste management in all phases of the project be adhered to	

ii) **Liquid wastes**

Impacts	
i.	Surface water contamination through runoff
ii.	Ground water contamination through leaching from dumpsites and material storage points
iii.	Soil contamination through adsorption
iv.	Pollution from condensed and rain washed fumes from construction activities
Mitigation Measures	
i.	Correct storage and processing of liquid waste in tanks and drums with secure secondary containment
ii.	Avoid stockpiling of waste or discharge without appropriate treatment and consent from relevant authorities and agencies
iii.	Segregate, clearly label and appropriately handle incompatible wastes to avoid accidental mixing and dangerous outcomes.
Residual Impacts	
i.	Accidental spillages are a persistence risk during the road operation phase
ii.	The road surface will consistently generate flood water laced with grease, oils, rubber and other exudates from vehicle operations
Recommendations The ESMP strategies on liquid waste to be adhered at all times	

7.2.14 Safety and health risks

Impacts	
i.	Local community and workers exposure to noise and vibrations
ii.	Bronchial and other respiratory tract diseases from particulate matter generated and emissions pollution from equipment and road construction activities

iii. Increased exposure to water borne disease vectors from vectors breeding in stagnant water in road side pools and borrow pits iv. Potential exposure to accidents, fire and hearing impairment from construction works
Mitigation Measures i. Adherence to OHS plan in ESIA report ii. Regular maintenance of construction machinery to minimize accidents and professional hazards during construction period iii. Continuous education on Safety, Health and Environment (SHE) issues iv. Compliance with Occupation Health and Safety Act (2007) by provision of safety gears, equipments and clothing's v. Adequate signage and availability of First Aid Kit vi. Ensure hygiene and sanitation is maintained at the labour camps vii. Management and use of blasting materials to be only conducted by Contractor registered with Mines and Geology department in strict conformity with the safety requirements as stipulated in legislation viii. Drain and restore open pits to reduce incidence of disease vector breeding sites unless local community request to use them as water storage structures with appropriate safeguards ix. Ensure security of team when working in wildlife habitats at night by training workers, providing appropriate gear and engaging wildlife wardens
Residual Impacts i. Unavoidable exposure to road use generated particulate matter where residential and business facilities are located close to the road during construction and operation phases
Recommendations i. The ESMP recommends strategies to minimize exposure to dust and vehicular emissions ii. NCA Legislative guidelines on establishment of residential areas be followed in new housing and business faculties

7.2.15 Social Characteristics

Impacts i. Negative changes in behaviors and social relations affecting teenage sexuality, spousal conflict, alcoholism, crime and commercial sex work ii. Poor relationship between project implementers and community due to untenable demands for employment iii. Road rehabilitation risks/disruptions from accidents involving people and livestock, traffic diversions and disruptions, disruption and blockage of entry and exit routes to estates, households and utilities such as schools, markets, hospitals
Mitigation Measures i. Educational curriculum targeting construction workers, general community, and population groups at higher risk including schooling adolescents, youth and

commercial sex workers ii. Project implementers' involve/co-opt community in decision making in procurement of local labour ensuring gender equity, procurement of local raw materials, provision of security, determination of camp sites iii. Community risk reduction campaigns on road safety through public meetings, information, education and communication materials and events
Residual Impacts i. Potential cultural diffusion of material and non-material aspects ii. Skill transfer to the local community iii. Safety issues related to construction machinery and regular/normal traffic
Recommendations i. Rapid appraisal for skill profiling

7.2.16 Economic Settings

Impacts i. Job creation within the construction works and outside ii. Increased land use activities iii. Increased land and land-based property value iv. Increased local economic investments v. Increased tourism and recreation vi. Increased trading activities vii. Potential reduced people and livestock transport costs (tariffs and vehicle maintenance costs) viii. Disruption of economic activities such as sand harvesting and stone quarrying activities during the construction phase **ix.** Traffic disruptions and delays
Mitigation Measures i. Planning for efficient access to markets (e.g., minimize or avoid works during market days) **ii.** Project implementers hold discussions with sand harvesters on possible disruptions to exit/entry points to the road
Residual Impact i. Potential economic growth of the communities ii. Increase of road users, of motor vehicles and population especially in market centers **iii.** Grievances related to employment, traffic and occupational disruptions
Recommendations i. Hold discussions with business operators/community with respect to traffic disruptions and delays

7.2.17 Health Settings

Impacts i. High real and perceived concern of increased sexually transmitted diseases including HIV/AIDS. **ii.** Disrupted access to health facilities by road work
Mitigation Measures i. Educational curriculum targeting construction workers, general community, and population groups at higher risk including schooling adolescents, youth and commercial sex workers ii. Proper planning to avoid obstructing access to health facilities (e.g., may consider construction works at entry/exist to be done at night)
Residual Impacts i. Increased uptake of safe sex practices
Recommendations i. Development of a training curriculum

7.2.18 Security and Public Safety

Impacts i. Increased safety of the road during and potentially after the construction; **ii.** Potential for increased conflict from the community in relation to traffic disruptions, people and animal accidents, sexual relations between local girls and "foreigners", theft of livestock and/or other property **iii.** Improperly sited drainage systems and material dumps affecting community livelihood systems and residences
Mitigation Measures i. Hold discussions with security agencies to determine traffic management arrangements and to enhance security of people and property ii. Hold discussions with local national government agencies to enhance protection of children (under 18 years), and to monitor any conflict issues
Residual Impacts i. Improved "ownership" of the road project by the community; **ii.** Increased contact between the community and security agents**.**
Recommendations i. Community consensus building meetings; **ii.** Community negotiation meetings especially to the ideal CSR project.

7.3 COMMUNITY VIEWS AND CONCERNS/PUBLIC CONSULTATIONS

The purpose was to create awareness of the road project and elicit views about concerns of the road in the current condition, and during and after construction. The views were

collected during public consultation meetings that were arranged through the assistance of local national government officials. Four meetings were held at Olasiti (Duka Moja), Keekonyokie, Suswa, and Mai-Mahiu.

Data were collected through focus group discussion guide with a single grand tour question to start off the discussion. The question was stated as follows:

"The Government of Kenya, through the Kenya National Highway Authority is considering the rehabilitation of the Mai-Mahiu to Suswa road section. The purpose of this meeting is to identify how the community uses/benefits from the road, the major current concerns, and the major concerns during and after completion of the works".

Probing questions were not formulated but were asked during the FGDs based on the discussions. The strength of this data collection technique is that it allows interaction amongst participants, which makes them reevaluate and reconsider their own understanding of specific experiences (Kitzinger, 1995). This results in a much more in-depth discussion (Gibbs, 1997). The limitation to the study was that some participants did not give their opinions and did not agree with the views of the rest of the group. Each discussion had about 20 participants representing critical population categories including gender and age groups, opinion leaders, local professionals, production categories (i.e., herders, farmers and traders); and lasted about 2 hours. Data analysis involved line by line coding after, which the codes were grouped into sub themes and finally into themes.

7.4 CORPORATE SOCIAL RESPONSIBILITY (CSR) SUGGESTED

1. A sustainable water supply system for Narok East
2. Rehabilitation of the road to Olasiti Health Centre and any other works in the centre.
3. Rehabilitation of Karima Primary School toilets and classrooms in Naivasha East

CHAPTER 8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 INTRODUCTION

The sustainability of the Suswa Mai-Mahiu road is intricately linked to the state of its hinterland and underlying geology and the implementation of an ESMP that includes the catchment and road passage area is obligatory. To achieve this, it is implicit that all stakeholders with activities that impact the road will need to be part of the management structure as well as those affected by the road in the immediate environs and downstream. It is envisaged that the structure established will be inclusive and comprise of:

- Road and transport infrastructure management bodies-KeNHA, KeRRA, County Governments, KWS, KenGen, Kenya Railways and other IPPs
- Regulatory and oversight authorities: NEMA, KFS, KWS and the Offices in The Presidency
- Private large scale landowners that comprise of Kedong and Akira ranche
- Local community comprising of small scale land farmers, livestock owners and the business community
- State Corporations with resource and land based operations in the area- Kenya Railways, KenGen, KWS, KETRACO
- Downstream currently and potentially impacted stakeholders suchTata Magadi Chemicals, KPA through ICD, KETRACO, Kenya Railways, Communities and KeNHA

8.2 OBJECTIVES OF THE ESMP

The Environmental and Social Management Plans (ESMP) for development projects are intended to provide a logical framework by which the identified negative environmental impacts can be mitigated and monitored. Within the ESMP, responsibilities for actions are assigned to different actors involved in the project's implementation. The ESMP further provides timeframes for implementing the mitigation measures and conducting monitoring against set targets or values. The ESMP is an output of an ESIA providing a checklist for project monitoring and subsequent evaluation of a development project. Benchmarks and indicators are provided in the ESMP to continually assess the nature and magnitude of anticipated environmental and social impacts arising from the project. The monitoring process can either be a continuous or periodic review of construction and maintenance activities that determine the effectiveness of recommended mitigation strategies and measures. From the monitoring, trends in environmental degradation or improvement can be ascertained, and unforeseen impacts and trends, elucidated, identified or pre-empted and levels of conformity or divergence evaluated.

The ESMP establishes the project's environmental and social limits and ensures compliance with applicable policies, enacted legislation, established regulations and guidelines, and best international practices. Review of the ESMP can be made to accommodate critical alternations with emergent new developments, climatic events and unforeseen site conditions in the Suswa–Mai Mahiu area with it's challenging, unique and profoundly tectonically influenced geology and physiography. The project area is undergoing rapid transformations with far reaching consequences socially and economically in an increasingly climatically, environmentally and potentially geologically dynamic physical context.

The ESMP contains financial estimates for costs of undertaking the prescribed activities. The roles and responsibilities of various stakeholders are also indicated for the successful attainment of intended outcomes. Where multiple actors and institutions are involved, the proposed management interagency committee should be the responsible entity with appropriate funding and supervision by the oversight agent.

The ESMP is aimed at making the Suswa-Mahiu road viable and sustainable to attains rational and meet its development objectives. To ensure this, the project ESMP objectives were to:

- Ensure the project is compliant with applicable national environmental and social legal requirements
- Delineate the mitigating/enhancing, and monitoring parameters and protocols for prevention, minimization, mitigation and/or compensation of adverse environmental and social impacts
- Develop the consultative processes and institutional arrangements required to enhance the project beneficial impacts and assure its viability and sustainability
- Enable skills acquisition and capacity building amongst stakeholders necessary to attain the project's objectives.

The ESMP is binding and has to be adhered to by the KeNHA and contractors and is enforceable as set out in various laws and regulations governing environmental and social aspects in projects of this nature.

ESMP is a binding document between the CLIENT and the CONTRACTOR so that noncompliance on the part of the contractor attracts penalties. The ESMP has to availed

and understood by all Project Staff. The ESMP addresses the following objectives aspects:

8.3 APPLICABLE LEGISLATION AND REGULATIONS

The project will be undertaken in a legal context governed by policies, legislation and regulations and guidelines contained in Section of this document. The summarized spectrum of legislation and regulations that specifically apply to the project are:

A: Kenyan Laws and Regulations

i. Environmental Management and Coordination Act No 8 of 1999
ii. Environmental (Impact Assessment and Audit) Regulations, 2003
iii. EMCA (Controlled Substances) Regulations, 2007
iv. EMCA (Noise and Vibration Control) Regulation, 2009
v. EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management)
vi. EMCA (Waste Management) Regulations, 2006
vii. Environmental Management and Coordination (Water Quality) Regulations, 2006
viii. EMCA (Conservation of Biological Diversity and Resources, Access to Genetic, Resources and Benefit Sharing) Regulations, 2006
ix. Environmental Management and Coordination, Fossil Fuel Emission, Control Regulation 2006
x. The Occupational Health and Safety Act, 2007
xi. The Water Act 2002
xii. Local Authority Act (Cap. 265)
xiii. Energy Act, 2006
xiv. The Lakes and Rivers Act Chapter 409 Laws of Kenya
xv. The Wildlife Conservation and Management Act, 2013, Cap 376
xvi. The Public Health Act (Cap. 242)
xvii. Kenya National Aids Strategic Plan (KNASP III)
xviii. Waste Management Regulations (2006)
xix. Physical Planning Act (Cap286)
xx. Way Leaves Act (Cap. 292)
xxi. Land Acquisition Act (Cap. 295)
xxii. Public Roads and Roads of Access Act (Cap. 399)
xxiii. The Limitations of Actions Act (Cap. 22)
xxiv. The Registered Land Act Chapter 300 Laws of Kenya:
xxv. The Standards Act Cap 496
xxvi. The Antiquities and Monuments Act, 1983 Cap 215

B International best practices

i. World Bank's safeguard policies

ii. The Kyoto Protocol
iii. WHO Air Quality and Emissions Guidelines.
iv. WHO Drinking Water Quality Guidelines

8.4 KeNHA ENVIRONMENTAL POLICIES AND PROCEDURES

KeNHA was established after the enactment of the Kenya Roads Act, 2007 under the Ministry of Transport and Infrastructure as one of the road agencies in Kenya. Its role is the management, development, rehabilitation and maintenance of the National roads. Under Part II, Section 4 of the Act, the functions of the authority include:

i. Constructing, upgrading, rehabilitating and maintaining roads under its control
ii. Controlling the national roads and road reserves and access to the road side development
iii. Implementing road policies in relation to the national roads
iv. Ensuring adherence to the roles and guidelines on the axle load control prescribed under the traffic act (Cap. 403) and under any regulations under these act ensuring roads quality as prescribed by the minister
v. Monitoring and evaluating the use of national roads
vi. Liaising and coordinating with other road authorities in planning and operation with respect to roads

The Environmental and Social Division at KeNHA facilitates compliance of road projects with environmental regulations. The Division advises on the projects on compliance and provides direct liaisons with NEMA. Projects concerns reach this office directly or through the supervisor while on the other, NEMA (or any other environmental stakeholder) is expected to address project related issues through the same office. The office, therefore, is expected to be well informed of all project related issues at all times. KeNHA, and the Environment Division specifically is represented on the ground by the Supervision for the day to day operations and engagements. However, the office is expected to have direct representation during monthly progress/site meetings and other consultative forums.

8.5 ROLES, RESPONSIBILITIES AND TRAINING

The successful implementation of the ESMP requires the participation of different agencies and entities and their effective uptake and discharge of their roles and responsibilities in participatory frameworks to be developed during project implantation. The roles are complimentary and the agreed hierarchy and institutional frameworks are to be mutually agreed upon.

8.5.1 Roles and responsibilities

The Environmental and Social Management Plan (ESMP) contains the schedule for implementing the mitigation interventions and measures for impacts identified for the Suswa-Mai Mahiu Road Project. It includes the identified environmental and social

parameters, indicators, monitoring frequency, targeted area, units, measuring procedures, targeted standards, assigns monitoring responsibility and associated costs. The ESMP implementation will involve the implementation agency i.e. KeNHA), the Contractor, Resident Engineer, Environmental Specialist, Sociologist, Health and Safety Expert, Government Agencies with activities in the areas, Local Governments, Large Scale Land Owners, infrastructure users and the local communities and their organizations.

8.5.2 Institution Arrangements

The proposed ESMP mitigation measures for the road project on environmental, social and engineering aspects shall constitute part of the project contract documents for the Suswa-Mai Mahiu Road. The contractor shall understand its scope and implement the mitigation measures prescribed to the fullest extent possible. Modifications can be made after consultations based on newly emergent issues and developments that may arise during the project implementation timeframe. It is envisaged that an Environmental specialist shall be appointed to assist the Resident Engineer to ensure the measures recommended in this report are effected with satisfactorily. The environmental and social experts will be recruited with respect to their experience and expertise in environmental knowledge, scientific measurement of environmental parameters, and socio-economic and cultural aspects respectively and their ability to implement the necessary remedies. They will liaise with all relevant public agencies and conduct the training modules relevant to the successful delivery of the ESMP expectations.

a) Financing Agency

The project is financed by the GoK through the Ministry of Transport and Heavy Infrastructure. The financing will be disbursed through KeNHA as the designated implementing GoK agency for this project.

b) Implementing Agency

The Project is owned the GOK who is the Proponent and executed by KeNHA as its representative and holder of the responsibility for the execution of ESMP and delivery of the entire road Project.

c) Supervision Consultant

The Supervision Consultant will be appointed by the implementing agency and will be responsible for monitoring and supervision of the construction works including and the implementation of ESMP. A Resident Engineer (RE) shall be appointed by the Consultant to oversee the construction works and monitor the works undertaken by the Contractor. This will include the implementation of ESMP with assistance from Environmental and Social Experts to ensure compliance with contract specifications and other contractual requirements. An Independent Environmental Consultant Team (IEC) comprising of an environmentalist, geologist, sociologist and health and safety expert may also be engaged. The IEC shall be responsible for checking, verifying and validating the overall environmental performance of the project through regular audits, field inspections and review of project submissions.

d) Contractor

The Contractor will implement the construction works while ensuring compliance with ESMP requirements. The Contractor will compose a Team of Engineers, Environmentalists and Sociologists responsible for implementation and management of the ESMP programme in the Project.

e) Other Government Agencies and Stakeholders

The government established the National Environmental Management Authority (NEMA) as the regulatory and advisory body on environmental management in Kenya under EMCA 1999. NEMA is charged with the responsibility of coordinating and supervising the various environmental management activities being undertaken by other statutory organs. NEMA also ensures that environmental management is integrated into development policies, programmes, plans and projects.

It is envisaged that other Government Agencies such as KenGen, KWS, Kenya Railways, KETRACO, KPA and Ministries with activities upstream or within the road environs will engage with KeNHA to ensure that Suswa Mai Mahiu road that is vital to their operations is sustainable and not negatively impacted by their activities. The cooperation should be within structures agreed upon and assumptions of responsibilities as outlined in the ESMP.

Other stakeholders such a landowners (Kedomg and Akira Ranches), Magadi TaTa Chemicals, County Governments of Narok, Nakuru, Kiambu, Kajiado and Nyandarua will play their roles in management of the catchment and provision of support and services where necessary. The local communities will be expected to play a crucial role as the custodians of the largest portion of the road catchment and impact source areas. Assisted by Government Agencies and other stakeholders a large proportion of impacts affecting the road can be ameliorated if not diminished.

8.5.3 Training Requirements

Training targets

To be effective training on environmental and ESMP aspects shall be targeted at the following categories of personnel and entities:

- Residents along the road passage and road users whose actions can compromise compliance and adherence to environmental statutory requirements and obligations
- Officers with environmental responsibilities in state agencies, companies and landowner in the wider road activities realm that can impact the road project during construction and operation
- Construction and maintenance workers in the road project cycle
- Emergency responses personnel
- Project supervisors and managers

Training components

The training components shall include:

- Pertinent and operational legislative frameworks comprising of all applicable laws, regulations, standards and technical guidelines in work aspects that will affect environmental compliance
- Policies and procedures to be followed by road implementing agency and contractors applicable to the project
- ESMP as the tool and key document for project environmental compliance and associated documents including EHS and ERP among others
- Environmental monitoring and surveillance for ESMP implementation
- Documentation, record keeping and reporting procedures for ESMP related aspects
- Awareness creation methods, information packaging and communication procedures for ESMP purposes
- Complaints handling and good relationship nurturing with other stakeholders local communities
- The economic and social cultural contexts and behavior of local communities in the road project area

8.6 COMMUNICATION WITH STAKEHOLDERS AND GRIEVANCE REDRESS MECHANISM

A Stakeholder Engagement Plan (SEP) is proposed for the Suswa-Mai Mahiu road project for communication with stakeholders alongside a Grievance Redress Mechanism. The objectives of the engagement plan are to:

- Understand the stakeholder engagement requirements in line with the Constitution of Kenya and attendant legislation
- Provide guidance for stakeholder engagement to meet KeNHA's Policies and Environmental Procedures requirements as well as International Best Practice standards
- Identify key stakeholders that are affected, and/or able to influence the Project and its activities
- Identify the most effective methods, timing and structures for sharing project information, and to ensure regular, accessible, transparent and appropriate consultations
- Develop a stakeholders engagement process that provides stakeholders with an opportunity to engage in subsidiary project planning and design and its implementation
- Establish formal grievance resolution mechanisms
- Define roles and responsibilities for the implementation of the SEP
- Define reporting and monitoring measures to ensure the effectiveness of the SEP and periodical reviews of the SEP based on findings

8.6.1 Regulations and requirements

The SEP will enable compliance with the Public Participation Bill, 2016 enacted by Parliament to provide a general framework for effective public participation that give effect to the constitutional principles of democracy and participation of the people under various Articles that:

(a) Promote democracy and participation of the people in accordance with Article 10 of the Constitution
(b) Promote transparency and accountability in decision-making
(c) Enhance public awareness and understanding of governance processes
(d) Promote community ownership of public decisions; and
(e) Promote public participation and collaboration in governance processes

The SEP developed will improve decision-making and performance by:

- Managing costs
- Managing risk
- Enhancing reputation
- Avoiding conflict
- Improving corporate policy
- Identifying, monitoring and reporting on impacts
- Managing stakeholder expectations

8.6.2 Stakeholders' identification and communication

The stakeholders in the project area consist of National Government Agencies and Ministries with activities and oversight roles in the project location area. The County Governments of Narok and Nakuru and Kajiado are also key stakeholders with respect to devolved functions that may affect or be affected by the road construction. Local communities comprising of farmers, livestock keepers, traders and business people, transporters and large scale land owners in the immediate road environs are critical stakeholders. Downstream communities and other stakeholders whose infrastructure and economic activities may be impacted upon by the road project will also be incorporated. The personnel participating in the road construction can also be considered as stakeholders.

a) Culturally appropriate Stakeholder Engagement Process

Concerted efforts will be made through a Project Public Relations Office to engage directly with all relevant stakeholders. Affected individuals, especially vulnerable groups at the local level, are to be consulted directly and/or through their representatives, and established Governance Structures at both the County Administration and Local Communities levels.

Engagement meetings will follow local practices and norms as the road traverses a culturally and ethically diverse landscape. Meetings are to be held with the local administration and community leaders prior to any wider communication in the communities to conform to traditional engagement structures and protocols. All affected communities and groups will have to be made aware of the Project feedback and grievance mechanism.

b) Stakeholder Engagement Activities Reporting

Stakeholder engagement performance will be reviewed immediately after engagement sessions are conducted. This will enable the ESMP implementation team to review and

assess outcomes depending on the nature and level of feedback received from stakeholders during engagement sessions. Evaluation of performance will be assessed based on the extent to which the engagement activities and outputs meet those outlined in this SEP.

In assessing performance, the following will be considered:

- Materials disseminated: types, frequency, and location
- Place and time of formal engagement events and level of participation including specific stakeholder groups (e.g. women, youth, community leaders)
- Number of people attending public or formal meetings
- Number of comments received on specific issues, type of stakeholder and details of feedback provided
- Numbers and type of stakeholders who are in contact with the Project team by mail, telephone and any other means of communication
- Meeting minutes, attendance registers and photographic evidence
- Comments received by government authorities, community leaders and other parties and passed on to the Project
- Numbers and types of feedback and/or grievances and the nature and timing of their resolution; and the extent to which feedback and comments have been addressed and have led to corrective actions being taken.

8.6.3 Grievance Redress Mechanism

a) Grievance Procedure Channels of Communication

Numerous communication channels will be deployed to enable stakeholders submit complaints and requests:

i) Telephone: All incoming calls will be registered and information summarized daily and sent to relevant departments for processing and action in accordance with the grievance procedure outlined above.

ii) Electronic channels: Stakeholders will have the opportunity to send comments, remarks, requests and complaints via the official website of the Project Contractor, email, Twitter or WhattsApp or any other applicable platform.

iii) Post or courier: Postal mail can be used by stakeholders for submission of their queries/requests/complaints/comments for consideration by the public relations officer (PRO). All incoming letters will be documented and stored as well as the responses sent to the originating party in accordance with the grievance procedure outlined above. The PRO address will be availed to stakeholders and have:

- Name
- Telephone
- Email
- Postal address and code
- Any other applicable electronic platform

Any queries/requests/complaints/comments can be brought to the attention of the Project Contractor verbally or written or email or by filling in a Grievance Form that will be availed in the project site office.

b) Grievance redresses process and mechanism

The grievance mechanism is aimed at achieving mutually agreed resolution of grievances raised by any stakeholders as shown in Table 24. Labour related grievances are to be addressed in accordance with the established labour laws while resettlement related grievances would be resolved as contained in the resettlement action plan (RAP) where applicable.

The grievance mechanism ensures that complaints and grievances are addressed in good faith and through transparent and impartial processes that are culturally acceptable in the project area. These are defined as:

a) Complaint which is an expression of dissatisfaction related to an impact caused by the project activities, which has affected
    (i) an individual or group adversely,
    (ii) the interests of an individual or group that need to be addressed and resolved
b) Grievance which is a claim raised by an individual or group whose livelihood, health and safety, cultural norms and heritage are considered to have been adversely affected by a project activity which, if not addressed effectively, may pose risks to KeNHA operations through road blockage or the livelihood, well-being or quality of life of the claimant(s).

A complaint is usually of a less serious nature than a grievance but when not addressed satisfactorily, can become a concern, which may then transform to a grievance. Grievances raised by stakeholders are to be managed through a transparent process, acceptable to affected communities and other stakeholders. This will be at no cost to them and without prejudice or retribution. The grievance mechanism should be appropriate to the scale of impacts and risks presented by the project and beneficial to the proponent, operator, contractor or external stakeholders. The redress mechanism shall not impede access to other judicial or administrative remedies.

Stakeholders' grievances that could potentially arise on the Suswa-Mai Mahiu Road project may include, but not limited to:

- Negative impacts on communities, which may include, but are not limited to financial loss, livestock and wildlife loss, physical harm and nuisance from construction or operational activities
- Health and safety risks
- Negative impacts on the environment; and
- Unacceptable behavior by staff or employees.

Stakeholders shall be made to understand that all grievances lodged, regardless of the project phase or activity being implemented will follow the established mechanism.

Table 24: Proposed grievances redress process for the Suswa-Mai Mahiu Road project

Stage	Process	Duration
1	The Aggrieved Party (AP) will take his/her grievance to through community liaison persons or Construction Site Supervisor (CSS), Social Standards officer (SSO) or call or send a message through email, SMS, WhattsApp or Twitter to the Contractor who will endeavour to resolve it immediately. Where AP is not satisfied, the CSS will refer the AP to the Public Relations Officer (PRO). For complaints that were satisfactorily resolved by the CSS, he/she will inform the PRO who will log the grievance and the actions that were taken.	Anytime
2	On receipt of the complaint, the Project PRO will endeavour to resolve it immediately. If unsuccessful, he/she then notifies KeNHA Project Manager	Immediately after logging grievance
3	The KeNHA Project Manager will endeavour to address and resolve the complaint and inform the aggrieved party. If it's a land issue, the Project Manager will advise the KeNHA CEO to engage the NLC. The Project Manager will also refer to the KeNHA Project Manager other unresolved grievances for his/her action.	1 month
4	If the matter remains unresolved, or complainant is not satisfied with the outcome at the project level, the KeNHA Project Manager, will then refer to matter to the Project Steering Committee at KeNHA for a resolution.	1 month
5	If it remains unresolved or the complainant is dissatisfied with the outcome proposed by the NSC, he/she is free to refer the matter to the Ombudsman's Office or NLC if it is land matters.	Anytime
6	Land related issues; KeNHA CEO may seek the assistance of the NLC.	Immediately after stage 3
7	If the issue remains unresolved through the Ombudsman's decision or the NLC's decision, then the ultimate step will be for the Courts or National Environmental Tribunal respectively to deliberate. Any such decisions are final.	Anytime

The grievance redress mechanism (GRM) is expected to uphold the project's social and environmental safeguards performance. The purpose of the GRM is to record and address any complaints that may arise during the implementation phase of the project and/or any future operational issues that may not have potentially been foreseen and designed for during implementation phase. The GRM is designed to address concerns and complaints promptly and transparently with no impacts (cost, discrimination) for any reports made by project affected people (PAPs). The GRM will work within existing legal and cultural frameworks, providing an additional opportunity to resolve grievances at the local project level.

The key objectives of the GRM are to:

- Record, categorize and prioritize the grievances;

- Settle the grievances via consultation with all stakeholders (and inform those stakeholders of the solutions)
- Forward any unresolved cases to the relevant authority

As the GRM works within existing legal and cultural frameworks, it is recognized that the GRM will comprise of community level, project level and Kenyan judiciary level redress mechanisms.

Community level redress mechanisms will consist of existing traditional and cultural grievance redress mechanisms but where issues are triggered indirectly by the Road Project, the mechanism will involve the local administration, landowner(s) concerned, and if required, the KeNHA or Contractor representative.

Project Level Grievance Redress Mechanism for minor grievances that are site specific such as vibrations or noise will be resolved at site level. More complex grievances such as on land boundaries, or misunderstandings between affected households and the Contractor regarding access arrangements to homes or business will be resolved at the project level. The grievance will be registered by the PRO and PAP liaison officer and forwarded to a grievance redress committee (CRC) that will include:

a. Sub-County Commissioner as Chairperson
b. Supervising Consultant, Member
c. KeNHA Project Manager, Member
d. Contractor, Member
e. Community Officer
f. PAPs' representative

If there is no solution at the project levels, the issue will be taken up by KeNHA headquarters for resolution and the Judiciary level if this fails.

Judiciary level: The project level process will not impede affected persons access to the legal system and at any time, the complainant may take the matter to the appropriate legal or judicial authority as per the laws of Kenya.

c) Grievance Monitoring

The grievance redress mechanism process will involve documentation at all stages. This will take the following process:

- Record of time and grievance received and name of complainant
- Nature of complaint or grievance and place of occurrence
- Action taken and internal process initiated
- Track of grievance redress to completion

8.7 AUDITING AND MONITORING

The audit monitoring plan will ensure that environmental and social mitigation measures are implemented during project development. The environmental mitigation and monitoring plans are to be included in the contractor's guidelines and contract. It is envisaged that that project output and, certificates of payment and actual payment will be subject to implementation of the EMP. It is recommended that:

- The ESIA baseline conditions will form the basis for future evaluation and be conducted in accordance to the targets established through the designated indicators
- Monitoring checklists will be prepared by the Supervising consultant or external ESIA expert to ensure that all set standards, targets and milestones are met

The auditing monitoring will consist of:

i) Internal Monitoring

KeNHA will have the responsibility of conducting regular internal monitoring of the project to verify the reports of the Contractor and to audit direct implementation of environmental mitigation measures contained in the ESMP and construction contract clauses for the ProjectExternal Monitoring

ii) External monitoring

It is recommended that an independent ESIA Expert/Firm be hired to carry out Annual Environmental Audits in line with NEMA requirements.

An Environmental Management Unit (EMU) will be established at the site office level to work with the engineering supervision team and ensure compliance with ESMP. The EMU at the site office shall coordinate environmental management and monitoring activities on a daily basis. The contractor will implement environmental and social mitigation measures under the Supervision of Resident Engineer and Environmental Supervisor from EMU to ensure that the Contractor actualizes technical and environmental requirements.

A feedback mechanism will be established during monitoring to ensure that implementation failure is penalized on to the Contractor. The Resident Engineer's will ensure enforcement of mitigation measures. Where approved mitigation measure fail to achieve the desired effect or lead to unforeseen adverse impacts, such occurrences shall be communicated to the EMU site Office. Reasons for failure will be investigated and alternative mitigation mechanisms be commissioned after consultation with the team that conducted the ESMP.

8.8 THE ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) FOR THE PROJECT

Components addressed in this section include:

- Physiography and geology
- Soils
- Air quality
- Surface and groundwater resources
- Water quality
- Terrestrial environnent (habitats, flora, and fauna)
- Land resources and National Parks
- Archaeological, historical and cultural Sites
- Visual aesthetics

- Noise and vibrations
- Solid and liquid wastes
- Social characteristics
- Economic characteristics
- Occupational health and safety
- Security and public safety

The structure of the Environmental and Social Management Plan and areas of concern to be addressed are outlined in the Table 25 below. Other general requirements and trainings are outlined below.

Table 25: Detailed Environmental, Social Management Monitoring Plan

Parameter	Indicator	Monitoring frequency	Sampling area	Measurement Units	Methods	Target/Standards	Responsibility	Cost	Applicable (yes/No)
Preconstruction phase									
Physiography	Landforms	Once before commencement	Road passage and borrow pit areas	Descriptive and qualitative	Visual/ Photography	Approximate restoration of preexisting landscape after construction	ES	100,000	Yes
Geology	Fault lines, fissures and pyroduct status	Once before commencement	Faultiness, fissures and pyroducts	Size, location depth and direction	Seismic and ERT	Identified locations in geological report	KeNHA/ Contractor/ Consultant geologist	10,000,000	Yes
Soils	Soil horizon profile	Once before construction	Water flow systems crossing points along road	Soil strata width	Coring	Retention of existing strata profiles and detection of subsurface erosion potential	KeNHA/ Project Consultant geologist/ ES	1,000,000	Yes
Land Resources	Land use	Once before construction	Along road passage and catchment	Km^2	Satellite imagery		KeNHA and Identified catchment stakeholders, ES	500,000	Yes
Surface water	Water levels	Once before construction	Water pans and seasonal streams	cm	Staff meter gauges or bathymetry	Livestock watering and domestic use standards	Contractor/ ES	50,000	Yes
Groundwater Resources	Water levels		N/A	m asl	Peizometer	N/A. No identified resource			No Area has no known underground water resources
Dust	Dust deposition	Once before commencement	Near settlements and along road	$\mu g/m^3$	Glass slides	Zero	Contractor		Yes

Air Quality	Particulate matter	Once before construction	Near settlements and along road	µg/m^3	Portable meter	0.01	Contractor/ES	30,000	Yes
National parks	Habitat composition/ Wildlife numbers								No Project does not traverse national park
Water Quality	Turbidity, Conductivity, BOD, COD, pH, TSS TDS Venous metals and other dissolved chemical compounds	Wet season	Near culverts/bridges, livestock watering ponds	NTU µS/cm, mg/ml mg/ml Log H^+, mg/l mg/l Various units (mg/l, µg/l)	Multi-parameter portable meter Laboratory analysis	10 NTU, <400 µS/cm, 4 mg O_2 l^{-1}, <20 mg l^{-1} O_2 6-8 100 mg/l 3,000 Kenyan and WHO standards	Contract/ ES	400,000	Yes
Noise	Noise level/ mapping	Once before the construction starts	Near settlements/ Institutions	dBA	Calibrated precision integrating sound level	45 residential 55 Commercial area 70 Industrial areas	Constrictor/ ES	100,000	Yes
Vibrations	Vibrations sensing	Once before the construction starts	Near settlements/ Institutions	mm/s	Instantel Micromate with Geophone and GPS	5 mm/s	Constrictor/ ES	100,000	Yes
Solid Waste	Visual, Presence of solid waste	Once before construction	Settlements/ Urban centres/ Institutions/ Road passage	Tones	Visual	Nil	Contractor/ ES/ County Government	50,000	Yes
Liquid waste	Visual,	Once before	Settlements/	Litres	Visual	Nil	Contractor/ ES/	50,000	Yes

	Pools and spills	construction	Institutions/ Road passage				County Government		
Flora	Tree density, land cover, Species composition	Once before construction commencement	Entire project area	% Cover, No/Ha, Checklist	Quadrats, Belt transects, Transect walks	Near preconstruction conditions where pristine, improved where degraded	Contractor/ Es/ NEMA/ KFS	500,000	Yes
Fauna	Animal densities, species composition, abundance, Road kills and accidents	Once before construction commencement	Wildlife rich areas	Animal numbers, Checklist Road kill reports/ counts	Road transects, Incident reports, Road kill count	Stable or increased populations	Contractor/ ES/ KWS	400,000	Yes
Soil erosion	Visual, Gullies depth and activity status, Silt deposits	Once before construction	Areas with gullies and deposition points	Width and Depth of gullies, number/Km^2, status, tones of soil	Identified sites	Healing gullies, no new deposits	Contractor/ ES/ NEMA/ KWS/ KenGen	400,000	Yes
Archeological/ Cultural/ Historical sites	Numbers and state of site	Once before construction	Identified sites		Visual	Preserved as is	ES/ NMK/ Contractor		No No such sites identified
Social Characteristics	Demographic attributes, and socio-cultural aspects	Once before construction	Urban and rural areas	Population densities, economic activities and income levels, population composition	Census and household questionnaires	Enhanced income, sustainable livelihoods	Project sociologist	800,000	Yes
Economic Characteristics	Types of economic activities and	Once before construction	Rural and urban centres	KES	Questionnaires and tax returns	Increased income across areas economic	Project economist	800,000	Yes

	financial returns					sectors			
Occupational Health and Safety	Reported incidents	Once before construction	Health centres	Numbers and nature	Treatment registers inspection	Zero	Project sociologist/ Es/ Contractors	50,000	Yes
Security and Public Safety	Reported crime incidents	Once before construction	Police satiations and County Commissioners offices	Number and nature of incidents	Occurrence books inspection	Zero	Project sociologist	50,000	Yes
Total cost preconstruction phase								**15.380,000**	
Parameter	Indicator	Monitoring frequency	Sampling area	Measurement Units	Methods	Target/Standards	Responsibility	Cost	**Applicable (yes/No)**
Construction phase									
Physiography	Landforms	Every 3 months	Road passage and borrow pit areas	Descriptive and qualitative	Visual/ Photography	Approximate restoration of preexisting landscape after construction	ES	90,000	Yes
Geology	Fault lines, fissures and pyroduct status	4 times Before and after both short and long rainy seasons	Faultiness, fissures and pyroducts	Size, location depth and direction	Seismic and ERT	Identified locations in geological report	KeNHA/ Contractor/ consultant geologist	10,000,000	Yes
Soils	Soil horizon profile	2 times After rainy seasons	Water flow systems crossing points along road	Soil strata width	Coring	Retention of existing strata profiles and detection of subsurface erosion potential	KeNHA/ Project Consultant geologist/ ES	4,000,000	Yes
Land Resources	Land use	Every 3 months	Along road passage and catchment	Km^2	Satellite imagery		KeNHA and Identified catchment stakeholders, ES	1,500,000	Yes

Surface water	Water levels	6 time Beginning During After Short and long rains	Water pans and seasonal streams	cm	Staff meter gauges or bathymetry	N/A. Most are seasonal	Contractor/ES	60,000	Yes
Groundwater Resources	Water levels		N/A	m asl	Peizometer	N/A. No identified resource			No Area has no known underground water resources
Air Quality	Dust Smoke, Internal combustion engine emissions	Monthly along road Weekly at construction sites with dust and machinery emissions	Near settlements and along road	PM µg/m^3 Volatiles concentrations		0.01	Contractor/ES	500,000	Yes
National parks	Habitat composition/ Wildlife numbers								No Project does not traverse national park
Water Quality	Turbidity, Conductivity, BOD, COD, pH, TSS TDS Venous metals and other dissolved chemical compounds	6 time Beginning During After Short and Long rains	Near culverts/bridges, livestock watering ponds	NTU µS/cm, mg/ml mg/ml Log H^+ , mg/l mg/l Various units (mg/l, µg/l)	Multi-parameter portable meter (Hanna or WTG), Laboratory analysis	10 NTU, <400 µS/cm, 4 mg O_2 l^{-1}, <20 mg l^{-1} O_2 6-8 100 mg/l 3,000 Kenyan and WHO standards	Contract/ ES	1,000,000	Yes
Noise	Noise level/	Monthly	Near	dBA	calibrated	Residential 45	Constrictor/ ES	600,000	Yes

	mapping	along road Weekly at construction sites with dust and machinery emissions	settlements/ Institutions		precision integrating sound level	Commercial area 55 Industrial areas 70			
Vibrations	Vibrations sensing	Monthly along road Weekly at construction sites with dust and machinery emissions	Near settlements/ Institutions	mm/s	Instantel Micromate with Geophone and GPS	5 mm/s	Constrictor/ ES	300,000	Yes
Solid Waste	Presence of solid waste	Weekly at construction sites, material depots Monthly along road and shopping centres	Settlements/ Urban centres/ Institutions/ Road passage	Tones	Visual	Nil	Contractor/ ES/ County Government	150,000	Yes
Liquid waste	Pools and spills	Weekly at construction sites, material depots Monthly along road and shopping centres	Settlements/ Institutions/ Road passage	Litres	Visual	Nil	Contractor/ ES/ County Government	150,000	Yes
Flora	Tree density, land cover, Species compositio n	Every 4 months	Entire project area	% Cover, No/Ha, Checklist	Quadrats, Belt transects, Transect walks	Near preconstructio n conditions where pristine, improved where degraded	Contractor/ Es/ NEMA/ KFS	300,000	Yes
Fauna	Animal densities,	Every 4 months	Wildlife rich areas	Animal numbers,	Road transects,	Stable or increased	Contractor/ ES/ KWS	240,000	Yes

	species composition, abundance, Road kills and accidents			Checklist Road kill reports/ counts	Incident reports, Road kill count	populations			
Soil erosion	Visual, Gullies depth and activity status, Silt deposits	6 time Beginning During After Short and Long rains	Areas with gullies and deposition points	Width and Depth of gullies, number/Km^2, status, tones of soil	Identified sites	Healing gullies, no new deposits	Contractor/ ES/ NEMA/ KWS/ KenGen	180,000	Yes
Archeological/ Cultural/ Historical sites	Numbers and state of site	Continuously where excavation is taking place for archeological finds	Identified sites		Visual	Preserved as is	ES/ NMK/ Contractor	600,000	No No such sites identified
Social Characteristics	Demographic attributes, and socio-cultural aspects	Once a year	Urban and rural areas	Population densities, economic activities and income levels, population composition	Census and household questionnaires	Enhanced income, sustainable livelihoods	Project sociologist	600,000	Yes
Economic Characteristics	Types of economic activities and financial returns	Once a year	Rural and urban centers	KES	Questionnaires and tax returns	Increased income across areas economic sectors	Project economist	600,000	Yes
Occupational Health and Safety	Reported incidents	Continuously	Health centers	Numbers and nature	Treatment registers inspection	Zero	Project sociologist/ Es/ Contractors	750,000	Yes
Security and Public Safety	Reported crime incidents	Continuously	Police satiations and County	Number and nature of incidents	Occurrence books inspection	Zero	Project sociologist	750,000	Yes

			Commissioners offices						
Total cost during construction phase								22,370,000	
Parameter	Indicator	Monitoring frequency	Sampling area	Measurement Units	Methods	Target/Standards	Responsibility	Cost	**Applicable (yes/No)**
Operation phase									
Physiography	Landforms	Every two years	Road passage and borrow pit areas	Descriptive and qualitative	Visual/ Photography	Approximate restoration of preexisting landscape after construction	ES	100,000	Yes
Geology	Fault lines, fissures and pyroducts status	One a year at identified critical points	Faultiness, fissures and pyroducts	Size, location depth and direction	Seismic and ERT	Identified locations in geological report	KeNHA/ Contractor/Consultant geologist	10,000,000	Yes
Soils	Soil horizon profile	2 times After rainy seasons	Water flow systems crossing points along road	Soil strata width	Coring	Retention of existing strata profiles and detection of subsurface erosion potential	KeNHA/ Project Consultant geologist/ ES	1,000,000	Yes
Land Resources	Land use	Twice a year	Along road passage and catchment	Km^2	Satellite imagery		KeNHA and Identified catchment stakeholders, ES	500,000	Yes
Surface Water	Water levels	Once a year During long rains	Water pans and seasonal streams	cm	Staff meter gauges or bathymetry	N/A most are seasonal	Contractor/ ES	50,000	Yes
Groundwater Resources	Water levels		N/A	masl	Peizometer	N/A. No identified resource			No Area has no known underground water resources

Air Quality	Dust Smoke, Internal combustion engine emissions	Twice a year	Near settlements and along road	PM µg/m^3 Volatile levels		0.01	Contractor/ES	30,000	Yes
National parks	Habitat composition/ Wildlife numbers								No Project does not traverse national park
Water Quality	Turbidity, Conductivity, BOD, COD, pH, TSS TDS Venous metals and other dissolved chemical compounds	Once a year during long rains	Near culverts/bridges, livestock watering ponds	NTU µS/cm, mg/ml mg/ml Log H^+ , mg/l mg/l Various units (mg/l, µg/l)	Multi-parameter portable meter (Hanna or WTG), Laboratory analysis	10 NTU, <400 µS/cm, 4 mg O_2 l^{-1}, <20 mg l^{-1} O_2 6-8 100 mg/l 3,000 Kenyan and WHO standards	Contract/ ES	400,000	Yes
Noise	Noise level/ mapping	Twice annually	Near settlements/ Institutions	dBA	calibrated precision integrating sound level	45 residential 55 Commercial area 70 Industrial areas	Constrictor/ ES	100,000	Yes
Vibrations	Vibrations sensing	Twice annually	Near settlements/ Institutions	mm/s	Instantel Micromate with Geophone and GPS	5 mm/s	Constrictor/ ES	100,000	Yes
Solid Waste	Presence of solid waste	Monthly along road and shopping centres	Settlements/ Urban centres/ Institutions/	Tones	Visual	Nil	Contractor/ ES/ County Government	50,000	Yes

			Road passage						
Liquid waste	Pools and spills	Monthly along road and shopping centres	Settlements/ Institutions/ Road passage	Litres	Visual	Nil	Contractor/ ES/ County Government	50,000	Yes
Flora	Tree density, land cover, Species composition	Once a year	Entire project area	% Cover, No/Ha, Checklist	Quadrats, Belt transects, Transect walks	Near preconstruction conditions where pristine, improved where degraded	Contractor/ Es/ NEMA/ KFS	500,000	Yes
Fauna	Animal densities, species composition, abundance, Road kills and accidents	Once a year	Wildlife rich areas	Animal numbers, Checklist Road kill reports/ counts	Road transects, Incident reports, Road kill count	Stable or increased populations	Contractor/ ES/ KWS	400,000	Yes
Soil erosion	Visual, Gullies depth and activity status, Silt deposits	During and After Short and Long rains	Areas with gullies and deposition points	Width and Depth of gullies, number/Km^2, status, tones of soil	Identified sites	Healing gullies, no new deposits	Contractor/ ES/ NEMA/ KWS/ KenGen	400,000	Yes
Archeological/ Cultural/ Historical sites	Numbers and state of site	N/A	Identified sites		Visual	Preserved as is	ES/ NMK/ Contractor		No Any finds would have been documented during construction identified
Social Characteristics	Demographic attributes, and socio-cultural	Every two years (selected households and business	Urban centres and rural areas	Population densities, economic activities and income	Census and household questionnaires	Enhanced income, sustainable livelihoods	Project sociologist	800,000	Yes

	aspects	centers		levels, population composition					
Economic Characteristics	Types of economic activities and financial returns	Every two years (selected households and businesses)	Rural homesteads and urban centers	KES	Questionnaires and tax returns	Increased income across areas economic sectors	Project economist	800,000	Yes
Occupational Health and Safety	Reported incidents	Monthly	Health facilities/Police stations	Numbers and nature	Treatment registers inspection	Zero	Project sociologist/ Es/ Contractors	50,000	Yes
Security and Public Safety	Reported crime incidents	Monthly	Police satiations and County Commissioners offices	Number and nature of incidents	Occurrence books inspection	Zero	Project sociologist	50,000	Yes
Annual Total cost during operation phase								15,380,000	

8.9 CATCHMENT MANAGEMENT PLAN

a) Background

The Suswa-Mai Mahiu Road is predominantly affected by processes and phenomena originating from the hinterland that arise from its geographic and geological settings. The combinations of topography, geology, soil types, land use, land cover, infrastructure, climate and hydrology leads to subsidence at fault lines, flooding, siltation along the road and downstream environments. The road alignment and elevation with its limited and easily blocked drainage structures converts the road into a dam wall and the culverts also act as spillways with subsequent gully erosion initiation. Where the road trends along the slope gullies form parallel to the road and result in undercutting and potential road base collapse at several points. The sustainability of the road will depend on the effective management of the catchment in addition to engineering designs and constructions to enable it withstand impacts of catchment related phenomena.

There are several national Government agencies, landowners, county governments and local communities with activities and infrastructure developments that have detrimental impacts on the road. The relevant stakeholders in the catchment management are documented in the ESIA report.

The adverse impacts on the road emanating from the catchment area related to:

- Gully formation due to easily eroded and unconsolidated soils enhancing headword and downward cutting of channels further widened by bank collapses
- Sand harvesting in gullies and other deposition points
- Infrastructure construction and well pads that cause channel flow and initiate gully formation
- Vegetation removal by livestock overgrazing and charcoal burning
- Natural flow blockage and redirection by dykes, roads and SGR foundation elevation

b) Nature and impact source areas

There are several areas impacted by basin wide hydrological processes where interventions will reduce inflows, reverse land degradation, improve livelihoods and aesthetics. Table 26 indicates the target areas, impacts, interventions and responsible entities.

Table 26: Target areas, impacts, intervention and responsibility in the Suswa-Mai Mahiu road catchment

A: Upstream areas			
Target Area	**Impacts**	**Interventions**	**Responsibility**
Western Mt Suswa	Gully formation Siltation Livestock tracks Overgrazing Erosion Road water channeling	Check dams Water pans Range management Flow dispersal	Community Narok County Government KeNHA NEMA Suswa Conservancy
Olkaria area	Gully formation	Check dams	KenGen

	Siltation Overgrazing Erosion Road water channeling Geothermal well pads compaction generated flow	Water pans Range management Flow dispersal Bunding	Nakuru County Government KWS KeNHA Community NEMA Suswa Conservancy
Hell's Gate NP and Longonot NP	Gully formation Road Runoff rills Soil erosion from wildlife and livestock trails Geothermal wells pads	Check dams Flow dispersion Weirs establishment	KWS KeNHA KenGen
Jorowa Gorge and tributaries	Erosion Silt deposition Pumice generation Sand harvesting Construction/Solid waste dumping by sand harvesting trucks Gazette water flow system as a protected riparian	Headwater control Diversion of waste water from geothermal facilities Weirs and check dams Sand harvesting control	KWS Community KenGen IPP NEMA
Kedong/Akira Ranches	Sand harvesting Charcoal burring Illegal grazing and land denudation Gully formation and pumice generation Poor road alignments leading to gully formation SGR elevation and drainage structures	Conservancies and wildlife sanctuaries Weirs Check dams Inland deltas creation for water dispersion Control of illegal activities Creation of conservancies to control encroachment Sand harvesting control	Ranch Management KWS KFS NEMA KeNHA Kenya Railways
Longonot community area	Poor soil and water conservation Overgrazing Gully formation Poor road network alignment Sand harvesting Flooding Siltation	Check dams Water pans Soil and water conservation structures on farms Rehabilitation of gullies Sand harvesting control	Community Nakuru County Government KeNHA
Syabei catchment and Nairegia Enkare escarpment	Poor soil and water conservation Overgrazing	Check dams Water pans Soil and water	Community Narok County Government

	Gully formation Poor road network alignment Sand harvesting Flooding Siltation	conservation structures on farms Rehabilitation of gullies	KeNHA TaTa Magadi Chemical Company
Mai-Mahiu Naivasha Road and its catchment	Water damming and channeling Gully initiation	Water pans Weirs Check dam upstream and downstream Gully rehabilitation Sand harvesting control	KeNHA Community
Townships (Suswa, Mi Mahiu, OlLasit)	Channeled flow generation Erosion Solid waste deposition	Storm water management Solid waste management	Narok and Nakuru County Governments Residents
B: Downstream areas			
Ewaso Kedong/Satellite areas	Flooding Flash floods on Magadi-Nairobi road Silt and pumice Gully formation Overgrazing Invasive species establishment Road/SGR drainage structures driven channeling	Check dams Weirs Low dispersal Gully rehabilitation Pumice deposits removal Sand harvesting control	Narok and Nakuru County Governments KeNHA Community ICD Kenya Railways
Suswa Ketracco Station	Water flow obstruction through dykes construction Flooding of road Pumice deposition	Removal of flow blocking structures from non sensitive areas	Ketraco
Lake Magadi	Siltation of lake Magadi (20%) Loss of pastures through erosion Flash floods and siltation	Check dams Gully rehabilitation Catchment management Dredging Suswa-Mai Mahiu road design that prevents water chambering, damming effects and gully formation	Tata Lake Magadi Chemical Company Community Suswa Conservancy Nakuru, Narok and Kajiado County Governments KeNHA NEMA
Industrial park, inland container terminal, access	Surface runoff generation Gully formation	Catchment management Appropriate runoff	KeNHA Kenya Railways KPA

roads and SGR	Flooding rand siltation risks from upstream activities Damming effects	water management Designs that that prevent damming and water channeling	

c) Check Dams Design

The check dams should be designed and constructed in a manner that does not breach underground fissures. They should be established in areas with flat to undulating terrain.

- The surfaces should be lined to enable water retention
- Dam sides should be strengthened
- Spillways should constitute part of natural flows
- Series of dams to be constructed to cumulatively store larger water volumes downstream
- Perimeter fencing to prevent dam side degradation by livestock and wildlife

d) Terraced weirs and check dams

These are to be established in steep sloping upper areas and built in close proximity to each other to reduce water velocity, enhance sedimentation and ground water infiltration. It is important that:

- Local material are used for dam walls
- Toe of upper dam is at level with the wall of the lower one
- Dam walls are firmed up, vegetated and protected from livestock and wildlife

Terraced weirs are to be established in gullies in undulating to flat areas. Sequences along the gully floor will reduce water flow velocities; allow accumulation of silt and sediments assist in natural healing and vegetation establishment.

e) Water pans

In the farming and grazing areas, small water pans are to be established and their bottoms firmed or lined to enhance water retention. The design and appropriate location can be adapted from operational ones in the community area around Olasiti and Suswa. Where established widely they will effectively collect runoff water, prevent soil erosion and increase water availability in dry seasons.

f) Inland deltas and flow dispersal structures

Inland deltas and deposition fans were observed to form at termination of some small gullies. They disperse and dissipate channelized flows and can be replicated upstream and along tributaries that combine to form the major gullies. The soils in the area are porous and capable of absorbing dispersed low velocity discharges. Transportation of downstream silt deposits, road cut spoils to form barriers in the gullies with vegetation establishment at appropriate locations

can be used to create the inland deltas and flow barriers in the gullies, reducing water flow velocities and erosive power.

g) Conservancies and wildlife sanctuaries

The creation of wildlife sanctuaries, electric fencing and security will curtail and discourage the damaging impacts of overgrazing, charcoal burning and activation of gullies through sand harvesting. Benefits from wildlife conservation, tourism, environmental conservation and infrastructure protection will also ensue.

h) Conduct of catchment management plans ESIA

Environmental and social impacts studies will be conducted prior to commencement of the catchment management processes. An inter agency committee will need to be established to coordinate the process in collaboration with other stakeholders. The ESIAs will identify the numbers, size and location of the required structures and assign responsibilities.

8.10 GENERAL EHS PLANS REQUIREMENTS IN CONSTRUCTION PROJECTS

The plans presented in this section are outlines and the Contractor, Resident Engineer and Environmental Specialist shall prepare detailed applicable specific plans. The plans will incorporate Audit and Monitoring Checklists to ensure compliance with the intended interventions and adherence to national legislations, regulations and guidelines requirements.

8.10.1 Occupational Health and Safety Plan

A wide variety of activities that deploy humans and equipment in dynamic and ever-changing situations are involved in road construction and their inter-phase creates an environment where occupational hazards are highly probable. Road contractor and supervisory personnel will ensure that where practicable; exposure to health and safety risks to workers and other persons arising from the road construction undertakings are minimized. To achieve this, the risks will be identified, assessed and their occurrence probabilities reduced. The occupational health and safety plan has the following components:

a) Identification of risks and hazards

The risk management process requires identification of potential hazards associated with road construction undertakings that are:

- Nature of the construction site, its location, layout, conditions and access
- Presence of incorrectly erected equipment, unguarded holes, penetrations and voids
- Unguarded excavations, trenches, shafts, unstable structures including incomplete ladders scaffolding, mobile platforms, fragile and brittle surfaces, and unprotected formwork decks
- Falling objects such as tools and equipment, work material, debris, etc
- Collapsing trenches and road banks

- Erected and construction structures collapse
- Inappropriate handling, use, storage, and transport or disposal of hazardous substances
- Emissions from welding fumes, gases and arcs
- Dangerous manual tasks
- Uncoordinated linkages between works components

Other potential risks in the working environment comprise of electric shocks, immersion in water or other liquids, engulfment in fire or explosions, slipping, tripping, accidental falls, injuries by moving plants or their parts, injurious exposure to noise, heat, cold, vibrations or contaminated atmosphere and movement confinement.

b) Risks assessment

An assessment of risks will be undertaken as part of the occupational health and safety plan and categorize the:

- Severity of injuries or illnesses that could result and its ranking as minor, significant with wide ranging and severe affects, and
- Probability of occurrence of injury or illness relative to the number of people likely exposed to the hazards.

The risk assessment will enable appropriate control measures deployment, planning and assist in:

- Identification of workers and categories at risk
- Determination of sources and processes associated with specific risks
- Verification of effectiveness of adopted and operational control measures

c) Control and elimination of risks

Control measures have varying outcomes and need to be ranked hierarchically in terms of level of protection, reliability and effectiveness. The risk analysis and elimination process will precede road construction works to create a safe working environment. Where risks elimination is not possible, risks reduction will be supplemented through:

- Substitution with less hazardous aspects or practices
- Hazard isolation
- Engineering interventions and controls such as shoring of excavations, cavities and machinery enclosure

Site administrative controls are to be deployed concurrently with other control measures and will encompass:

- Work area entry control
- Assessed competence on use of deployed equipment and training on upgrades or new equipment.
- Implementation and adherence to a fixed rotation system and no overtime
- Use of permit systems to control access to different road construction work sectors
- Appropriate site and activity specific personal protective equipment (PPE) for safety

An array of applicable control measures and protocols will be used in the Suswa–Mai Mahiu road project and all personnel involved in the project trained on health and safety aspects and their obligations in the discharge of duties.

8.10.2 Borrow pit/Quarry Rehabilitation Plan

The restoration of borrow pits and quarries will be accomplished through refilling, ground leveling and planting of suitable trees, shrubs and grass indigenous to the site specific area. Suitable trees or other plants that can establish in the rehabilitated areas but are not native will only be used after a thorough evaluation and profiling on their suitability, economic value and invasiveness potential. Stockpiled soil from road cuttings, borrow pits and surplus excavated materials from earth works will be used in the rehabilitation.

Prior to material extraction from the borrow areas, photographic documentation of the areas will be made so that restoration replicates or approximates original conditions. Rehabilitated areas will be made to blend with their surrounding landscapes and be sufficiently drained. At least a one year or more maintenance period is recommended for the replanted vegetation before handover to relevant stakeholders or authorities.

8.10.3 Vehicle/Traffic Management Plan

Road construction activities will increase the ambient traffic along the road due to movement of trucks and other construction equipment. Traffic bottlenecks will inevitably occur at construction sites and where excavations are being made. Diversions created for traffic will reduce conveyance speeds causing traffic buildups and snarl ups thereby inconveniencing road users. Operation of machinery and vehicle movements on unpaved diversion road surfaces will create dust, reduce visibility and increase likelihood of accidents occurrence, especially at night. Extreme climatic conditions causing flooding and siltation may be exacerbated by road works leading to accidents, closures and impeded vehicular movement. The traffic vehicle management plan is aimed at reducing and managing these scenarios.

To facilitate traffic flow and reduce accidents occurrence potential, it is recommended that:

- The contractor provide, erects and maintain barricades, signs, markings, lights and personnel where necessary to ensure the safety of all road users throughout the entire stretch of the road works and period,
- Bulky materials be moved to sites where and when required during off peak hours
- Prior arrangements are made with long haul transporters where extraordinary loads are being ferried along the road's construction sections
- Visible and comprehensible signage is located at all critical points for safety of project workers and road users
- Road diversions are clearly indicated and motorable
- Access roads and junction are kept open and functional at all times

- Flagmen or traffic marshals are present at all operation sites where traffic flows through road works to direct vehicles
- Fences either using corrugated iron sheets, tape or light mess is installed to separate work areas from pedestrians
- A communication system is established with traffic police at Mai Mahiu, Narok and Kaplong Junction in Bomet to divert traffic in case of the Mai-Mahiu Road section closure for major works or flooding, siltation or fault line/fissure subsidence during construction

8.10.4 Waste Management Plan

The road construction process will also involve decommissioning of existing structures, construction of the new road, operations and decommissioning at the end of project's lifespan. These will result in generation of varying types and quantities of wastes constituting consumables, surpluses and byproducts of the construction processes. The Waste Management Plan (WMP) will be elaborated for specific wastes and implemented by all parties in the road construction process.

The following within the WMP will be elaborated for respective phases of the Project:

- Identify agencies and contractors responsible for each key stage and indicate their responsibilities.
- Identify the types and quantities from all waste streams produced during construction, operation and decommissioning phases
- Identify waste management options with particular attention to hazardous wastes e and their necessary management requirements and procedures
- Identify suitable waste management sites in conjunction with County Governments and NEMA
- Use NEMA licensed waste disposal contractors and facilities that comply with the Kenyan Environmental Legislative requirements at the local and national levels
- Train project staff on the requirements of the WMP as contained in the ESMP
- Document the quantities of wastes produced on a monthly basis, and where possible measures taken to re-use, reduce or recycle waste as appropriate
- Monitor throughout the project life cycle, waste management to ensure compliance with the WMP
- Identify waste management options as described in the ESMP and develop a hierarchy of waste reduction, reuse, and recycling protocols
- Develop hazardous wastes identification and management procedures according to national requirements

8.10.5 Camp design/Installation plan

The magnitude and nature of the Suswa-Mai Mahiu Road project, and its socio-economic and cultural settings indicate that workers' camps, material depots and project management site offices have to be constructed. The following impacts and mitigation interventions inform on the need to construct workers camps and material depots (Table 27).

Table 27: Camp installation impacts and mitigation

Potential Impacts	**Mitigation**
i) Negative adverse environmental conditions associated with specific impacts during construction	i) Conform to ESMP mitigation measures
ii) Increased demand on community infrastructure, services and facilities	ii) Construction of a workers camp with requisite facilities and services
iii) Disruptive impacts on community health and safety due to influx of a large workforce	iii) Develop a self sufficient workers' camp for avoidance of competition and conflict and health issues with local communities
iv) Loss of land for other uses to construct workers camp	iv) Adopt the RAP/borrow areas recommendations on land acquisition, operation and rehabilitation processes and protocols
v) Decommissioning adverse environmental impacts	v) Adopt similar options to those proposed for the general works in the ESMP

a) Camp location

The site selected for establishing the camp shall meet the following requirements:

- Located away from learning institutions, urban centers and high density community settlements areas
- Located away from environmentally sensitive areas
- Area should not be prone to flooding
- Enable establishment of sanitation facilities and disposal of wastes
- Not strain community infrastructure and facilities
- Have adequate area for establishment all requisite facilities

b) Management Plan

This framework of the camp installation and Management plan will be elaborated and implemented by the contractor during construction phase. KeNHA will review and approve the camps location, construction and management plans.

A camp management plan will be developed for the camps prior to their inhabitation according to KeNHA's environmental and social responsibilities policy guidelines. The camps will conform to national and international best practices, housing standards and the National Construction Authority (NCA) guidelines for human habitation structures and County

Government bylaws. All NEMA environmental guidelines and applicable national legislation shall apply to the camps.

An assessment of the need for workers' accommodation in relation to the total needed workforce, potentially locally sourced work force and availability of existing housing and their adequacy will be conducted. If a workers' camp is deemed necessary, an analysis of the camps impacts on the community will undertaken and include:

- Camp impacts during construction phase
- Community services and facilities infrastructure
- Local businesses and local employment
- Community health, safety and well being
- Socio-cultural impacts and community cohesion
- Land acquisition and resettlement, and
- Decommissioning and land restoration

The camps installation plans will include elaborations on:

- General living facilities
- Room occupancy
- Sanitary and toilet facilities
- Fire fighting and safety procedure
- Canteen, cooking, laundry facilities
- Nutrition and food safety controls to avoid contamination
- Medical facilities; leisure, and social facilities;

A description of the structures, management and monitoring protocols, roles and responsibilities of the accommodation area will be made in relation to:

- Management and staff structure
- Charging fees for accommodation and services
- Health and safety within the site
- Security of workers' accommodation from external threats
- Human rights, rules and regulations within the camp
- Consultation and grievance redress mechanisms; and
- Management of community relations

The plan for the camp will be integrated with the occupational health plan; emergency response plans and conforms to other relevant ESMP plans on solid and waste management, social responsibilities and HIV/AIDS aspects.

8.10.6 Auxiliary Plants

The road construction will require the use of machinery, establishment of material processing plants, material depots and yards for servicing and parking of machinery and vehicles and site

offices. The auxiliary plants will include various types of construction machinery, asphalt plants, concrete batching equipment, uplifting systems, rock aggregate and gravel crushers, scaffolding and concrete pumps among others as the nature of work may dictate (Table 28).

Table 28: Auxiliary plants management plan for the Suswa-Mai Mahiu Road Project

Potential Impacts	**Mitigation**
i) Dust generation by vehicle movement, crushers and concrete mix plant	Water sprinkling Transport fine material in bags or under tarpaulins Close tail boards or spill-proof Educate workers on good engineering practices and material handling
i) Emissions from Hot mix plant Vehicles Generators Heavy construction machinery	Emission control ESMP guidelines Appropriate site selection and regular maintenance Regular maintenance as per manufacturers' specification Exhaust pipe of appropriate length Exhaust silencers, maintenance as per manufacturer guidelines
ii) Noise and vibrations Crushers Generators	ESMP aspects on noise and vibrations Appropriate sitting Mandatory acoustic enclosures and vibration cushions
iii) Oil spills from storage and handling	Good practices on waste handling in waste management plan
iv) Residual waste from dust collectors and pits	Good practices on waste management
v) Concrete waste from concrete mix plant	Guidelines on waste management
vi) Bitumen and bitumen mix from hot mix plant	Guidelines on waste management
vii) Stone chips from crushers	Guidelines on waste management
Health and safety • Trajectory of moving equipments • Moving parts of equipment • Plant area/site • Accident/Health • Breakdown of vehicles	OHS guidelines • No person should in vehicle's trajectory • Caution signs, awareness among workers • Caution/Safety equipment • First aid/Periodic health checks of operators • Towing arrangement

The Contractor shall undertake measures as indicated above to minimize dust generation, emissions, noise, oil spills, residual waste and accidents at the auxiliary plant sites and during transportation of material to construction site.

Emission from hot-mix and batching plants will potentially affect workers and nearby residents. The hot mix plants and batching plants shall be located away from human habitation, agricultural areas, road construction operations or industrial establishments. Auxiliary plants will be located at least l Km away from the nearest human habitation. The exhaust gases from all plants shall comply with the requirements of the relevant emissions control legislation and guidelines. All operations at plants shall be undertaken in accordance with all current rules and regulations protecting the environment.

Noise from vehicles, plants and equipment used in the road construction (including the aggregate crushing plant) shall strictly conform to the NEMA noise standards. All vehicles and equipment used in construction shall be fitted with exhaust silencers and mufflers. During routine servicing operations, the effectiveness of exhaust silencers shall be checked and replaced if defective.

The noise limits for construction equipment used in the project shall be measured at one meter from the edge of the equipment. In open areas, equipment such as compactors, rollers, front loaders, concrete mixers, moveable cranes, vibrators and others shall not exceed 75 dB, as specified in the NEMA guidelines. Maintenance of vehicles, equipment and machinery shall be regular and in accordance with manufacturers specifications to the satisfaction of the Environment Specialist and the Engineer, to keep noise at a minimum.

Concrete mixing and batching, mechanical compaction ad other noise and vibration generating activities shall stop between 6:00 PM and 6:00 AM. In silence zone that are areas within 100 m around premises such as hospitals, educational institutions and courts, no hot mix, batching or aggregate crushing plants will be allowed. Construction shall cease within 100 m around hospitals and learning institutions between 6:00 PM and 06.00 AM.
Workers in vicinity of loud noise, or working with or in crushing, compaction, batching or concrete mixing operations shall wear earplugs. The crushers used in the construction shall conform to relevant legislated dust emissions controls. Construction and clearance authorization for auxiliary plants sites shall be obtained from the NCA and NEMA. Alternatively, established, operating offsite crushers licensed by the relevant authorities can contracted and material transported to road construction area. Dust screening shall be erected on the edge of RoW for any established crushers and monitoring for dust emissions and other parameters shall be conducted fortnightly or a need basis.

8.10.7 Spills Prevention and Response Plan

The Suswa-Mai Mahiu Road Project will consist of activities and operations that will use various materials with potential for accidental spill incidences leading to fires, explosions, health impacts, surface and ground water contamination, and soil pollution. The hazards posed are dependent on the spilt material toxicity, chemistry, quantity, spill area, work processes and weather conditions. The spills can emanate from construction equipment, stored materials, or

during the construction activities. The formulated response plan for the Suswa-Mai Mahiu Road Project elaborates on procedures for prevention and responses to spills that will involve:

a) Spill Prevention

Appropriate management, handling, and storage of only limited quantities of hazardous materials will considerably minimize risks of spills and mitigate potential effects to construction personnel, works and the environment in the event of one. The source and attendant mitigation of spills are:

i) Construction equipment spills risk mitigated through:
- Storage and maintenance of equipment in designated areas
- Use of secondary containment such as drain pans when removing or changing fluids
- Use of right equipment such as. pumps or funnels to transfer fluids
- Conduct of fueling in designated areas
- Filling of tanks and containers to manufacturer indicated fill levels
- Examination of incoming vehicles to for oils and fluids leaks
- Transfer of used fluids and oil filters to waste bins or recycling drums
- Routine inspection of all equipment for leaks and spills
- Immediate repair of leaking equipment
- Design and use of preventive maintenance schedules for all equipment and vehicles

ii) Use and storage of regulated and hazardous wastes mitigated by:
- Completely use of contents before disposal of containers
- Retention of original product labels to avoid confusion and accidental mixing
- Recycling of useful materials
- Segregation of wastes by type
- Minimization of hazardous waste quantities generation on sites
- Maintenance of only needed quantities of material at specific times and disposal of excess or expired substances in compliance with NEMA regulations
- Disposal of hazardous wastes at only NEMA approved facilities
- Training of employees on safe handling of hazardous material and safe waste management

b) Spill Kits

Appropriate kits for spill-containment and cleanup for the materials used in the road project shall comprise part of the contractor's suite of equipment. These are to be well-marked, accessible and maintained at material storage areas, operation points and project field offices. The spill kits shall include poly containment pails, oil absorbent pads, oil absorbent socks, heavy duty disposal bags, nitrile gloves (synthetic rubber), all-purpose absorbents (e.g. sawdust), shovels, plugs and clamps to control line breaks. All personnel working on the road construction project and its

ancillary components have to be trained on the nature of likely spill hazards, location, content, and usage of spill kits.

c) Spill Response

Spills at equipment staging, maintenance area, leaks from fuel tanks, equipment seals breakages, or a hydraulic line severance are to be contained with a spill pad placed beneath the potential source. Spills at fueling area during fueling operations will be contained within a spill pan for small container handling, or by use of portable secondary containment berms in the storage areas.

d) Spills on Soil

Hazardous material may leak and spreads on soils during accidents and the following procedure shall be followed management and mitigation:

- Stop ongoing operations immediately
- Identify the product and examine container integrity, design, warning labels and markings
- Prevent personnel from approaching the site and keep them at a safe distance to avoid injury, fire ignition or explosion
- Stop substance flow at its source, reduce or terminate the motion of the product without endangering anyone
- Assess the extent of spill
- Report the spill to Construction Site Manager and Environmental Monitor and provide basic information such as location of spill and amount.

Where the spills are massive or involve puncturing of Kenya Pipeline Company pipelines or those of any other operator, relevant agencies and the National Emergency and Disaster Response Authority shall be notified immediately.

A "Spill Response Form" shall be completed with copies sent to Site Manager and Environment Specialist. Contaminated soil shall be scooped and stored in sealed containers for disposal according to set procedures after consultations, consensus establishment and relevant authorization.

8.10.8 Emergency Response Plans (ERP)

Emergencies could potentially occur any time during road construction activities compromising safety of workers, motorists and other road users. The emergencies may extend to local communities and possibly result in adverse environmental impacts. For the Suswa-Mai Mahiu Road, the ERP will have the following aspects:

- Identification of potential emergency scenarios that may arise at different construction and operation sites prior to project commencement

- An emergency incident classification and ranking in order of likelihood and severity rating
- An emergency response protocol with clear roles and responsibilities
- Training of workers on the emergency the response plan developed
- Mechanisms for co-ordination with external/County and National Governmental emergency response units and organizations, Local Hospitals and health care providers, emergency evacuation agencies such as St John's and Red Cross ambulances
- Emergency alarms and communication systems strategically placed at different working sites
- Clearly established and communicated emergency response procedures
- Emergency response equipment at operation sites and project management headquarters including first aid kits with designated and trained personnel in charge
- Coordinated evacuation procedures
- Post emergency recovery systems
- Post emergency mitigation protocols to prevent recurrence
- Regular and impromptu emergency preparedness inspections, training and drills to ensure emergency preparedness at all times
- Emergency, community and media communication procedures

Emergency response procedures

The emergency response procedures will depend on the nature, magnitude and complexity of the incidence, nature of operations, location and number of people affected.

It is recommended that:

1. At every operations site, there is a trained person responsible for coordination of emergency response
2. An internal and external emergency reporting system is in place and there is a senior person at project operations office on standby for emergencies
3. Effective communication channels such as mobile phones, SMS or Whatsapp or two-way radio sets are available in the project area
4. A method for sounding alarms, such as air horns or warning bells with codes corresponding to incidence magnitude and severity is established
5. A list of persons responsible for emergency responses, their roles and contacts are visibly posted at all sites where emergencies may occur
6. Visibly posted lists of phone numbers for emergency and support services are available at critical locations
7. A plan or protocol for incident investigation and correction of hazard is developed for given categories of emergencies
8. A description is made of potential emergencies and response procedures on which all personnel are trained as emergency preparedness in anticipation of all possible situations

9. Visible and appropriately placed maps of work places and operations project areas are made indicating evacuation routes clearly, muster points, head count locations, location of emergency equipment, first aid stations, and fire extinguishers
10. Routines for activities shutdowns are established by all site managers and supervisors to ensure that during an emergency shutdown, no potential hazards are abandoned or unattended.
11. Functional evacuation, head count and rescue plans are established
12. Rescue operations are only undertaken by trained persons and only when there is no of risk injury to them

The emergency plan will be developed by the contractor in conjunction with KeNHA, Supervising Engineers, and Environment Manager with inputs from emergency services providers.

8.10 9 Environmental Awareness Plan

The implementation of ESMP requires that all persons involved with and working for the project are familiar with the ESMP, the environmental management requirements, and their assigned roles and responsibilities in the implementation of the ESMP. Knowledge of environmental impacts arising from their work activities and consequences noncompliance with environmental management legislation and protocols as set in the ESMP is important. Personnel in the project will need to have a sense of environment ownership and become stewards of the environment they are working in and the benefits associated with compliance with environmental requirements. Penalties and consequences for noncompliance will be communicated to all project personnel by the Environment Specialist and the Resident Engineer.

Project personnel and stakeholders will be made conversant with the ESMP through various information dissemination techniques as outlined in Table 29. Knowledge of the ESMP will enable project stakeholders and affected persons participate in its implementation and auditing either directly or indirectly. The project and ESMP awareness will include that to be made during community consultations, key stakeholder engagements and the call for public comments during the ESIA feeding back process prior to finalization of contract and commence of works. The ESIA document will be placed at the County Commissioners offices in the project area and other relevant publicized places to obtain feedback from the public and stakeholders after NEMA publishes the same in the media.

Table 29: Stakeholder awareness creation engagement and application for the Suswa-Mai Mahiu Road project

Engagement Technique	Appropriate application of the technique
Public ESMP feedback	Deposition of ESMP document at centrally accessible locations Invitation for written submissions Public presentation of ESMP with feedback sessions
Correspondences (Phone, Emails)	Distribute information on ESMP to Government officials, NGOs, Local Government, and organisations/agencies Invite stakeholders to meetings and follow-up
One-on-one meetings	Seeking views and opinions Enable stakeholder to speak freely about sensitive issues Build personal relationships Record meetings
Formal meetings	Present the Project information to a group of stakeholders Allow group to comment – opinions and views Build impersonal relation with high level stakeholders Disseminate technical information Record discussions
Public meetings	Present Project information to a large group of stakeholders, especially communities Allow the group to provide their views and opinions Build relationship with the communities, especially those impacted Distribute non-technical information Facilitate meetings with presentations, PowerPoint, posters etc. Record discussions, comments, questions.
Focus group meetings	Present Project information to a group of stakeholders Allow stakeholders to provide their views on targeted baseline information Build relationships with communities Record responses
Project website	Present project information and progress updates Disclose ESMP and other relevant project documentation
Direct communication with affected land/asset owners	Share information on timing of road clearance Agree options for removing crops and relocation of fences.
Road signs	Share information on project activities Reminders of potential impacts (e.g. for road clearance activities; remind asset owners to relocate outside the road reservation)
Project leaflet	Brief project information to provide regular update site specific project information.

8.10.10 Decommissioning Plans for the camps and other installations

The plan outlined here shall be applicable at the project post construction phase. Following the certified completion of the road project construction phase, all construction facilities and labour camps shall be decommissioned. The sites occupied by these facilities shall be restored to conditions that are not inferior to those existing prior to the commencement of works. The decommissioning and rehabilitation activities shall include:

- Oil and fuel contaminated soils removal and disposal in designated and licensed waste disposal areas
- Soak pits and septic tanks exhaustion, disposal of wastes, coverage and effective sealing
- Disposal of debris, surplus material and other wastes in accordance with ESMP waste disposal guidelines
- Leveling of all ramps erected for the works
- Covering of underground water tank in barren/non-agricultural land and retention of those in agricultural lands in functional conditions
- Spreading of top soil on agricultural or grazing land to accelerate the natural restoration processes

To avoid future litigation or complaints, documentation of site rehabilitation processes shall be undertaken. These shall comprise of:

- Photographs of the area prior to camp establishment
- Photographs of the campsites before and after rehabilitation taken at geo-referenced points
- Site inspection report by NEMA
- Undertaking by contractor to amend any documented deficits
- Land owner consent letter on satisfactory rehabilitation and suitability of site
- Certification from KeNHA Engineer in charge of the Project

8.10.11 Community Management plan

The road passes through areas with diverse community, cultural and socio-economic conditions. The road project impact are likely to be differential between and within communities especially with respect to gender, social class and age group categories. To manage communities and their expectations, the social aspects highlighted in the ESMP has to be implemented in addition to health and security, stakeholder engagement and tariff management plans.

In implementing the social management plan, it is recommended that the social expert in different section of the road the project with distinct social, economic and cultural attributes will have to understand:

- The social context of the project road area of interest
- Prevailing demographic and cultural trends
- The biophysical and natural resources linkages with livelihood systems
- Social risks' and vulnerabilities for different social categories
- Development and social transformation aspirations of different categories relative to the road project

- Local governance structures and key actors
- Negative impacts to be minimized and positive ones to be enhanced
- Multiple engagement pathways with the communities and existing leadership structures and governance arrangements
- Evolving social dynamics in the project area and their implication on project time schedules

Communication mechanisms that enable engagement with communities at all times during the project cycle will have to be developed. These will enable detection and resolution of emergent issues that may impinge negatively on the project implementation. The issues may be economic, political, cultural transgression, perceived or real concerns by the community.

8.11 COST OF THE PROJECT

Cost of works

Cost of the works from preliminary engineering report:

With Geogrid	13 billion
Without Geogrid	11 Billion

Cost of mitigation measures including rehabilitations of borrow pits and quarries (Will depend on the ToRS)

Cost of mitigation measures	53,130,000
Borrow pits rehabilitation	As presented in engineering works estimate

CHAPTER 9 CONCLUSIONS AND RECOMMENDATIONS

9.1 CONCLUSION

The road is an important economic contributor to attainment of the vision 2030 and a critical link to Narok and adjoining counties and Northern Tanzania to the rest of the Country. The reconstruction of the road will ensure communication and travel between in all seasons and removal expensive disruptions and rerouting during the wet season. The road in linking the internal container depot and the adjoining industrial park will spur economic development in the Country, ease access to neighboring Uganda, Rwanda, South Sudan and Eastern DRC in export and importation of goods. It is concluded that:

- The road project is economically viable
- Adverse environmental and socio-economic impacts can be successfully and adequately mitigated
- A joint management structure will ensure sustainability of the road and eliminate landscape wide adverse processes that threaten the road and other important economic undertakings and infrastructure

i) Engineering Aspects

The proposed construction design will use technologies that ensure that the road does not collapse at faultiness, reduces the possibility of overtopping and siltation as it will use bridges and concrete slabs to span subsurface unstable areas and faultiness. The increased number and size of drainage structures and road elevation in flood pain areas enable free water flow eliminating flooding and silting.

ii) Safety and Health

Analysis of potential Safety and Health aspects and impacts of the proposed project indicate that all of them are manageable with appropriate planning and involvement of all stakeholders and interested parties at the earliest opportunities. In particular;

- The location of the proposed project has an already operational road and reconstruction will not pose new or unknown serious Safety and Health negative impact to the area. Contractor and Proponent adherence to the ESMP during all project phases will minimize and mitigate any adverse impacts.
- The project proponent and contractor will engage project stakeholders such as the Directorate of Occupational Safety and Health, Public Health Workers and the Public in the project vicinity to create awareness and collaboration on issues of health and safety.
- Signage warning road users of ongoing traffic diversion and safety issues will be prominently displayed and visible at all times.

iii) Biodiversity

The road project traverse an area with potential connectivity to wildlife populations in the Hell's Gate and Mt Longonot National parks, Kedong and Akira ranches and dispersal areas to the south of the road adjoining Mt Suswa Conservancy and wildlife tolerant community areas. There is a likelihood of adverse impacts on fauna and flora resulting from the construction activities as well as operation of the new road. There is potential loss of vegetation along the road and establishment of alien and local plant invasive species favored by disturbed conditions arising from road construction. The elevation of the road and use may be a hindrance to free movements of wild animals and may block existing wildlife corridors. Large drainage structures will facilitate passage of small to medium body sized wildlife species. Road kills may also occur as well as accidents caused by wild animals crossing the road. Poaching has also been identified as an important impact on the biological environment of the project area. From analysis of the interaction of the project activities and the baseline biological environment it is concluded that;

- Some impacts such as habitat fragmentation may be long term, but some negative impacts of the proposed project on the site's biological environment will be of low magnitude.

- Apart from the area occupied by the road surface and ancillary structures, the surrounding areas will revert to their former vegetation states with implementation of the ESMP recommendations.

- The wildlife has already been impacted on by the existing road and the expansion of the road and other accompanying facilities in the corridor will not significantly contribute to the cumulative and long term impacts upon it.

It can be concluded that if all stakeholders implement their designated roles and a joint area management structure is formed as recommended the adverse impacts of the project and other activities impacting on the road will be addressed. The overall implementation of the ESMP recommendations may enhance the ecology of the area, increase wildlife populations and ensure sustainable conservation and utilization of the entire road linked ecosystem.

9.2 RECOMMENDATIONS

It is recommended that:

- The road be constructed and the proponent and contractor implement all the ESMP recommendations

- All legal and policy requirements be adhered to during construction, operations and decommissioning phases of the project

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APPENDICES

Appendix 1 Stakeholders Consulted

Appendix 3: Checklist of mammals, plants and birds in the road project area

3(a): Mammalian species found in the road project area and vicinities of Mt Longonot and Hell's Gate National Parks (other sources: KWS, 1991 & 2010)

Appendix 3(b): List of bird species recorded within Mt. Longonot and its Environs

Appendix 3 (c): List of plant species found in the study area and its environs

Appendix 4: Questionairre used in household surveys

Appendix 5: Public consultations meetings discussion sample

Appendix 6: Practicing license for lead expert

Appendix 7: Public consultations attendance