



Howard Humphreys
an Atkins company

Member of the SNC-Lavalin Group



Kenya National Highways Authority
Quality Highways, Better Connections

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT STUDY REPORT OF THE PROPOSED UPGRADE OF ISIOLO- KULAMAWE (77KM) ROAD TO BITUMEN STANDARDS, ISIOLO AND MERU COUNTIES, KENYA

Kenya National Highways Authority

22 March 2018

Notice

This document and its contents have been prepared and are intended solely for Kenya National Highways Authority's information and use in relation to Environmental & Social Impact Assessment Study Report of the Proposed Upgrading of Isiolo- Kulamawe (77km) Road to Bitumen Standards.

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Declarations

I, Jacob K. Kibwage on behalf of Howard Humphreys, an Atkins Company, submit this **Environmental & Social Impact Assessment Study Report of the Proposed Upgrading of Isiolo - Kulamawe (77km) Road to Bitumen Standard**. The ESIA Study has been carried out in accordance with the Environmental Management and Coordination Act, Cap 387, and the Environmental (Impact Assessment and Audit) Regulations, 2003 (and the amendment Regulations of 2016).

Signed at NAIROBI on this **22nd** day of **March** 2018

Signature: 

Designation: Lead Environmental Consultant and Team Leader, NEMA Expert Reg. No. 126

I,, on behalf of Kenya National Highways

Authority (KeNHA) (Proponent) submit this **Environmental & Social Impact Assessment Study Report of the Proposed Upgrading of Isiolo - Kulamawe (77km) Road to Bitumen Standard**.

Signed at NAIROBI on this day of 2018

Signature and Stamp:

Designation.....

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Acronyms

Asl	Above Sea Level
A-RAP	Abbreviated Resettlement Action Plan
ASALs	Arid and Semi-Arid Lands
CBOs	Community Based Organizations
CBD	Convention on Biological Diversity
CCTVs	Closed Circuit Televisions
CEDAW	Convention on the Elimination of all forms of Discrimination against Women
CPP	Consultation and Public Participation
CRC	Convention on the Rights of the Child
CSOs	Civil Society Organizations
CSR	Corporate Social Responsibility
DHP	Designated Health Practitioner
EA	Environmental Audit
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Co-ordination Act
EMP	Environmental Management/Monitoring Plan
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESF	Environmental and Social Framework
ESS	Environmental and Social Standards
FGDs	Focused Group Discussions
FI	Financial Intermediaries
GDP	Gross Domestic Product
GHG	Greenhouse gases
GMM	Grievance Management Mechanisms
GOK	Government of Kenya
GRC	Grievance Redress Committee
IFC	International Finance Corporation
IPF	Investment Project Financing
ILO	International Labor Organization
KBS	Kenya Bureau of Standards
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority
KFS	Kenya Forest Service
KWS	Kenya Wildlife Service
LHS	Left Hand Side
LDP	Local Development Plan
MEAs	Multi-Lateral Environmental Agreements
NBSAP	National Biodiversity Strategy and Action Plan
NCCRS	National Climate Change Response Strategy
NEAP	National Environment Action Plan
NET	National Environmental Tribunal
NEMA	National Environment Management Authority
NFD	Northern Frontier District
NGEC	National Gender Equality Commission

NGOs	Non-Governmental Organizations
NPEP	National Poverty Eradication Plan
NPGD	National Policy on Gender and Development
OSHA	Occupational Safety and Health Act
PAPs	Project Affected Persons
PCR	Physical Cultural Resources
PPC	Part of Project Cost
PPE	Personal Protective Equipment
PPPU	Public Private Partnership Unit
PVC	Polyvinylchloride
RAP	Resettlement Action Plan
RC	Reinforced Concrete
RDM	Road Design Manual
RHS	Right Hand Side
SDGs	Sustainable Development Goals
SHE	Safety Health and Environment
SWM	Solid Waste Management
ToR	Terms of Reference
TSS	Total Suspended Solids
TDS	Total Dissolved Solids
UNCBD	United Nations Convention on Biological Diversity
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on the Environment and Development
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commission for the Refugees
VMGs	Vulnerable and Marginalized Groups
VOC	Volatile Organic Compounds
WB	World Bank
WHO	World Health Organization
WIBA	Work Injury Benefit Act
WRA	Water Resources Authority

Units

CO	Carbon Monoxide
dB (A)	Decibel Amperes
KES	Kenya Shillings
Km	Kilometres
km/h	Kilometer per hour
km ²	Square Kilometer
m ³	Cubic metre
mm	Millimetres
Ppm	Parts Per Million

Glossary of terms

“Abbreviated Resettlement Plan (A-RAP)” According to the World Bank OP 4.12, Paragraph 25: “Where impacts on the entire displaced population are minor, or fewer than 200 people are displaced, an abbreviated resettlement plan may be agreed with the borrower”.

“Air quality” means the concentration prescribed under or pursuant to the Environment Management and Coordination Act (EMCA Cap 387) of a pollutant in the atmosphere at the point of measurement.

“Analysis” means the testing or examination of any matter, substance or process for determining its composition or qualities or its effect (whether physical, chemical or biological) on any segment of the environment.

“Biological diversity” means the variability among living organisms from all sources including, terrestrial ecosystems, aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, among species and of ecosystems.

“Ecosystem” means a dynamic complex of plant, animal, micro-organism communities and their non-living environment interacting as a functional unit.

“Effluent” means gaseous waste, water or liquid or other fluid of domestic, agricultural, trade or industrial origin treated or untreated and discharged directly or indirectly into the aquatic environment.

“Environment” includes the physical factors of the surroundings of human beings including land, water, atmosphere, climate, sound, odour, taste, the biological factors of animals and plants and the social factor of aesthetics and includes both the natural and the built environment.

Environmental and Social Assessment (Assessment) is a process that determines the potential environmental and social risks and impacts (including labour, health, and safety) of a proposed Project in its area of influence.

Environmental and Social Impact Assessment (ESIA) is a comprehensive document of a Project’s potential environmental and social risks and impacts.

Environmental and Social Management Plan (ESMP) summarizes the commitments to address and mitigate risks and impacts identified as part of the Assessment, through avoidance, minimization, and compensation/offset. This may range from a brief description of routine mitigation measures to a series of more comprehensive management plans (e.g. water management plan, waste management plan, resettlement action plan, indigenous peoples plan, emergency preparedness and response plan, decommissioning plan). The level of detail and complexity of the ESMP and the priority of the identified measures and actions will be commensurate with the Project’s potential risks and impacts.

Environmental and Social Management System (ESMS) is the overarching environmental, social, health and safety management system which may be applicable at a corporate or Project level. The system is designed to identify, assess and manage risks and impacts in respect to the Project on an ongoing basis. The system consists of manuals and related source documents, including policies, management programs and plans, procedures, requirements, performance indicators, responsibilities, training and periodic audits and inspections with respect to environmental or social issues, including Stakeholder Engagement and grievance mechanisms.

“Environmental management” includes the protection, conservation and sustainable use of the various elements or components of the environment.

“Environmental monitoring” means the continuous or periodic determination of actual and potential effects of any activity or phenomenon on the environment whether short-term or long term.

“Natural resources” include resources of the air, land, water, animals and plants including their aesthetic qualities.

“Noise” means any undesirable sound that is intrinsically objectionable or that may cause adverse effects on human health or the environment.

“Ozone layer” means the layer of the atmospheric zone above the planetary boundary layer as defined in the Vienna Convention for the Protection of the Ozone Layer, 1985.

“Pollutant” includes any substance whether liquid, solid or gaseous which-

- a may directly or indirectly alter the quality of any element of the receiving environment;
- b is hazardous or potentially hazardous to human health or the environment; and includes objectionable odours, radio-activity, noise, temperature change or physical, chemical or biological change to any segment or element of the environment;

“Pollution” means any direct or indirect alteration of the physical, thermal, chemical, biological, or radio-active properties of any part of the environment by discharging, emitting, or depositing wastes so as to affect any beneficial use adversely, to cause a condition which is hazardous or potentially hazardous to public health, safety or welfare, or to animals, birds, wildlife, fish or aquatic life, or to plants or to cause contravention of any condition, limitation, or restriction which is subject to a licence under the EMCA, Cap 387.

Executive summary

The current state of road infrastructure in Kenya remains inadequate and falls significantly short of requirements. Kenya has approximately 161,000 km of classified roads of which around 14,000 km are paved. The total length of paved roads per 10,000 inhabitants is 2.19 km, which is less than the East African Community (EAC) member countries average of 2.53 km.

The Government of the Republic of Kenya (GoK) through the Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD) represented by the Kenya National Highways Authority (KeNHA), Kenya Rural Roads Authority (KeRRA), and the Kenya Urban Roads Authority (KURA) being state corporations established under the Kenya Roads Act, 2007 has identified the need to upgrade to paved standards approximately 10,000 km of roads. These roads are intended to support the primary growth sectors of Commerce, Tourism, Agriculture and Rural Production, and Extractive Industries.

It is against this background that the Government of the Republic of Kenya (GoK) applied for a credit from the World Bank towards the cost of the North-Eastern Transport Improvement Project (NETIP). The GoK intends to use a portion of the proceeds of the credit for upgrading 348 km of the Isiolo-Wajir road to bitumen standard. This includes the Isiolo – Kulamawe section with a total length of 77km. North Eastern Improvement Project (NETIP) is aimed at enhancing connectivity between Kenya and Somalia as well as Ethiopia. This would be achieved through increasing transport efficiency, facilitation trade and development along the Isiolo-Wajir-Mandera part of the Mombasa-Garissa-Wajir-Mandera-Mogadishu road corridor, as well as connecting the area with information and communication technologies. As part of a much larger infrastructure and road development program, the GoK through the Kenya National Highways Authority (KeNHA), has embarked on a strategic program which entails upgrading of the 77km class A/B road from Isiolo to Kulamawe. Upon completion, the Isiolo- Kulamawe road will lead to opening of the North-Eastern part of Kenya. The project will create a linkage of Isiolo and Meru counties leading to improved transport network and growth of businesses. The road reserve for the proposed project is 60 meters. Most of the area traversed by the road is on trust land vested on Isiolo and Meru County Governments.

This study report was conducted in accordance to the requirements as stipulated in the Environmental Management and Coordination Act, (EMCA Cap 387), Environmental Impact Assessment and Audit (EIA/EA) Regulations 2003 and the World Bank Safeguards Policies and Procedures. The proposed project has been rated Category B under the World Bank Operational Policy on Environmental Assessment (OP4.01). The impacts of the proposed project are “site-specific in nature and do not significantly affect human populations or alter environmentally important areas, including wetlands, grasslands, and other major natural habitats. The potential impacts of the project on the environment are typically site-specific, reversible in nature; less adverse than those of Category A projects for which mitigatory measures can be designed more readily. Reference has been made to the World Bank Safeguard Policies, and the World Bank Environmental Assessment Source Book Volume II, which provides the relevant sectoral guidelines including the Banks Operation Policies/Bank Procedures.

The purpose of the study as provided in the terms of references (TORs) is to identify the negative and positive impacts that would be generated by the proposed road project. Means to mitigate the identified negative impacts and enhance the positive ones are dealt with as appropriately as possible.

Scope and objective of the Environmental and Social Impact Assessment (ESIA)

The purpose and terms of reference developed for this study was to assess the impacts that may result during the construction, operation and decommissioning phase of the proposed Isiolo-Kulamawe road project. Specifically, the terms of reference as guided by the Environmental Impact Assessment and Audit Regulations of 2003 and EMCA, Cap 387 developed for this study covered:

- i. The description of the proposed road project.
- ii. A brief but in-depth description of the national and local environmental legislative and regulatory framework, baseline information, and any other relevant information related to the project.

- iii. The project objectives.
- iv. The employed technology, procedures, and processes for the implementation of the project.
- v. The materials to be used in the construction and implementation of the project.
- vi. The products, by-products and waste to be generated by the project.
- vii. A description of the potentially affected environment.
- viii. The environmental effects of the project including the social and cultural effects and the direct, indirect, cumulative, irreversible, short-term and long-term effects anticipated.
- ix. Recommendation of a specific and environmentally sound and affordable waste management system.
- x. Analysis of alternatives for the: project site, design and technologies.
- xi. An Environmental and Social Management Plan (ESMP) proposing the measures for eliminating, minimizing or mitigating adverse impacts on the environment, including the cost, timeframe and responsibility to implement the measures.
- xii. A monitoring plan for the prevention and management of the foreseeable accidents and hazardous activities in the cause of carrying out development activities.
- xiii. Proposed measures for the prevention of health hazards and the ensuring of security in the working environment for the employees, local community and for the management in case of emergencies.
- xiv. Identification of gaps in knowledge and uncertainties, which were encountered in compiling the information.
- xv. Economic and social analysis of the project.
- xvi. Such other matters as may be directed by the National Environment Management Authority.

The study methodology

The exercise was carried out in accordance with the National Environment Management Authority (NEMA) of Kenya Environmental Impact Assessment and Audit Regulations of 2003 and EMCA, Cap 387 and World Bank Safeguards Policies and Procedures. Based on the magnitude of the proposed upgrading of the Isiolo-Kulamawe road to bitumen standards, the ecological and biophysical aspects of the road and its associated facilities, an Environmental and Social Assessment (ESIA) study was undertaken to determine the impacts of the project. Preliminary scoping and screening field visits were undertaken in July 2017 whereas detailed study and public participation meetings were conducted in November 2017. The general steps followed in environmental and social impact assessment were as follows:

- Environmental screening, in which the project was identified as among those requiring Environmental Impact Assessment under schedule 2 of EMCA, Cap 387.
- Environmental scoping that identified the key issues to be addressed in the ESIA study.
- Desktop studies to gather any relevant secondary data and information on the impacts of roads projects on the environment and possible mitigation measures by making use of similar reports for other infrastructural projects that have been undertaken along the proposed project corridor.
- Public participation by conducting interviews, discussions and public meetings with key stakeholders including members of the community affected by the project to obtain their views on the impacts of the project and possible mitigation measures. This is as per the Kenyan Constitution, EMCA Cap 387, and the World Bank Safeguard Policies
- Physical inspection of the routes of the proposed road.
- ESIA study report preparation, publication and submission.
- Integration of recommendations of the ESIA study into the design and implementation of the proposed road project.

The Government's policy on road transport is to provide efficient and reliable road network to spur Socio-economic development and improve security. Under the administrative framework, the National Environment Management Authority (NEMA) is responsible for ensuring that Environmental Impact Assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the requirements of the Environmental Management and Coordination Act (EMCA, Cap 387). These requirements are stipulated in the Environmental Management and Coordination Act (EMCA, Cap 387)

and EIA/EA Regulations 2003. Some of the key policies in which the proposed project will operate include;

- The National Biodiversity Strategy of 2000
- Sessional Paper No. 3 of 2009 on National Land Policy
- Sessional Paper No. 8 of 2012 on National Policy for the Sustainable Development of Northern Kenya and other Arid Lands
- Wildlife Policy of 2011
- Wetlands Policy of 2013
- Physical Planning Policy
- Occupational Health and Safety Policy of 2012
- HIV/AIDS Policy of 2009
- The Kenya National Climate Change Response Strategy of 2010

Below are some of the relevant legislations to the proposed project;

- Environmental Management and Coordination Act (EMCA, Cap 387).
- The Wildlife Management and Conservation Act 2013
- Forest Conservation and Management Act, 2016
- The Water Act 2016
- The Agriculture, Fisheries and Food Authority Act of 2013
- Natural Resource (Benefit sharing Bill), 2014
- Energy Act, 2006
- Land Act, 2012.
- The Land Registration Act, 2012
- The National Land Commission Act, 2012 (No. 5 of 2012)
- Community Land Act 2016
- The Environment and Land Court Act, 2011
- The County Governments Act 2012
- Occupational Safety and Health Act 2007
- The Public Health Act (Chapter 242) of Revised Edition 2012
- The Valuers Act (Cap 532), 1985
- Physical Planning Act (Cap. 286)
- The Penal Code (Cap. 63)
- The Employment Act, 2007
- Work Injury Compensation Benefit Act (WIBA) 2007
- Public Roads and Roads of Access Act Cap 399
- The Traffic Act Cap 403
- Building Code 2009
- The Kenya Roads Act, 2007
- HIV / AIDS Act, 2006
- Urban Areas and Cities Act No 13 of 2011
- The Kenya Roads Board Act, 1999
- The National Gender and Equality Act, 2011
- The Sexual Offences Act, 2006 and its amendment 2012

National institutional framework relevant to the project includes;

- The National Environment Management Authority
- KeNHA
- Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD)
- The Kenya Roads Board
- Kenya National Highways Authority (KeNHA)
- Development partners

Some of the relevant International conventions and guidelines that the project will operate in include;

- Vienna Convention on the Protection of the Ozone Layer
- United Nations Convention on Biological Diversity (UNCBD)

- African Convention on the Conservation of Nature and Natural Resources
- Convention on International Trade in Endangered Species
- The World Commission on Environment and Development (The Brundtland Commission of 1987)
- The Ramsar Convention for the conservation and sustainable utilization of wetlands
- The 1992 United Nations Framework Convention on Climate Change (UNFCCC)
- The Paris Agreement
- Rio Declaration on Environment and Development
- Earth Summit on Sustainable Development Agenda 21
- International Labour Organization
- Sustainable Development Goals (SDGs)

The financing institution (The World Bank) has also developed a policy on social and environmental sustainability that calls for positive development outcomes in the public and private sector. The proposed project has been rated Category B under the World Bank Operational Policy on Environmental Assessment (OP4.01).

The construction of the proposed road project is estimated to cost KES 12,940,049,793.81 exclusive ESMP implementation of approximately KES 60,600,000.

The four market centres namely Gambella (located at 0.399206N 37.683230E), Ndumuru (0.461698N 7.841246E), Kachuru (0.559207N 38.037834E) and Kulamawe (0.574647 N 38.149048 S) have varying number of human settlements with Kulamawe having the highest (approximately 300 households). Apart from the four market centres, isolated temporary structures and several police camps along the proposed road corridor form additional human settlements. Generally, the larger part of the road alignment passes through unsettled area characterized by nomadic pastoralism. The human settlements along the project area are largely dictated by availability of water sources. For instance, all the four market centres lie adjacent seasonal rivers/streams and other water points such as boreholes. The entire road corridor is extremely dry and water availability is key for a settled lifestyle.

The proposed project area and its environs lack critical infrastructure such as all-weather roads. It takes up to 5-6 hours to travel from Isiolo to Kulamawe by lorry which is the most common mode of transport. The poor road infrastructure has not only retarded development in the area but also made some areas land locked. On monthly basis the locals averagely use the road three times (Howard Humphreys (2017b). Some of the road sections are rendered impassable during rainy seasons. Most of the water that floods the road originates from the neighbouring Nyambene ranges.

The road traverses a territory occupied by Borana, Somali, Turkana pastoralists and Meru sections that keep livestock and occasionally the Samburu make forays. This explains why herding is a key factor for dropping out of school especially for boys. There is continuous and sporadic conflict between all the ethnic groups. The interethnic tensions and conflicts are caused by; disagreements on county boundary, cattle rustling amongst the communities, superiority on administrative positions, land ownership and conflict over pasture.

The health sector in the project area alignment is poorly developed and characterized by absence of health facilities such as dispensaries including chemists at the key market centres. There is a general lack of public and private investment in the health sector at the project area. Residents are forced to travel long distances to seek medical services.

Nomadic pastoralism is the most prominent land use and livelihood source in the project area covering more than 90% of land-use in the proposed project area. Over 90% of the total population depends on livestock and livestock products for their livelihood. The road project hence traverses key livestock crossing and migration routes. Nonetheless, there are isolated cases of food crop growing in some parts of project within Meru County. It is, however, important to note that the entire road alignment is extremely dry making it unsuitable for rain-fed agriculture. Very few water points exist in sections of the road with most of the rivers being seasonal while man-made water structures such as earth pans and earth dams are small and end up drying during dry spell. Most structures along the project area are residences which also function as business premises. Most of them were temporary/ semi-permanent. The temporary nature demonstrates the seasonal migration of most residents.

It is important to note that the drainage pattern of the project area is characterized by rivers and streams originating from catchment areas such as Nyambene ranges. The rivers cut through the hilly terrain on the upper zones to the lower zones and drain into the Tana and Ewaso Nyiro Rivers. Though there exists no gazetted wildlife reserve in the proposed project area, wild game roam freely in the expansive woodland. Meru National Park lies approximately 90 Km from the proposed project area. Lewa Downs is about 25 km away whereas Shaba National Reserve and Bufallo springs are approximately 30Km and 50Km respectively away from project area.

The public consultation and participation was conducted through the use of Household socio-economic survey; Key stakeholder interviews; Key stakeholder Meeting (Isiolo and Meru); Public Meetings and Focused Group Discussions. Five public participation meetings were conducted in five urban centers of Isiolo, Gambella, Ndumuru, Kachuru and Kulamawe. A total of 620 people (489 Male and 131 Female) participated in the meetings. The stakeholder's participation raised below positive comments about the proposed project:

- Creation of employment opportunities
- Increased business opportunities:
- Improved social infrastructure
- Faster means of transport:
- Cheap / affordable fares
- Easy and fast movement of people
- Easy and fast movement of goods
- Interaction of people from different communities
- Growth of towns
- Potential for increased economic activities
- Transfer of skills
- Improved security

Negative concerns of the stakeholders

- Increased Accidents
- Impact on water resources
- Noise pollution
- Dust generation
- Waste disposal and spoils
- Loss of vegetation cover
- Loss of pasture for livestock and wildlife
- Displacement of local communities and loss of
- Disruption and loss of businesses
- Cultural erosion
- Increase in the spread of STD, HIV and AIDS

The public suggested that since the area is a marginalized area and social infrastructure is not developed, the contractor should consider ways of giving back to the community to enhance the development of the area. The following projects were to be given priority as suggested by the locals:

- Water - Construction of boreholes, and water pans since the area is a water stressed area.
- Education: Public Primary and Secondary Schools should be constructed due to lack of educational infrastructure in the area.
- Health: Most of the public lamented that they travel for long distances to seek for medication and the construction of health centres should be prioritized at Kulamawe, Kachuru, Ndumuru and Gambella Centres.
- Markets: The residents suggested that markets should be constructed at all the market centres along the road
- Rehabilitation centre: The Youth of Isiolo town suggested that a rehabilitation centre should be built in the area due to the prevalence of drug abuse.

The proposed Isiolo-Kulamawe Road project will come along with numerous positive impacts as exhaustively discussed within the report. They include:

- Creation of employment opportunities for construction, maintenance and operation crews.
- Creation of faster means of transport for passengers and bulk cargo within Isiolo and Meru counties.
- Reduced cost of public transportation.
- Increased business opportunities for small and medium -scale traders such as hotel and shop owners, food vendors, etc. especially during construction phase.
- Increased regional trade.
- Increased security.
- Reduced risk of accidents on the roads.
- Contribution of revenue to the county, national and regional governments, and
- Emergence of new towns and markets.

Negative impacts and the respective mitigation measures of the proposed road project

The key negative impacts and proposed mitigation measures for the proposed project are summarized in Table 1.0 as follows: -

Table 1: 0 Summary of negative environmental and social impacts and the proposed mitigation measures

Possible impacts	Mitigation measures
<i>Acquisition of land and property for earth borrow pits, quarries, water, spoil pits and construction camp</i>	<ul style="list-style-type: none"> • The acquisition of land should be done in conjunction with the local community. • Determination of agreeable rates for compensation to affected persons by key players being National Land Commission (NLC), NEMA, Ministry in charge of Lands, Transport, Infrastructure, Housing and Urban Development and all other relevant statutory institutions. • Cultivable lands should not be used as borrow pit sites for excavation of construction materials, unless other sites have been exhausted. • Siting of quarries far from communal settlements, providing adequate buffer zones and adopting best available and safest controlled blasting techniques. • Separate EIAs should be conducted for quarries, borrow pits, water pans and campsites. • Adopt the following key rehabilitation principles during decommissioning; <ol style="list-style-type: none"> i. Rehabilitate the affected areas to a state equal to or better than the original, that supports plant growth. ii. Rehabilitate within terms agreed between the affected party (land owner) and the contractor. iii. Comply with terms and conditions provided in the NEMA EIA License of the project.
<i>contamination of soil by fuels, oil spills and lubricants</i>	<ul style="list-style-type: none"> • Vehicle, machinery, and equipment maintenance and refuelling will be carried out on paved surfaces so that spilled materials do not seep into the soil. • Fuel storage and refilling areas will be located at least 300 m from drainage structures and important water bodies (rivers, water pans etc). • Fuel storage and refuelling areas, if located in agricultural land or areas supporting vegetation, will have topsoil stripped, stockpiled, and returned after completion of refuelling/construction activities. • All spoils and wastes will be disposed of as per approved disposal plans in wastelands, and in consultation with the county environmental administrators and local communities. • Bituminous wastes will be disposed of at approved sites with impervious linings.
<i>Air pollution due to dust generation and exhaust emissions</i>	<ul style="list-style-type: none"> • Sprinkling of water on dry and dusty surfaces regularly including the access murram roads and diversions. • All precautions to be taken for reduction in dust emissions from batching and/or hot mix plants and crushers, etc. • Adherence to personal protective clothing such as the use dust masks and respiratory masks by workers. • Enforce onsite speed limit regulations. • Ensure machines and vehicles are properly and regularly maintained. • Installing dust nets around batching plants.
<i>Noise pollution and excessive vibrations during construction</i>	<ul style="list-style-type: none"> • Ensure that all vehicles and construction machinery are kept in good condition all the time to avoid excessive noise generation. • Ensure that all workers wear ear muffs and other personal protective gear/equipment when working in noisy sections. • Ensure machines are switched off when not in use. • Undertake loud noise and vibration level activities during off-peak hours during the day (i.e. between 8.00 am and 5.00 pm).

	<ul style="list-style-type: none"> • Ensure the World Health Organization (WHO) bare minimum noise level is maintained for the eight working hours i.e. 70 dB.
Possible displacement and disruption of businesses located along proposed route	<ul style="list-style-type: none"> • The affected community members should be informed early enough. • The affected businesses should be compensated appropriately according to existing best practices on current market rates or mutually agreed rates. • Explore the alternative of by-passing the road outside the major towns to avoid displacement, • The proponent will need to ensure that the final designs of the road will be realigned to ensure that displacements are minimized as much as possible. • Ensure that the Resettlement Action Plan is done appropriately and professionally as per the laid World Bank guidelines. • Provide support to squatters / community members to establish small-scale businesses in other suitable locations of the main towns (Kulamawe, Ndumuru, Kachuru and Gambella) • Provide comprehensive environmental health and safety education to community members along the road. • Promote other sources of livelihood among the local communities such as employment at the construction sites.
Water abstraction and consumption	<ul style="list-style-type: none"> • Install water conserving taps and toilets where possible e.g. in the work camps. • Construct water pans for storage of harvested storm water in conjunction with the local community members. • Drilling of boreholes to supplement water obtained from other sources. • It would be a noble arrangement to enhance community water supply by handing over the project's boreholes to the community after construction. • Install gutters on the roof of houses in workers camps to harvest rain water.
Solid waste generation	<ul style="list-style-type: none"> • Maximizing the rate of recycling of road resurfacing waste either in the aggregate (e.g. reclaimed asphalt pavement from the first few kilometres of the existing road or reclaimed concrete material) or as a base. • Collecting road litter or illegally dumped waste and managing it according to the Waste Management Regulations 2006 and as provided in the Environmental Management and Monitoring Plan. • Provision of temporary waste handling facilities (litter bins) both during construction and operation phase.
Energy consumption	<ul style="list-style-type: none"> • Promote the use of solar energy and energy efficient bulbs in workers base camps and for street lights in villages situated along the proposed road. • Switch off lights when not in use. • Install electricity meters to monitor the consumption of electricity in workers camps. • Ensure construction machinery and trucks are well maintained. • Use energy-efficient construction machinery and trucks during construction phase of the project.
Discharge of wastewater, sewage and degradation of water quality	<ul style="list-style-type: none"> • Construction of a communal septic tank linked to an approved wetland system. • Explore the use of bio-digester in treatment of sewage in the workers camps. • Promote recycling of wastewater especially storm water for dust suppression. • Install meters in base camps to control and monitor consumption of water. • Ensure regular maintenance of the plumbing system and septic tanks to avoid leakage or spillage of wastewater.

Storm water	<ul style="list-style-type: none"> • Use of storm water management practices that slow peak runoff flow, reduce sediment load and increase infiltration. • Use of vegetated swales, filter strips, terracing, check dams / water pans, detention ponds or basins, infiltration trenches and infiltration basins. • Regular inspection and maintenance of permanent erosion and runoff control features. • Paving in dry weather to prevent runoff of asphalt or cement materials.
Loss of vegetation cover and biodiversity	<ul style="list-style-type: none"> • Ensure separate EIAs are conducted for campsites, ancillary facilities, borrow pits, boreholes and water pans • Minimize clearing and disruption of riparian vegetation. • Minimize removal of indigenous plant species and replant indigenous plant species in disturbed areas, • Restoring the vegetative cover through properly designed afforestation and reforestation practices, whose success can be appreciated through vigilant monitoring and evaluation after planting. • To reduce invasion by invasive species such as <i>Prosopis juliflora</i>, reduce roadside gaps by planting tree species suitable for highway planting. • Always monitor species regenerating in road reserve and take immediate actions such clearance in case of invasive species.
Disturbance to wildlife	<ul style="list-style-type: none"> • Minimize clearance and disruption of riparian vegetation. • Avoid critical terrestrial and aquatic habitats when siting roads and support facilities by utilizing existing transport corridors. • Design and construct wildlife migration routes / passage such as culverts at key crossing points to avoid or minimize habitat fragmentation. • Minimize removal of indigenous plant species, and replant indigenous plant species in disturbed areas. • Explore opportunities for habitat enhancement through reduced clearance to conserve or restore native species. • All open pits such as quarries and borrow pits should be backfilled to avoid creation of artificial pools that may alter the natural behaviour of avian species.
Community conflicts	<p>Ensure all stakeholders and the public are involved in the planning process.</p> <ul style="list-style-type: none"> • Ensure proper identification and compensation of all persons who will lose businesses and land. • Obtain necessary permissions and approvals from the County Governments. • Ensure EIAs are conducted for specific project activities such as sand harvesting, borrow pit and quarrying sites. • Largely involve the community in the project through their leaders, take keen in timely addressing their grievances and ensure a good percentage of the local community members are employees in the project

Sexual Exploitation/Child Abuse	<ul style="list-style-type: none"> • Conduct awareness and educational programmes to workers and minors on the issue of sexual exploitation and child abuse • Provide hotlines for the reporting of such cases • Ensure that stern action is taken for offenders found to have committed sexual exploitation • Employ adults(18 and over) provided with a national identity card
Gender Based Violence	<p>This should be mitigated as follows:</p> <ul style="list-style-type: none"> • Financial management training should be conducted to the PAPs and the employees • Have separate latrines for different genders • Provide a communication line to report such cases
Cumulative Impacts	<p>Specific actions that may be needed to effectively manage cumulative impacts include the following:</p> <ul style="list-style-type: none"> • Project design changes to avoid cumulative impacts (location, timing, technology). • Adaptive management approaches to project mitigation • Mitigation of project impacts by other projects (not under control of the proponent to further minimize impacts). • Collaborative engagement in other regional cumulative impact management strategies. • Participation in regional monitoring programs to assess the realized cumulative impacts and efficacy of management efforts. • Effect monitoring needed to assess the realized cumulative impacts is clearly defined and implemented. • Ensure multiparty regional mitigation and/or management (e.g., additional mitigation of other developments, offsets, management programs) that may be needed to effectively manage cumulative impacts is also identified • Support from other stakeholders (County Governments, developers and communities) is sought to implement it

The proposed road project will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that saves energy and water will be given priority without compromising on cost or availability factors. On the alternative construction materials and technology; rainwater will be harvested and be used in construction activities and supply to labour camps for flushing toilets and other non-domestic activities. Community members will be encouraged to harvest rain water not only to supplement the water supplied but also to help reduce pressure on the drainage structures. Heavy use of timber and wood during construction will be discouraged to minimize destruction of natural resources. A lot of solid waste will be generated from the proposed development. An integrated solid waste management system is recommendable. This will entail priority on reduction at source of the waste materials, implementing a solid waste management awareness programme, recycling, reuse and compositing of the waste.

The ESMP implementation will be monitored by a team of key experts with experience in Environment, Social, Health and Safety (ESHS) matters. The key ESHS Personnel will include; Supervising Engineer; Environmental Safeguards Specialist; Social Safeguards Specialist and Civil works contractor. In essence KeNHA will put in place a Project Management Team (PIT) which will include Environmental and Social Specialist to ensure the contractor complies with the ESHS requirements. The Supervising Consultant will assist KeNHA to provide full time presence on site to ensure environmental and social compliance with the applicable World Bank Safeguards Policies and National legislations, regulations and agreements.

Conclusions

The studies conducted on the proposed upgrading of Isiolo-Kulamawe road to bitumen standard, shows that the project will pioneer development in the North-Eastern region of Kenya and has significant impacts, both positive and negative, on the environment and socio-economic set up of the region through which the road will traverse.

The project as currently proposed is environmentally sound, based on the findings of this ESIA and the implementation of mitigation measures as proposed in the ESMP. An ESMP has been outlined to guide resolution of potential adverse impacts while enhancing the positive ones. Based on this, the recommendation is for this project to be granted environmental licensing to pave the way for implementation. Kenya as a country has a big shortage of such road project developments especially in the Northern side of the country; hence the construction of the proposed project goes a long way in solving part of the road transportation sector challenges.

1. Introduction

1.1. Project background

Road transport is the predominant mode of transport in Kenya, carrying approximately 93 percent of all cargo and passenger traffic in the country. The road network in Kenya has been established to be approximately 161,000 km long comprising of about 14,100 km of paved roads. The bulk of the road network in Kenya lies within the highly-populated parts of the country, providing some level of access to the rest of the country. In sparsely populated areas of the North-Eastern counties of Isiolo, Wajir, Mandera and Garissa covering a total area of approximately 152,694km² or 26 percent of Kenya's land mass has a road network of only 9,386km or 6 percent of the total road network in the country which is predominately unpaved. The poor condition of road network in these areas has contributed to uneven distribution of local produce due to time factor and breakage. The effect of this is that recovery and development costs in all sectors are adversely affected, hindering a rapid development of the region. In addition, failure to improve the road conditions of the transport corridors in this region that provide access to the sea and productive centres hinders the realization of full benefits from devolution.

It is against this background that the Government of the Republic of Kenya (GoK) applied for a credit from the World Bank towards the cost of the North-Eastern Transport Improvement Project (NETIP). The GoK intends to use a portion of the proceeds of the credit for the upgrading to bitumen standard of sections of the Isiolo– Mandera road, including the Isiolo – Kulamawe section with a total length of 77km.

It is however notable that a similar ESIA study was done for the proposed upgrading of Isiolo- Garbatula-Modogashe gravel road to bitumen standards in 2008. This study covered the same road under focus in this report, and therefore the ESIA study of 2008 will be factored in as an important resource. The study for the presently proposed upgrading of Isiolo-Kulamawe road takes place with new frameworks in place e.g. The Constitution of Kenya, 2010 and new administrative units due to devolution, that were not in place by 2008.

1.2. ESIA objectives

The Environmental and Social Impact Assessment (ESIA) Study was carried out to identify both the negative and positive impacts of the road project and formulate a sustainable Environmental and Social Management Plan (ESMP). This would guide the decision and policy makers on appropriate ways to handle the pertinent environmental issues that may arise during the project life and afterwards. Myriad adverse impacts, ranging from wildlife habitat destruction, changes in ecological setup, human and property displacement, and environmental pollution to cultural disorientation need keen appraisal to achieve less retrogressive impacts from such development.

The main objective of the ESIA study was to predict, assess, and analyse the possible positive and negative environmental and social impacts that are expected during the construction, operation and decommissioning phases of the project. This was done with the aim of proposing the possible mitigation measures for the highlighted negative impacts. This is in line with ensuring that the development does not impact negatively on the environment in terms of social, health, economic and physical (soil, water, plant and animals) state of the project site. The exercise was carried out in accordance with the National Environment Management Authority (NEMA) of Kenya Environmental Impact Assessment and Audit Regulations of 2003 and EMCA, Cap 387 and World Bank Safeguards Policies and Procedures.

The specific objectives were to:

- Identify all potential significant adverse environmental and social impacts of the proposed project and recommend mitigation measures;
- Ensure compliance with the environmental regulations and industry's standards;
- Generate baseline data for monitoring and evaluation of the success of the mitigation measures implemented during the project life cycle;

- Recommend cost effective measures to be implemented to mitigate against the expected impacts;
- Provide guidelines to stakeholders participating in the mitigation of adverse social impacts of the project;
- Prepare an environmental Impact Assessment Study report compliant to the Environmental Management and Coordination Act, EMCA Cap 387 and detailing findings and recommendations.

1.3. Terms of Reference

The terms of reference developed for this study are outlined in **Appendix. G**

1.4. Project objectives

The Proposed Road Project is expected to meet the following objectives and service needs both during construction and operation phases of the project:

- Improve the region's road network,
- Reduce travel time along and across the roads,
- Enhance the operational efficiency of the road,
- Promote economic growth within the region,
- Improve safety and reliability for all road users,
- Attract diverted traffic that will foster regional growth,
- Provide employment opportunities to local inhabitants, among other benefits.

1.5. Scope of the project

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

In conducting this exercise, the consultant undertook:

- The reviewing of preliminary designs for the proposed project to get acquainted with environmental issues in the project site vicinity.
- The planning and preparing of a time schedule for the activities to be undertaken for the ESIA.
- Visiting the project site, and widely consulting with the local communities at Kulamawe, Kachuru, Ndumuru, Gambella and Isiolo town centres, local leaders and other relevant key stakeholders such as the Isiolo and Meru County Governments etc.
- Carrying out a comprehensive assessment ensuring all environmental concerns and views of all parties/persons likely to be affected by the project are taken into consideration.
- Developing an environmental and social management plan with mechanisms for monitoring and evaluating the compliance and environmental performance, which include the cost of mitigation measures and the timeframe of implementing the measures.
- Publicizing the project and its anticipated effects by posters in strategic places, publishing a notice in both official and local languages in the Kenyan Gazette and one of the local dailies.
- Liaising with NEMA for compliance with all mandatory and regulatory requirements relating to the ESIA.

1.6. Data collection methods and procedures

The data collection was carried out from the 13th November to 15th November 2017 through questionnaires/standard interview schedules, key informant interviews, focused group discussions, use of checklists, observations and photography, site visits, desktop environmental studies and field studies, where necessary in the manner specified in the Environmental (Impact Assessment and Audit) Regulations, 2003.

As stated earlier, the ESIA Study was carried out in compliance with the government of Kenya's Environment Management and Coordination Act (EMCA Cap 387) and the Environmental (Impact Assessment and Audit) Regulations 2003, World Bank's Environmental and Social Performance Standards among other laws, regulations guidelines and standards.

The general steps followed during the assessment were as follows:

- Environment screening, in which the project was identified as among those requiring environmental impact assessment under schedule 2 of EMCA, Cap 387 Environmental scoping that provided the key environmental issues;
- Desktop studies;
- Physical inspection of the area and surrounding areas;
- ESIA Public participation via the use of questionnaires/ interviews/ meetings / focused group discussion;
- Data analysis; and
- Report preparation.

1.6.1. Environmental screening

This step was conducted through legal review and desktop studies to assess whether there will be a need for an environmental and social impact assessment, and what level of assessment is necessary. This was done using a screening checklist in reference to requirements of the EMCA Cap 387 specifically the second schedule. In line with the second schedule of the Environment Management Act EMCA Cap 387, all new roads including trunk roads are categorized as high-risk projects and require a TOR to be prepared and full ESIA Study be undertaken for submission to the National Environment Management Authority (NEMA) for approval.

1.6.2. Environmental scoping

The scoping process, through an ESIA scoping checklist, was conducted to help narrow down onto the most critical issues requiring attention during the assessment. Environmental issues were categorized into physical, natural/ecological and social, economic and cultural aspects. It also included discussions with key stakeholders, managers and design engineers as well as interviews with local communities.

1.6.3. Desktop study

Desktop study included document review on the nature of the proposed activities, project documents, designs, policy and legislative framework as well as the environmental setting of the area among others. The key documents reviewed included the following: -

- Environment and Social Impact Assessment Study for Proposed Upgrading of Isiolo - Kulamawe Road to Bitumen Standards, Inception Report.
- Design review of the Isiolo - Kulamawe Road, Reconnaissance Visit Findings.
- Kenya National and County Laws.
- World Bank Safeguards Policies and Procedures
- Social Impact Assessment of the Proposed Isiolo - Kulamawe Road.
- Applicable Multilateral Environmental Agreement (MEAs).

- Previous Environmental Impact Assessment Study (EIAS) Report for the Proposed Upgrading of Isiolo-Garbatula-Modogashe Gravel Road (B9) to Bitumen Standards.

1.6.4. Site assessment

Reconnaissance surveys along the route of traverse were conducted by the study team to familiarise with the site conditions and identify transects for further detailed investigation. Selected sites were then subjected to further detailed investigations and screening to document baseline conditions as a basis for anticipating Project Impacts.

1.6.5. Public participation

This activity whose progress and outcomes are reported in Chapter Five of this report was undertaken in fulfilment of the requirements of the Kenyan Constitution, 2010, EMCA Cap 387 and OP/BP 4.01 Environment Assessment which require all project development to be proceeded by mandatory public consultation and stakeholder engagement as a measure of improving environmental and social sustainability of projects, enhancing project acceptance and making a significant contribution to successful project design and implementation. Public participation meetings were conducted at **Muriri/Isiolo junction, Gambella, Ndumuru, Kachuru and Kulamawe towns**. House to house surveys and Focused Group Discussions (FGDs) were also conducted in the other townships located along the road corridor i.e. Haidaven, Kachuru and Yaqbarsathi. To ensure adequate public participation in the ESIA process, questionnaires were administered to the local communities, leaders, and the information gathered was subsequently synthesized and incorporated into the ESIA Study Report. The consultant has incorporated the concerns and views of all stakeholders and the affected people.

1.6.6. Data analysis, reporting and documentation

Upon data analysis, potential environmental impacts (both positive and adverse) were predicted based mainly on concerns raised by the public, stakeholders and expert observations on the ground and available tools. The magnitude, significance, and acceptability of predicted impacts were evaluated with a view to determining whether observed adverse impacts are significant enough to warrant mitigation. Impacts were further screened for occurrence and significance of residual (those which cannot be mitigated satisfactorily) and cumulative impacts with a view to providing a basis of making recommendations on the way forward for the project.

1.7. ESIA organization and structure

Based on the existing information, the ESIA study was carried out to full completion within a period of 45 days and processing is estimated to take another 45 days from the date of undertaking. The Consultant (Lead Expert) coordinated the day-to-day functions and any related institutional support matters. Otherwise, all formal communications are to be directed to NEMA through the proponent.

The ESIA study as proposed above culminated with production of this Study Report designed to ensure that the proposed development complies with the Environmental Management and Coordination Act (EMCA, Cap 387). The report is organized in 10 chapters as outlined below: -

Chapter 1: Gives Background Information to the Study Describing the Objectives and the Terms of Reference.

Chapter 2: Project Description.

Chapter 3: Outlines the Baseline Information of the Study Area.

Chapter 4: Gives the Policy, Legal and Regulatory Framework Policy, Legal, Institutional and Administrative Framework.

Chapter 5: Summarizes the outcome of the Stakeholder Engagement and Public Consultations process.

Chapter 6: Identification of Potential Impacts of the Project.

Chapter 7: Mitigation of Potential Impacts of the Project.

Chapter 8: Project Alternatives to the Project.

Chapter 9: Environmental and Social Management Plan (ESMP).

Chapter 10: Concludes the findings and recaps the main recommendations.

The implementation of ESMP is a core part of the project implementation from design to completion stage and is expected to be adopted by the project stakeholders – the contractor, supervising consultant and the client ministry's implementing team

2. Project description

2.1. Introduction

The Government of the Republic of Kenya through the Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD) represented by the Kenya National Highways Authority (KeNHA), Kenya Rural Roads Authority (KeRRA), and the Kenya Urban Roads Authority (KURA) being state corporations established under the Kenya Roads Act, 2007 has identified the need to upgrade to paved standards approximately 10,000 km of roads. These roads are intended to support the primary growth sectors of Commerce, Tourism, Agriculture and Rural Production, and Extractive Industries. As such, the Government of Kenya (GOK) through its road agency, Kenya National Highways Authority (KeNHA) has embarked on a pivotal infrastructure project to improve the 77Km Isiolo- Kulamawe road to bitumen standard. The project is located in Isiolo and Meru Counties. The existing road is gravel surfaced and in a poor condition. Geometrics of the current existing road will need to be improved because the road terrain is pre-dominantly flat with gently rolling sections thereby presenting drainage challenges. Figure 1 below gives the Google Earth view of the proposed road.



Figure 2:1 Google Earth View of Isiolo-Kulamawe road alignment

(Source: Google Earth, 2016)

The ride quality of the project road is quite low with international roughness index (IRI) of at least 13.0. Road washouts are numerous. The road is maintained through spot improvement and general grading.

2.1.1. Road categories in the project road alignment

The roads along the project alignment are as outlined below:

Class A: These are international trunk roads linking international boundaries e.g. Garissa – Dadaab – Liboi Road (A3) and sections of Isiolo-Modogashe-Wajir-Mandera Road. The Isiolo-Mandera road previously classified as road B9 had sections of it recently re-classified to A10 (Isiolo-Kachuru) B84 (Kachuru - Modogashe) and A13 (Modogashe-Wajir-Mandera).

Class B: These are national trunk roads linking counties and centres of national importance.

Class C: These are primary roads linking Sub-County headquarters to each other or to higher class roads e.g. Garissa – Modogashe section.

Class D: Secondary roads linking locally important centres to each other or to higher class roads.

Class E: Minor roads linking minor centres.

The figure below shows National map showing the project delineation.

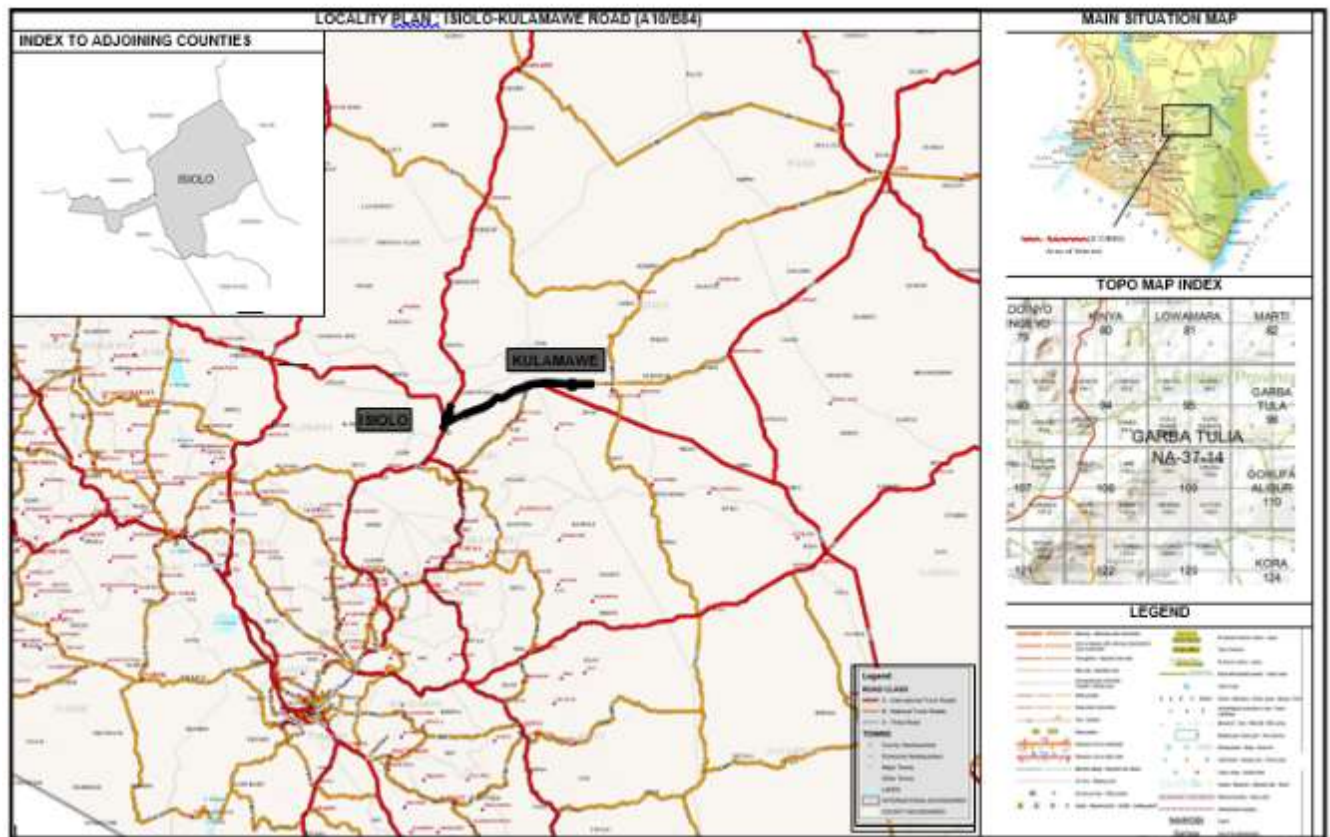


Figure 2:2: Kenya map showing the project delineation

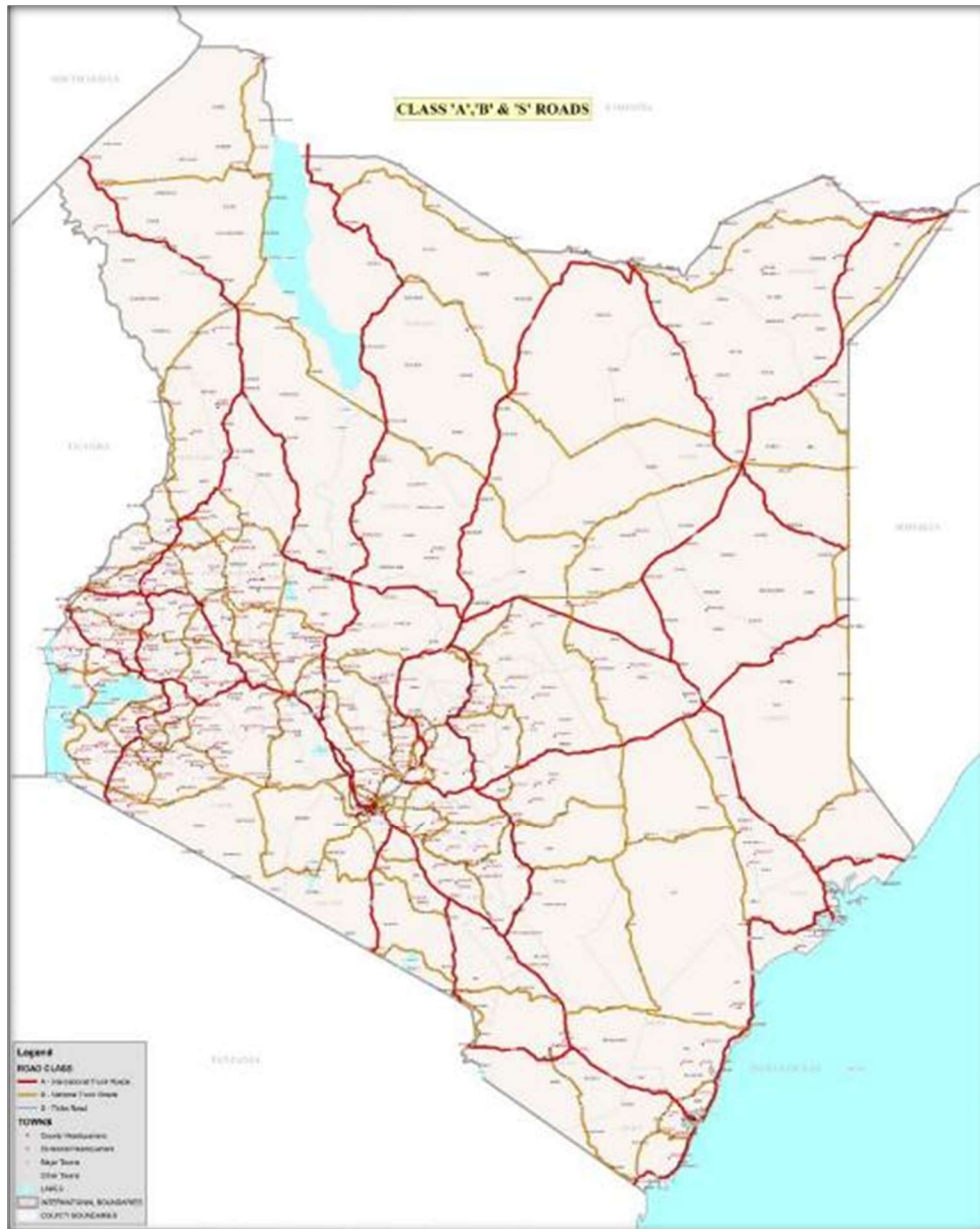


Figure 2:3. Kenya Roads Network of Class A, B, and S Roads (New Classification)

2.1.2. Direction

The project road starts from Isiolo town, at a T-junction with road A2 approximately 1Km from Isiolo town Central Business District (CBD) and traverses for approximately 3Km in easterly direction within Isiolo County. The alignment then exits Isiolo County into Meru County, curving into a north-easterly direction traversing approximately 63Km to Kachuru trading centre in Meru County, where it exits Meru County back to Isiolo to terminate at Kulamawe trading centre. The alignment follows the existing Isiolo – Mandera road, formerly classified as RD B9. Approximately 10km of the alignment lies within Isiolo County while the rest of the alignment lies within Meru County. The project road is currently classified as RD A10 from Isiolo to Kachuru at the junction with the proposed Lamu Port South Sudan Ethiopia Transport (LAPSSET) corridor (Figure 2.4) and as RD B84 beyond the Junction under the new road classification by Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD).

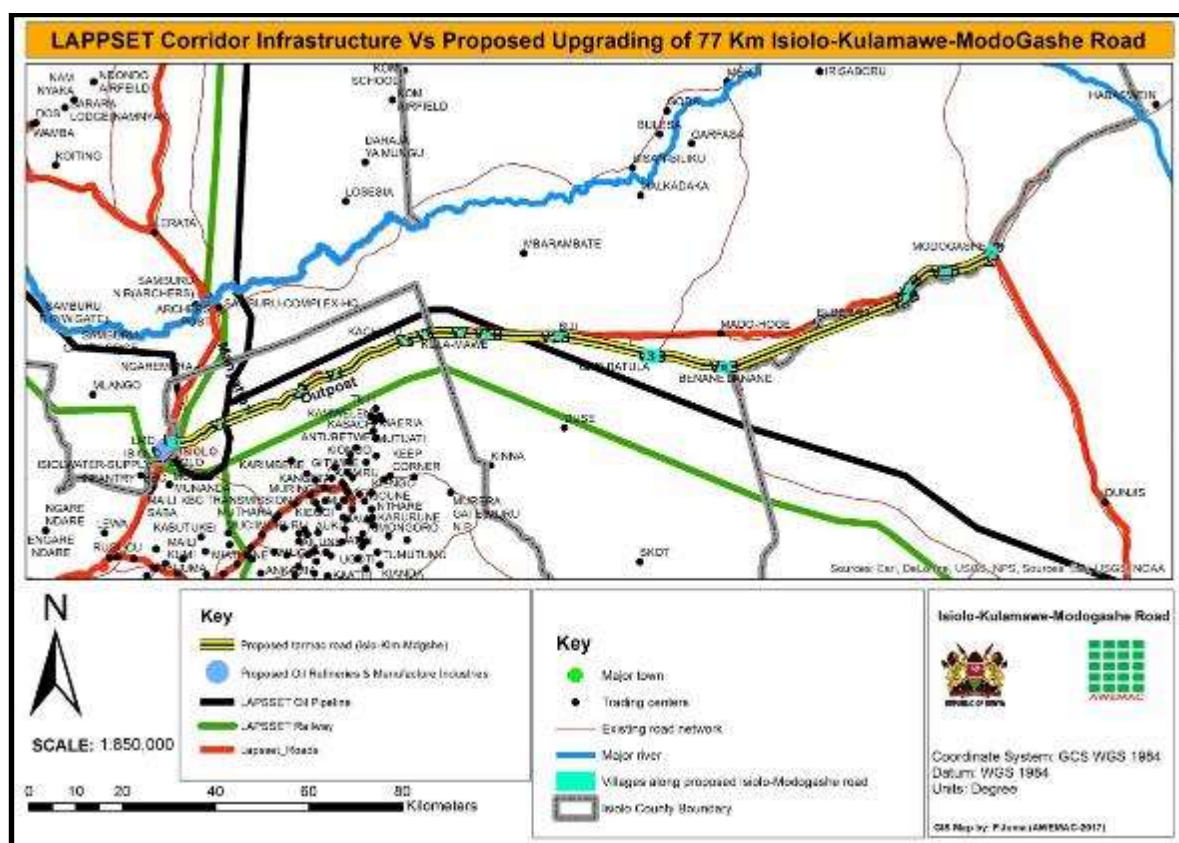


Figure 2:4. Proposed road project versus LAPPSET Corridor Infrastructure

2.2. Condition of the existing road

2.2.1. Construction history

The Isiolo-Mandera corridor, which forms a section of the project road is among the major roads that remain unpaved in Kenya. The road has for the longest time been to earth standard with dismal level of maintenance, thereby making the region inaccessible due to the time factor and breakage of vehicles. With the formation of the road authorities, the project road has undergone upgrading to gravel standard for most of the sections by KeNHA and continues to benefit from the routine maintenance program funded by KRB using RMLF. The road is currently earmarked for upgrading to bitumen standard.

The upgrading of the road corridor is one of the top priority of the Government of Kenya and is consistent with the transport policy of bituminizing of all Class A roads in the country. Improving of the road will no doubt stimulate the development, integrate, and contribute to improving security and bringing about sharing the prosperity of the country with this region.

2.2.2. Existing road geometry

2.2.2.1. Horizontal alignment

The existing horizontal alignment from Isiolo town is characterised by long straights and horizontal curves with characteristic short lengths and long radii. The existing road is gravel finished, in a motorable state having been regularly maintained by KeNHA using the RMLF.

2.2.2.2. Vertical alignment

The vertical alignment of the project road is characterised by a gentle slope from a high of 1100m at Isiolo town to a low of approximately 1034m at about Km 20+000, then gently rises for approximately 8km to a high of 1100m, from where it falls gently to a low of about 805m at Kulamawe trading centre.

2.2.2.3. Cross-section

The cross section of the existing road varies from well-defined 7m width to undefined 11m width at sections where erosion of the carriageway has taken place. The road levels generally follow those of the existing grounds with some sections falling below the existing ground levels. The low-level sections act as drainage-ways and therefore are clogged with sand making it difficult for motorists to manoeuvre through. However, the sections which were recently gravelled by KeNHA are well defined with side drains on either side, coupled with mitre drains.

2.2.2.4. Road reserve

The project road section has recently been reclassified from road class B9 to road class A10, following the recent roads re-classification in Kenya. This means that the existing road reserve requires expansion to meet the requirements of the new road classification i.e. 60m.

2.2.2.5. Existing traffic

Traffic volume along the project road can be described as very low, comprising of mainly medium goods trucks, large buses and 4-wheel drive vehicles. It is expected that the development will lead to generated traffic comprising of all vehicle classes originating from the neighbouring counties/towns including Garissa, Marsabit and Wajir.

2.2.2.6. Existing Drainage Structures

The following are the common drainage structures on the project road;

- 1No. Single lane, double span composite bridge. 900 mm dia. pipe culverts.
- 6No. Box culverts of various sizes.
- PCC and CMP culverts of various sizes.
- Drifts.

The existing structures are mostly silted, eroded, cracked, scoured and damaged. The drainage channels in many cases show signs of erosion from the seasonal rivers.

New structures are required together with raising the road embankment to protect the road from overtopping.

2.3. Project designs

2.3.1. Traffic surveys and analysis

The traffic class adopted was based on traffic studies. Based on the poor state of the roads, relatively low economic activity and the insecurity in the project areas, traffic had not changed significantly since the last survey.

Observations and conclusions from the traffic survey were that:

- There was a high increase in the number of motor cycles from 2005 to 2015 and further to 2017.
- The traffic volumes have only increased marginally from 2015 to 2017.
- The high number of motorcycle traffic is an indicator of underlying unmet travel demand, which ideally should be served by PSVs.
- Traffic growth (and by extension, economic growth) has been stifled by the condition of the road. The areas therefore appear to be lagging as the rest of the country is experiencing exponential growth in traffic.

Taking into account the LAPPSET traffic expected to use section of the road, the traffic class of T1 has been used for design. However, traffic class T3 is considered for the loop and service roads.

2.3.2. Materials investigation and pavement design

A full-fledged materials investigation exercise was carried out comprising of sampling and testing of subgrade soils at 1km intervals, identification of potential material sites and quarries, sampling and testing of gravel, hard stone and water for construction.

2.3.2.1. Alignment soils

It was established that the alignment soils along the proposed road varied from subgrade class S2 to subgrade class S6 with the larger section falling under subgrade S4.

2.3.2.2. Gravel material sites

A total 9 No. potential material sites for the proposed project comprising of both existing and new ones were investigated. The GPS locations of the identified material sites are as follows;

Table 2:1: List of proposed gravel sources

S/No.	GPS Locations	MS Label	Chainage	Approximate Area
1	0352478, 0042440	MS 1	Km 10 + 800 RHS	350 x 200 m ²
2	0371669, 0052959	MS 2	Km 33 + 600 LHS	500 x 200 m ²
3	0360113, 0046430	MS 3	Km 19 + 500 RHS	200 x 150 m ²
4	0399693, 0063969	MS 4	Km 65 + 700 LHS	300 x 200 m ²
5	0411012, 0063083	MS 5	Km 77 + 000 LHS	150 x 120 m ²
6	0410559, 0062435	MS 6	Km 77 + 400 RHS	200 x 180 m ²
7	0349311, 0042164	MS 21	Km 7 + 400 LHS	300 x 200 m ²
8	0384041, 0058149	MS 22	Km 46 + 000 LHS	300 x 250 m ²
9	0381977, 0056934	MS 23	Km 48 + 800 LHS	270 x 220 m ²

Laboratory testing of the materials was carried out to ascertain their suitability for use as subbase and base material before and after improvement with cement. It was established that the natural gravel from potential material sites could not be used as subbase and base material in their natural state, and improvement of the materials with cement was therefore adopted to increase its bearing strength.

2.3.2.3. Hard stone quarries

A total of 5 potential sources of hard rock for aggregates were identified and investigated for the following:

- Los Angeles Abrasion (AASHTO T96).
- Aggregate Crushing Value (BS 812, Part 110).
- Specific Gravity and water absorption (AASHTO T85).
- Sodium sulphate soundness (AASHTO T104).
- PI of LAA fines (AASHTO T89).
- Bitumen affinity (AASHTO T182).

2.3.2.4. Sand for construction

Nine sand sources were identified and samples were taken for laboratory testing to ascertain their quality and their compliance with the requirements of Road Design Manual (RDM) Part III. It was established that the sites are appropriate and there is sufficient sand to cater for the structures envisaged for the project.

2.3.2.5. Water for construction

The project road traverses an area of arid/semi-arid climate, with low water availability. Water for human and livestock consumption along the project road is currently sourced from a few boreholes and water pans. These existing water supply points are located at selected centres along the alignment. The available water sources are not sufficient to meet the human and animal consumption demand and

cannot be used to provide construction water. Establishing sources of water for construction is therefore critical for the project works.

The alternative systems that can be used to provide construction water are sinking boreholes to tap ground water, rain water harvesting through construction of water pans, or damming of the seasonal rivers. These alternatives have been investigated and sinking of boreholes is considered the most feasible for the project, as the other alternatives would be expensive and would take rather too long to complete. A water pan can also be constructed to provide additional water.

A construction water demand of 240,000m³ has been estimated for the whole road. For purposes of daily supplies and designing of water supply systems, however, assessment of daily water demands is necessary. An assessment has been made based on anticipated average daily work production rates, and this has given a daily construction water demand of 300m³. Due to the socio-cultural setting of the project, the sources constructed for the project would have to be available for use by the local community. Allowing for demand for about 400 project staff and workers and allowing for use by the local community, the total average daily project water demand is approximately 350 m³. Because of the envisaged use of the same water for both construction and consumption both quantity and quality are important, but the ground water sources have been found to be palatable.

2.3.2.6. Pavement design

The proposed pavement design is based on results of detailed materials investigation and testing, alignment soil testing and traffic studies. The designs put into consideration the economic study findings of the project area, and in particular the economic impact of the proposed LAPPSET corridor and the Isiolo satellite city.

The following are possible pavement structures based on the design traffic loading.

Table 2:2: Pavement structure

Structure Type	Base/Subbase Material	Layer Thickness
4	Cement Stabilized Gravel Base Base quality graded crushed stone Subbase	AC-100mm Base -200mm Subbase - 175mm
5	Cement Stabilized Gravel Base Cement Improved Material Subbase (Base quality)	AC-100mm Base -150mm Subbase -175mm
11	Dense bitumen macadam Base Cement Improved Material Subbase (Base quality)	AC – 50mm Base - 150mm Subbase -175mm
12	Dense bitumen macadam Base Graded Crushed Stone Subbase (Base quality)	AC-50mm Base - 150mm Subbase -175mm
13	Lean Concrete Base Cement Improved Material Subbase (Base quality)	AC -75mm Base -150mm Subbase -150mm

2.3.2.6.1. Pavement structure for the main carriageway

Based on the findings from materials investigation and cost of construction, a pavement structure type 5 for the main carriageway is recommended.

Table 2:3: Proposed pavement structure

	100 mm surfacing – AC type 1
	150 mm Cement Stabilized Gravel Base
	175 mm Cement Improved material subbase (Base Quality)
	300mm compacted natural material improved subgrade to S5

2.3.2.6.2. Pavement structure for service roads, access roads and market loop roads

A pavement structure type T3 for all town service and loop roads is proposed due to expected reduced traffic loading and cost effectiveness.

Table 2:4: Pavement Structure for town service and loop roads

	50 mm surfacing – AC type 1
	150 mm Cement Improved Material Base
	175 mm Cement Improved material subbase
	300mm compacted natural material subgrade

2.3.2.6.3. Pavement for truck parking

A rigid pavement for truck parking is proposed comprising of the following;

Table 2:5: Pavement for truck parking

	200mm Concrete Slab
	3mm Polythene Sheet
	175mm Cement Improved material subbase
	300mm compacted natural material subgrade

2.3.2.6.4. Pavement for emergency landing for light aircrafts

A pavement structure of the same standard as the pavement for the main carriage way is proposed for emergency landing of light aircrafts. However, the width of the emergency landing section shall be 15m and length of 1,500m.

Table 2:6: Pavement for emergency landing of aircrafts

	100 mm surfacing – AC type 1
	150 mm Cement Stabilized Gravel Base
	175 mm Cement Improved material subbase (Base Quality)
	300mm compacted natural material subgrade

2.3.3. Geometric design

Horizontal and vertical design is guided by standards as contained in the Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD), Road Design Manuals (Part 1 &3) and Manual for Traffic Signs in Kenya (Part 1 & 2); construction specifications are in accordance with the MoTIHUD Standard Specification for Road and Bridge Construction (1986). Methodologies used in pavement design, earthworks, drainage and structures are in conformity with the latest international techniques to ensure economical use of available materials and a balance between capital and maintenance costs.

2.3.3.1. Road reserve width

A 60m road reserve width is recommended for the project.

2.3.3.2. Access control

In consideration of the Class A category of the project road, full access control should ideally be exercised to give preference to through traffic by providing access connections with selected public roads only and by prohibiting private accesses. However, since private accesses are few and pose no significant effect on efficiency and safety, and since in built up areas/markets the design speed has been reduced to 50km/h, it is reasoned that a more appropriate solution would be to adopt a reduced level of control. Therefore, partial access control, as defined by the RDM I, has been adopted.

2.3.3.3. Design philosophy

The following general design philosophy has been used as a guideline while carrying out the geometric designs of the project road:

- Achievement of economic designs which will result in optimum balance between the construction and overall road user costs;
- Having optimal horizontal alignments phased or coordinated with vertical alignments where possible and commensurate with the requirements of Road Design Manuals of the MoR;
- Segregation of motorized traffic (MT) and non-motorized traffic (NMT), and between one vehicle and another by use of right/left turn lanes, foot paths, refuge and channelizing islands at junctions and on-street parking to reduce conflict points thus enhancing safety and efficiency;
- Provision of road alignments that are safe and aesthetically pleasing and that maintain harmony between the roads and the surrounding environment, while minimising any negative impacts on the environment.

2.3.3.4. Design speed

The design speed determines the operational and safety characteristics of a road. The design speed is used as an index which links road function, traffic flow and terrain to the design parameters of sight distances and curvature to ensure that a driver is presented with a reasonably consistent speed environment. It must be defined precisely at the beginning of the designs. It depends on the context wherein the road is. Its choice is influenced by the following factors:

2.3.3.5. Classification and function of the road

Isiolo – Kulamawe is classified as Class A10/B84– International Trunk Road forming part of a strategic route from Isiolo to Mandera. Along such an important arterial road serving long distance journeys, drivers expect higher speeds without compromising safety. The major function of such an arterial is to provide mobility (as opposed to access).

2.3.3.6. Effects of terrain and road environment

The topography traversed by the project is predominantly flat. For this type of terrain, design speed of 100km/h is acceptable according to the guidelines set in the Road Design Manual Part 1. Along sections with restrictive terrain, a design speed of 60km/h has been adopted.

2.3.3.7. Density and character of land use

The road crosses a desert-like environment typical of Arid and Semi-Arid Lands (ASAL) and serves few villages and few towns. Save for the first 4km off Isiolo Town and at towns and villages, higher design speeds are desirable to achieve operational efficiency and acceptable level of service for the road users but safe enough at urban/built up areas.

2.3.3.8. Traffic volume expected to use the project road

The existing traffic flow is low. However, from the traffic study, it has been established that the project will carry projected traffic of 5550 pcu in year 10. High design speeds are therefore acceptable on the roads in view of the prevailing and predicted future traffic conditions.

2.3.3.9. Selection of design speed

The Road Design Manual Part 1 provides the following guidance in the selection of appropriate design speeds for different terrain categories and for Class A and B roads;

Table 2:7: Criteria for selection of design speed

Terrain	Road Classification		
	A & B	C	D & E
Level	100-120	90-100	80
Rolling	70-100	60-90	50-80
Mountainous	50-70	40-60	30-50

A design speed of 100km/hr would be appropriate for a level terrain. However, for economic considerations, the lower design speed of 60km/hr will be applicable for mountainous terrain along sections with physical restrictions including

- Sharp horizontal and vertical curvature;
- Steep vertical alignment gradients;
- Stopping and passing sight distances.

Along towns, villages and built up areas a design speed of 50km/hr is deemed appropriate on account of safety.

2.3.3.10. Design vehicle

The characteristics of the design vehicle affects the geometric aspects of the road and particularly the cross-section, widening at horizontal curves and junction layouts. Their influences on the road geometry are particularly critical on terrains with steep gradients and sharp horizontal curves.

Semi-Trailer combination (15m overall) has been adopted as the design vehicle in the geometric design of road and associated facilities such as truck parking.

2.3.4. Road features

2.3.4.1. Cross section

Traffic surveys and data analysis has projected the following traffic at year 10.

Table 2:8: Adopted cross section details

Section of Road	pcu at year 10	Recommended cross-section
Isiolo to Kulamawe	5,550	Type II (7m carriageway but shoulders to be widened to 2m instead of the 1.5m recommended in the RDM Part 1)

2.3.4.2. Embankments and cut slopes

Embankment and cut slopes were adopted based on the requirements of the RDM 1

Table 2:9: Embankment and cut slopes

Fill slopes		Cut Slopes	
Height of Fill	Slope	Cut Depth	Slope
$H_f \leq 1\text{m}$	1:4	$H_c \leq 1\text{m}$	1:3
$1\text{m} \leq H_f \leq 3\text{m}$	1:2	$1\text{m} < H_c \leq 3\text{m}$	1:2
$H_f > 3\text{m}$	1:1.5	$H_c > 3\text{m}$	1:1.5

2.3.4.3. Side drains and cut-off ditches

Pursuant to the RDM I, type B-2 is recommended to be applied in areas with flat/rolling terrain, and type A-2 in areas with steeper grades and Cut-off ditches to be provided at steep sections.

2.3.4.4. Emergency runway

An emergency runway to allow the landing of light aircrafts is required as part of the design. The location between km 18+100-km 19+600 meets the ICAO runway requirements and is therefore proposed as the site of the emergency runway;

Table 2:10: Emergency runway requirements

Element	Requirement
Distance from licensed Aerodrome	9.3km minimum
Obstacle free Threshold	60m minimum
Obstacle free approach gradient	Less or equal 3.3%

Longitudinal slope on runway	Not more than 2.0%
Longitudinal slope change on runway from one slope to the next	Not exceeding 0.4% or minimum radius of curvature of 7500
Distance between longitudinal slope changes on runways	45m minimum
Transverse slope	Maximum slope not exceeding 2.5% and 1.5% minimum
Runway strip width	60m minimum
Runway shoulder slope	Not exceeding 4%
Longitudinal slopes on graded area	Not exceeding 2.0%
Longitudinal slope change on graded area	Not exceeding 2.0%
Transverse slope on runway slope	Not exceeding 3.0%

2.3.4.5. Service/ market roads

Service roads are proposed at Ndumuru, Kachuru and Kulamawe markets.

2.3.4.6. Bus bays

Simple bus bays as recommended in the RDM I have been proposed. Although indicative locations have been identified, specific locations shall be determined on site during construction.

2.3.4.7. Lorry parking

Lorry parking locations have been proposed at Ndumuru and Kulamawe Markets.

2.3.4.8. Junction design

2.3.4.8.1. Interchanges

Grade separated junctions are proposed at A2/A10 and at A10/B66 junctions. An interchange at A10/B84 junction has not been designed since the precise location for this junction is not known and considering the link road from Kachuru to Duse does not exist. Geometric design for A10/B84 interchange will be done once the exact location is determined.

2.3.4.8.2. Major & minor junctions

Major and Minor junction intersecting the project road have also been designed.

2.3.4.9. Road furniture

The following recommendations are made on road furniture;

- **Road Reserve Boundary Posts**- these shall be provided at intervals of 250m on each side of the road reserve edge;
- **Edge Marker posts**-these are provided at bridge approaches, pipe culverts, sharp curves and at locations where sight distance requirements are not complied with. Exact location for the Edge Marker Posts will be determined during the construction phase of the project;
- **Kilometre Marker Posts**-these shall be provided at intervals of 2km staggered on either side of the road;
- **Road Signage**-these shall be provided and installed in accordance with the recommendations of Ministry of Works, Roads Department (Kenya); Manual for Traffic Signs in Kenya, Part I (Road Markings)- 1975;
- **Road Marking**. Locations for different types of road marking will be determined on site during construction. These are to be determined in accordance with the requirements of Ministry of Works, Roads Department (Kenya); Manual for Traffic Signs in Kenya, Part I (Road Markings)- 1975;
- **Guardrails**. These road furniture elements, whose exact locations will be determined on site during construction, shall be determined at bridge approaches, box culverts and high fill in accordance with Guardrail Need Index (G.N.I) as specified in the RDM I;
- **Kerbs** -these shall be provided at junctions, bus bays and parking bays. Exact locations shall be determined on site during construction;
- Locations of Reflective Road Stands, Rumble Strips and Speed Bumps shall be determined on site during Construction.

2.3.4.10. Bridges and other drainage structures

The existing structures include;

- Several 900 mm dia. pipe culverts.
- Several 600 mm dia. pipe culverts.
- Various 1200 mm dia. pipe culverts
- Drifts at various locations
- Box culverts at various locations
- 1no. Single lane 3.7m, double span 25m composite bridge at Km 7+953.

Most of these structures lack routine maintenance measures and are characterised by eroded aprons wingwall backfills, and clogging with debris, and are generally in unsound structural conditions. This, coupled with realignment of some sections of this road, renders the existing structures inappropriate. Geometric design envisages an 11m wide road (inclusive of shoulders) and thus the existing bridge being only 3.7m wide, even if it was structurally sound would not suffice. This bridge also lacks safety measures like guardrails.

From the above scenario coupled with the need to provide grade separated junctions, proposals have been made for interchange bridges and various drainage structures as detailed below.

2.3.4.10.1. Proposals for bridges

3No. bridges have been proposed and designed for this project:

- An interchange bridge at A2/A10 junction to be located at Km 0+000 of the road.
- An interchange bridge at A10/B66 junction located at approximately Km 55+330 of the road near Kachuru and
- A 25 x 4m height river crossing bridge at approximately Km 7+932 of realigned road.

2.3.4.10.2. Proposals for box culverts

A total of 27No. box culverts are proposed to be installed along this road section. These shall replace some of the existing culverts and or drifts. The box culverts are designed for loadings due to embankment fill, horizontal earth pressure on the sides of the culverts, culvert self-weight and vertical loads applied on top slabs due to vehicular traffic. The culvert lengths shall vary as per the fill heights above for each culvert with the minimum at 14m long.

2.3.4.10.3. Proposals for pipe culverts

Hydrological designs propose cross pipe culverts sizes of 900mm and 1200mm which shall be readily accessible for cleaning and maintenance purposes. For access culverts, minimum of 600mm diameter have been proposed.

2.3.4.10.4. Sizing of the drainage structures

The size of drainage structures has been determined using design floods determined in the Hydrological studies and design. The following guidelines have been used in determining the sizes:

- Bridges to pass 50-year flood with a clearance of 1.0m below soffit of beams/slab;
- Box culverts of opening greater than 5m² to pass 25-year flood with a free board of 1.0m;
- Box / pipe culverts of opening less than 5m² to pass 5-year flood;
- Velocity of stream flow estimated using Manning's formula;
- Area obtained checked using inlet control table for culverts;

2.4. Project activities and processes

The project has 4 major phases:

- i. Pre-construction (planning and design) phase.

- ii. Construction phase.
- iii. Operational phase.
- iv. Decommissioning phase.

2.4.1. Planning and design phase

This is the initial phase of the whole road construction project. It involves the following activities:

2.4.1.1. Preliminary design

The preliminary design entails the following:

- i. Review of the existing data on the proposed road project and social and economic activities in the project area.
- ii. Collection of social, environmental and physical data that is necessary to assist in the design of the project road.
- iii. Preliminary engineering survey and design work for the optimum alignment and design standards. These includes;
 - Topographical surveys
 - Hydrological and hydraulic studies
 - Sub surface soil exploration
 - Material surveys (borrow sites, quarries and water sources) and
 - Field and laboratory soils and materials investigations
- iv. To carry out an Environmental Impact Assessment of the project area in relation to the proposed project.

2.4.1.2. Detailed design

The detailed design entails:

- i. Comprehensive field surveys.
- ii. Soils and material investigation.
- iii. Drainage and bridge site investigation.
- iv. Geometric designs.

2.4.2. Construction phase

2.4.2.1. Setting out

The construction works shall start with setting out the alignment of the road. Reference pegs shall be 50mm in section 600mm long driven into ground and painted white above the ground. The offset from the centreline shall be indicated by small nail 20mm to 25mm long with its head driven flush with the top of the peg. Chainages, off-set and reference elevation would be indicated to the sides of the peg to the satisfaction of the proponent. After cutting of benches and prior to commencement of earthworks or sub-grade works, Contractor shall take commencement cross-sections again and submit the copy of the same to proponent for agreement. These cross-sections shall then be used as basis of measurement for all subsequent layers, unless otherwise stated.

2.4.2.2. Clearance of the alignment and creation of diversions

This will involve clearance of the site on road reserve including removal of trees, hedges and other vegetation and any deleterious materials, grub up roots, backfilling and compaction to 100% MDD (AASHTOT99) with approved material. It would also involve removal of topsoil to a maximum depth of 200mm. When instructed by the Engineer, the Contractor shall demolish or remove structure and any other obstruction from the road reserve.

2.4.2.3. Earthworks

Earthworks will involve:

- Filling in soft material including benching of embankments and compaction to 95% MDD (AASHTO T99) in layers not exceeding 150mm.
- Filling in hard material (rock fill in selected sections).
- Cutting to spoil both hard and material.
- Landscaping and grassing.

Specifically, this stage would involve:

2.4.2.3.1. Preparation prior to forming embankment

Where benching is required for existing pavement to accommodate earthworks sub-grade or sub-base for widening the road, the rate for compaction of existing ground shall be deemed to cover this activity.

Excavation in the pavement of the existing road shall be kept dry. In the event of water penetrating the underlying layer, construction of the subsequent layers shall be postponed until the underlying layers are dry enough to accommodate the construction plant without deforming or otherwise showing distress.

Step construction shall be carried out per layer at the joint where excavating, both vertically and perpendicular to the direction of the travel. The step shall be 500mm perpendicular to the direction of the travel and 150mm vertical unless otherwise instructed by the Engineer.

2.4.2.3.2. Construction of embankments

Only material approved by the Engineer shall be used for fill in embankments.

Material with high swelling characteristics or high organic matter content and any other undesirable material shall not be used, unless specifically directed by the Engineer.

Unsuitable material shall include:

- All material containing more than 5% by weight of organic matter (such topsoil, material from swamps, mud, logs, stumps and other perishable material).
- All material with a swell of more than 3% (such as black cotton soil) All clay of plasticity index exceeding 50.
- All material having moisture content greater than 105% of optimum moisture content (Standard Compaction).

2.4.2.3.3. Embankment repair

Where directed by the Engineer, any localized filling in soft, hard or natural; selected material requirements shall be executed.

2.4.2.3.4. Compaction of earthworks

At pipe culverts, all fill above ground level around the culverts shall be compacted to density of 100% MDD (AASHTO T.99) up to the level of the top of the pipes or top of the surround(s), if any and for a width equal to the internal diameter of the pipe on either side of the pipe(s) or surround(s) as applicable.

At locations adjacent to structures, all fill above ground level up to the underside of the sub-grade shall be compacted to density of 105% MDD (AASHTO T.99). In case of fill around box culverts this should be carried out for the full width of the fill and for a length bounded by the vertical plane passing through the ends of the wing walls.

Compaction of sub-grade material (i.e. material immediately below formation) in cut areas shall not be carried out by the contractor in areas where the formation is formed in hard material, unless specific instructions to the contrary are issued by the Engineer.

Where improved sub-grade material shall be required, this shall be compacted and finished to the same standards and tolerances as those required for normal sub-grade and clauses in the specifications applying to normal sub-grade shall also apply.

2.4.2.3.5. Mass-haul diagram

The Contractor will prepare a mass haul diagram and will also be responsible for locating suitable materials for constructing earth-works along the alignment and elsewhere.

2.4.2.3.6. Borrow pits

Fill material which is required in addition to that provided by excavation shall be obtained from borrow pits to be located and provided by the Contractor but to the approval of the Resident Engineer.

2.4.2.3.7. Top soiling, grassing and tree Planting

Top soiling and Grassing will be done as per specifications for Roads and Bridges 1986 and as guided by road engineer. Cleared trees will be compensated by planting suitably adapted and native tree species at the project site or its environs.

2.4.2.3.8. Sub-grade

Sub-grade shall mean upper 300mm of earthworks either in-situ or in fill and sub-grade shall be provided, as part of earthwork operation and payment shall be made as 'fill'. The material for sub-grade shall have a CBR of not less than 15% measured after a 4-day soak on a laboratory mix compacted to a dry density of 100% MDD (AASHTO T99) and swell less than 1%.

2.4.2.4. Excavations and filling for structures

The major activities would be:

- Excavations and backfilling for gabions in soft material.
- Excavation in soft materials for culverts and foundations for piers and abutments.
- Placement for gabions and mattresses as directed by the engineer.
- Rock-filing gabions.
- Placement of 200mm thick pitching including grouting to aprons upstream/downstream of bridges, culverts and drains.

2.4.2.5. Culverts and drainage works

The construction of culverts and drains would involve the following activities:

- Excavations in both soft and hard material for pipe culverts, headwalls, wing walls aprons, toe walls and drop inlets.
- Placement of class 20(20) concrete to headwalls, wing walls, aprons, inlets and outlets to pipe culverts including formwork.
- Excavations for side drains, mitre, drains cut-off drains and outfall drains.

The Contractor shall excavate and remove all existing blocked or collapsed culvert pipes of 450mm, 600mm and 900mm diameter including concrete surround, bedding, and inlet and outlet structure. The void left after removal of culvert pipes shall be widened as necessary to accommodate new concrete bedding, pipe and hunching.

2.4.2.6. Storm water management plan

Storm water management plan will address storm water quantity and quality and how to protect ecological, social/cultural and economic values. The plan will be used to aid decision making to ensure that remedial measures (structural and non-structural) are undertaken in a cost-effective, integrated and coordinated manner and that the decisions made with regard to the project take into full account implications for storm water impacts.

2.4.2.7. Construction of deviations for traffic

The contractor would construct deviation roads, minimum width 6m thickness of gravel 150mm minimum CBR 20. The construction would also involve erection and maintenance of signage and barriers along the route.

2.4.2.8. Transportation and treatment of construction materials

Some of the major materials to be used in the construction of the road include:

- Natural gravel;
- Water;
- Ordinary Portland cement and lime;
- Bitumen;
- Kerosene;
- Wrought Shuttering Timber; and
- Mild Steel.

A materials data schedule will be maintained and updated as necessary highlighting source, quantities and date of receipt of materials and in the converse materials going out, where utilized and date utilized.

2.4.2.9. Concrete works

All concrete works would be done according to the specifications as provided in the engineering design.

2.4.2.9.1. Formwork for culvert walls and slabs

This work shall consist of all temporary moulds for forming the concrete for culvert walls and slabs together with all temporary construction for their support. Unless otherwise directed by the Engineer all formworks shall be removed as required on completion of the walls and slabs.

2.4.2.9.2. Materials

Forms shall be made of wood or metal and shall conform to the shape, lines and dimensions shown on the Drawings.

All timber shall be free from holes, loose material, knots, cracks, splits and warps or other defects affecting the strength or appearance of the finished structure.

Release Agents – Release agents shall be either neat oils containing a surface activating agent, cream emulsions, or chemical agents to be approved by the Engineer.

2.4.2.9.3. Construction method

A. Formworks

Formworks shall be designed to carry the maximum loads that may be imposed, and so be rigidly constructed as to prevent deformation due to load, drying and wetting, vibration and other causes. After forms have been set in correct location, they shall be inspected and approved by the Engineer before the concrete is placed.

If requested, the contractor shall submit to the Engineer working drawings of the forms and also, if requested, calculations to certify the rigidity of the forms.

Unless otherwise described in the Contract, all form joints for exposed surfaces of concrete shall form a regular pattern with horizontal and vertical lines continuous throughout each structure and all construction joints shall coincide with these horizontal and vertical lines. PVC pipes of 50mm diameter for weep holes shall be arranged as shown on the Drawings.

Unless otherwise specified, formwork shall be designed to form chamfers at all external corners whether or not such chamfers are shown on the Drawings to prevent cracks and other damage from arising.

The inside surface of forms shall be cleaned and coated with a releasing agent to prevent adhesion of the concrete. Release agents shall be applied strictly in accordance with the manufacturer's detailed instructions. The release agent shall be applied to the formwork prior to erection. Release agent must not come into contact with reinforcement. Immediately before concrete is placed, the forms shall be thoroughly cleaned and freed from sawdust, shavings, dust, mud or other debris by hosing with water. Temporary openings shall be provided in the forms to drain away the water and rubbish.

i) Scaffolding

All scaffolding required to support the forms shall be designed and constructed to provide necessary rigidity and support the loads without appreciable deflection or deformation.

Details, plans and structural and flexural calculations for scaffolding shall be submitted to the Engineer for approval, but in no case, shall the contractor be relieved of his responsibility for the results obtained by use of these plans, etc.

ii) Removal of formwork

The time at which the formwork is truck shall be the Contractor's responsibility and the forms shall not be removed until the concrete strength has reached 20 N/mm².

iii) Concrete works of culvert walls and slabs

This work shall consist of furnishing, mixing, delivering and placing of the concrete for the construction of culvert walls and slabs, in accordance with these Specifications and in conformity with the requirements shown on the Drawings.

iv) Concrete materials

a. Cement

Cement shall be of Ordinary Portland Cement type CEM 1, 42.5 and shall conform to the requirements of K.S. 02-21 or equivalent.

The contractor shall select only one type or brand of cement or others. Changing of type or brand of cement will not be permitted without a new mix design approved by the Engineer. All cement is subject to the Engineer's approval; however, approval of cement by the Engineer shall not relieve the Contractor of the responsibility to furnish concrete of the specified compressive strength.

Conveyance of cement by jute bags shall not be permitted. Storage in the Contractor's silo or storehouse shall not exceed more than two (2) months, and age of cement after manufacture at mill shall not exceed more than four (4) months. The Contractor shall submit to the Engineer for his approval the result of quality certificate done prepared by the manufacturer.

Whenever it is found out that cement have been stored too long, moist, or caked, the cement shall be rejected and removed from the project.

b. Aggregates

Fine and coarse aggregates must be clean, hard, strong and durable, and free from absorbed chemicals, clay coating, or materials in amounts that could affect hydration, bonding, strength and durability of concrete.

c. Water

All sources of water to be used with cement shall be approved by the Engineer. Water shall be free from injurious quantities of oil, alkali, vegetable matter and salt as determined by the Engineer.

d. Admixture

Only admixture, which have been tested and approved in the site laboratory through trial mixing for design proportion shall be used.

Before selection of admixture, the Contractor shall submit to the Engineer the specific information or guarantees prepared by the admixture supplier.

The contractor shall not exclude the admixture from concrete proportions.

e. Proportioning concrete

The Contractor shall consult with the Engineer as to mix proportions at least thirty (30) days prior to beginning the concrete work. The actual mix proportions of cement, aggregates, water and admixture shall be determined by the Contractor under supervision of the Engineer in the site laboratory.

The Contractor shall prepare the design proportions which has 120% of the strength requirement specified for the designated class of concrete.

No class of concrete shall be prepared or placed until its job-mix proportions have been approved by the Engineer.

B. Concrete work**i) Batching**

Batching shall be done by weight with accuracy of:

- 1) Cement: ½ percent
- 2) Aggregate: ½ percent
- 3) Water and Admixture: 1 percent.

Equipment should be capable of measuring quantities within these tolerances for the smartest batch regularly used, as well as for larger batches.

The accuracy of batching equipment should be checked every month in the presence of the Engineer and adjusted when necessary.

ii) Mixing and delivery

Slump of mixed concrete shall be checked and approved at an accuracy of +25mm against designated slump in these specifications.

iii) Concreting at night

No concrete shall be mixed, placed or finished when natural light is insufficient, unless an adequate approved artificial lighting system is operated, such night work is subject to approval by the engineer.

iv) Placing

In preparation of the placing of concrete, the interior space of forms shall be cleaned and approved by the engineer prior to placing concrete. All temporary members except tie bars to support forms shall be removed entirely from the forms and not buried in the concrete. The use of open and vertical chute shall not be permitted unless otherwise directed by the engineer. The contractor would provide a sufficient number of vibrators to properly compact each batch immediately after it is placed in the forms.

2.4.2.10. Road furniture

This would involve the erection of concrete posts and flex-beam guardrails complete with spacers at 3810mm intervals. The contractor will also be required to provide and erect permanent road signs where instructed by the resident engineer and in accordance to special specifications. They will include:

- Warning signs.
- Priority, prohibitory and mandatory signs.
- Standard informatory signs.
- Non-standard informatory signs.

Along with the physical signs the contractor would be required to provide and deliver air tight corrosion resistant 20 liters containers approved white paints and yellow (reflectorised) and mark the road as directed by the engineer. The works would also involve provisions of road studs both unidirectional and bidirectional of stimsonite nature or similar.

2.4.2.10.1. Edge marker posts

Edge marker posts shall be provided as directed by the Engineer and in compliance with standard Specification Clause 2003.

2.4.2.10.2. Permanent road signs

Permanent Road Signs shall be provided as directed by the Engineer and in compliance with the requirements of the "Manual for Traffic Signs in Kenya" Part II and Standard Specification clause 2004. Old signs to be reused should also be tested.

2.4.2.10.3. Existing road signs

Where directed by the Engineer, the Contractor shall take down road signs including all posts, nuts, bolts and fittings, and remove and dispose of the concrete foundation and backfill the post holes. The signs shall be stored at the Contractor's store and they shall become the property of the proponent who shall remove them prior to the expiry of the maintenance period. Measurement and payment for taking down road signs shall be made by the number of signs of any type and size taken down, cleaned and stored as directed.

Where a salvaged existing sign complies with the requirements of new road signs, the Engineer may instruct the Contractor to remove the sign for safe storage, and re-erect it.

Measurement and payment shall be made by the number of road signs re-erected as directed and the rate shall include for excavation, concrete foundations and backfilling around posts and removal of surplus material to spoil.

2.4.2.10.4. Road marking

Paint for road marking shall be internally reflectorised hot applied thermoplastic material (with Ballotini beads) in accordance with Clause 218 d (ii) of the Standard Specification. The Ministry of Public Works Materials Branch must approve this reflectorised paint inclusive of the Ballotini beads.

2.4.2.10.5. Guardrails

Guardrail posts shall be concrete 210mm x 210mm x 1710mm set vertically at least 1.2m into the shoulder as directed by the Engineer. Beams for guardrails shall be "Armco Flex beam" or similar obtained from a manufacturer approved by the Engineer and tested to ensure compliance with AASHTO M180.

2.4.2.10.6. Vertical joints

Vertical joints between adjacent Kerbs shall not be greater than 5 mm in width and shall be filled with a mortar consisting of 1:3cement: sand by volume.

2.4.2.10.7. Transition between flush and raised kerbs

The transition between flush and raised kerbs (e.g. at bus bays) shall be termed as ramped kerbs. The transition between flush and raised kerbs shall occur within a length of 2.0 m.

2.4.2.10.8. Kilometre marker posts

Kilometer marker posts shall be provided as directed by the Engineer and in compliance with Standard Specification clause 2008.

2.4.2.10.9. Rumble strips

Where directed by the Engineer, the Contractor shall provide, place, trim, shape and compact to line and level asphalt concrete rumble strips on the finished shoulders. This shall be done to the satisfaction of the Engineer

2.4.2.11. Construction plant.

The plant would have the following machinery for construction purposes.

- Cat D6 Bull Dozer or Equivalent with Dozer/Ripper attachment
- Cat 120H Motor Grader or Equivalent Complete with Scarifier

- Vibrating Roller (10 Tonnes)
- Hand Propelled Vibrating Roller 850 Kg
- Cat 950G Wheel Loader or Equivalent
- 10 Tonne Tipper Lorry
- 50 mm Delivery water pump and motor
- Concrete mixer 0.7m³/min.
- Concrete Vibrator (Poker Type)
- Tractor and Trailer

2.4.2.12. Quarries, borrow pits, stockpiles and spoil areas

2.4.2.12.1. a) Provision of land

The Contractor will make available any land for quarries, borrow pits, stockpiles and spoil areas, except for those areas in road reserves specifically approved by the resident engineer. The contractor will be entirely responsible for locating suitable sources of materials complying with the Standard and Special Specifications and for the procurement, mining, haulage to site of these materials and all costs involved therein. Similarly, the contractor will be responsible for the provision and costs involved in providing suitable areas for stockpiling materials and spoil dumps. Should there be suitable sites for spoil dumps or stockpiles within the road reserve forming the site of the works the Contractor may utilize these subject to the approval of the Engineer.

2.4.2.13. Safety and public health requirements

This is an integral part of the project especially during the construction phase. Warning and advisory notices, drugs and condoms would be provided for throughout the project duration. The contractor shall allow for qualified professionals to conduct lectures to the workers regarding the spread of HIV/Aids.

2.4.2.14. Summary project activities

The major Works to be executed under the Contract comprise mainly of but are not limited to the following: -

- Limited site clearance and top soil removal.
- Earthworks.
- Preparation of the sub-grade to receive the pavement layers as per the standard specifications.
- Provision of cement improved gravel for road sub-base of the specified thickness.
- Dense Bitumen Macadam (DBM) road base of the specified thickness.
- Provision of 50mm thick asphaltic concrete Type 1 binder course.
- Provision of a single surface dressing using 14/20 mm pre-coated class 4 chippings for the carriageway and using 6/10 mm pre-coated class 4 chippings for the shoulders. The shoulders shall be constructed with the same material and thickness as for sub-base, base and surfacing.
- Construction of culverts and other drainage works.
- Protection works using stone pitching and gabions as necessary.
- Relocation of services as necessary.
- Installation of kerb stones where instructed.
- Provision of road furniture, including road marking and traffic signs.
- Landscaping including top soiling and grassing.
- Maintenance of passage of traffic through and around the works.

- Any other activity not listed above in either category but deemed to be necessary by the Engineer, shall be subject to the Engineer's formal instructions and within the mode of payment stipulated either by day works or on a measured basis.

2.4.3. Operation phase activities

The Contractor will be required to remedy any defects during the Defects Liability Period. The major items of work during Defects Liability period included in the contract are as follows:

- Repair of any defects on the road and road furniture;
- Removal of construction camps, removal of un-used material stockpiled on the road, tidying and general cleanness of the road and construction sites.

2.4.4. Decommissioning phase

Decommissioning refers to the final disposal of the project and associated materials at the expiry of the project life span. In respect to the road, decommissioning is not anticipated. However, it will be sustained in accordance to transportation demands of the project area expected at the end of construction works.

Nevertheless, after the construction period, construction equipment and dismantled camp materials will be salvaged and removed from the site by the contractor. The following is a description of some of the decommissioning activities.

2.4.4.1. Demolition works

The proposed project will have a lifespan of several decades save for period maintenance. Upon decommissioning, the project components including the road, pavements, drainage systems, potential parking areas and perimeter fence will be demolished. This will produce a lot of solid waste, which will be reused for other construction works or if not reusable, disposed of appropriately by a licensed waste disposal company.

2.4.4.2. Dismantling of equipment and fixtures

All equipment including road surface, electrical installations, furniture partitions, pipe-work and sinks among others will be dismantled and removed from the site on decommissioning of the camp site, the road and other project components. Priority will be given to reuse of these equipment in other projects. This will be achieved through resale of the equipment to other contractors or donation of this equipment to schools, churches and charitable institutions, rehabilitation of feeder roads etc.

2.4.4.3. Site restoration

Once all the waste resulting from demolition and dismantling works is removed from the site, the site will be restored through replenishment of the topsoil and re-vegetation using indigenous plant species or developed according to the development trend of the time.

2.4.4.4. Construction materials and energy used

The main sources of energy that will be required for decommissioning of the project will include electricity and fossil fuels (especially diesel). Electricity will be used for welding, metal cutting/grinding and provision of light. Diesel will run material transport vehicles and construction equipment/machinery such as bulldozers and concrete mixers. The proponent should intend to promote efficient use of materials and energy through proper planning to reduce economic and environmental costs of excavating new materials.

2.4.4.5. Solid waste generated

Large amounts of solid waste will be generated during decommissioning of construction phase facilities. These will include metal cuttings, rejected materials, surplus materials, surplus spoil, excavated materials, paper bags, empty cartons, empty paint and solvent containers, broken glass among others. The contractor is advised to take steps to minimize the generation of such waste and to ensure proper disposal procedures or recycling/ generated wastes.

2.4.4.6. Liquid effluents generated by the project

During decommissioning disconnection of pipes and other activities like washing are likely to generate effluents.

2.4.5. Environmental protection

The Contractor is supposed to ensure so far as is reasonably practicable and to the satisfaction of the proponent; that the impact of the construction on the environment shall be kept to a minimum and that appropriate measures as brought out in the ESMP are taken to mitigate any adverse effects during the construction. These measures shall include:

- a) After extraction of construction materials, all quarries and borrow pits shall be back-filled and landscaped to their original state to the satisfaction of the Engineer. Those near the project road shall be back-filled in such a way that no water collects in them.
- b) Spilling of bitumen, fuels, oils, lubricants and other pollutants shall be avoided and if spilt, shall be collected and disposed off in such a way as not to adversely affect the environment.
- c) Long traffic diversion roads shall be avoided to minimize the effect of dust on the surrounding environment. In any case all diversions shall be kept damp and dust free.

Table 2:1 below shows the various type of products, by products and waste that will be generated during the project's cycle.

Table 2:11: The products, by products and waste generated during project cycle

Project activities	Material /equipment to be used	Waste/by products generated	Disposal method
1 Planning and Design Phase – No anticipated physical activities or processes			
2 Construction Phase			
Clearing the site	-Power Saws -Caterpillars	-Cut vegetation -Rock debris -Noise (by power saw)	-Soil to be used for backfilling -Wood would be used as fuel and in the construction of workers houses. -Good maintenance of machines being used.
Excavation/Earthworks including removal of topsoil	-Excavation equipment's including caterpillars, haulers etc.	- Soil -Roots -Noise	- Soil to be used for backfilling and landscaping
Transportation of materials & maintenance of equipment's	Trucks Fuel, spare parts and lubricants oil	-Fumes -Used oil, and other lubricants	-Used oil/grease to be reused for lubricating movable parts of equipment
Construction/Building Materials	-Machine cut stones -Steel -Cement - Soils -Paving slabs -Timber -Nails, galvanized iron sheets -Gravel, sand -Glass	-Stone /Rock Debris - Timber Splits -Broken Glass -Nails and Iron Sheets Cuts -Piping Remains -Plastic Waste -Oil and Greases Spills -Waste Water -Used Containers	-Soil and rock debris would be used for landscaping & back filling the reserves -Timber splits would be used for firewood and burning of tar etc. -Plastic waste should be resold to waste collectors or dumped in appropriate designated sites.

	<ul style="list-style-type: none"> -Bitumen -Oil -Water -Packaging Materials -Pipes and Pvc -Oil and Grease -Storage Containers E.g. Drums -Paints 		<ul style="list-style-type: none"> -Metallic containers can be reused in storage of other materials or be sold to dealers. -Metallic wastes can be recycled or be sold to dealers. -Waste water can be recycled by watering diversions to control dust. -Oils and grease should be reused, be sold to dealer or be disposed off in areas.
Human Consumables	<ul style="list-style-type: none"> -Stationeries -Computers -Photocopiers -Clothing Materials -Vehicles -Medicines -Reagents -Food and Water 	<ul style="list-style-type: none"> -Used paper -Obsolete/spoilt clothing, computers, photocopiers and vehicle parts -Human waste -Expired drugs and reagents 	<ul style="list-style-type: none"> -Sell waste paper to dealers. -All obsolete materials should be carefully sorted, stored and sold to dealers. -Septic tanks should be provided in all the workmen's camps and disposed of appropriately in designated sites.

Post construction and operations phase activities

Table 2:12: Post constructions and operations phase activities

Post constructions and operations phase			
Project activities	Material /equipment to be used	Waste/by products generated	Disposal method
Workmen's Camps	All Associated Building Materials	Unusable materials e.g. broken timber, glass	Should be removed and disposed in accordance to waste categories
Construction Machinery	All Machines		Should be sold to dealers or be used in other projects
Road repairs due to accidents, old age breakdowns etc.	Bitumen Oil and Greases Sand and Gravel	Removed materials or road cover including the base materials	Should be transported to designated municipal sites.
Vehicles involved in accidents		Vehicle wreckages	Should be towed away to garages or other regulatory recommended areas

2.5. Project cost

The construction of the proposed road project is estimated to cost **KES 12,940,049,793.81**. In addition, the implementation of the ESMP will cost approximately **KES 70,600,000**. A summary of the Bill of Quantities (BoQs) is provided in the table below.

Table 2:13: BoQ summary

Summary sheet		
Bill no	Description	Amount

1	Preliminary and general items	472,255,983.86
4	Site clearance	356,038,000.00
5	Earthworks	2,430,300,000.00
7	Excavation and filling for structures	150,462,495.09
8	Culverts and drainage works	263,338,497.79
9	Passage of traffic	160,535,000.00
10	Gravel wearing course	5,525,520.00
12	Natural base and subbase	592,983,677.93
14	Cement and lime treatment	966,559,066.72
15	Bituminous surface treatment and surface dressing	718,660,727.02
16	Bituminous mix bases, binder courses & wearing courses	2,224,143,455.63
17	Concrete works	691,672,761.75
20	Road furniture	226,794,241.88
21	Miscellaneous bridge works	15,751,821.26
22	Dayworks	56,027,000.00
25	HIV/AIDS awareness and education	20,700,000.00
26	Piling	142,052,040.00
Subtotal - (1)		9,493,800,288.93
Contingencies @10% of Subtotal (1) - 2		949,380,028.89
VOP @ 7.5% of Subtotal (1) - 3		712,035,021.67
Subtotal (4); (1+2+3)		11,155,215,339.49
Allow for 16% VAT of Subtotal (5)		1,784,834,454.32
Grand Total		12,940,049,793.81

3. Baseline information of the project area

3.1. Introduction

This chapter examines the baseline environmental, ecological, socio-economic and cultural characteristics of the route through which the proposed Isiolo-Kulamawe road will pass. The chapter provides information on the existing environmental conditions including sensitive areas that will be potentially impacted by the project. The objective is to document the status quo for establishing and assessing the impacts of the project in future. The proposed road project area traverses parts of Isiolo (14km) and Meru (53km) Counties. Settlements along the project area are occupied by Meru, Borana and isolated cases of Turkana who are predominantly pastoralists.

3.2. Project location

3.2.1. Project physical location

The project road starts from Isiolo town, at a T-junction with road A2 approximately 1Km from Isiolo town Central Business District (CBD) and traverses for approximately 3Km in easterly direction within Isiolo County. The alignment then exits Isiolo County into Meru County, curving into a north-easterly direction traversing approximately 63Km to Kachuru trading centre in Meru County, where it exits Meru County back to Isiolo to terminates at Kulamawe trading centre. The alignment follows the existing Isiolo – Manderu road, formerly classified as RD B9. Approximately 10km of the alignment lies within Isiolo County while the rest of the alignment lies within Meru County. The project road section is currently classified as RD A10 from Isiolo to Kachuru at the junction with the proposed Lamu Port South Sudan Ethiopia Transport (LAPSSET) corridor and as RD B84 beyond the Junction under the new road classification by Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD).



Figure 3:1: Location Map of the Project

3.2.1.1. Isiolo County

Isiolo County is one of the counties in the lower eastern region of Kenya. It borders Marsabit County to the North, Samburu and Laikipia Counties to the West, Garissa County to the South East, Wajir County to the North East, Tana River and Kitui Counties to the South and Meru and Tharaka Nithi Counties to the South West (Figure 3.2). The county covers an area of approximately 25,700 km²

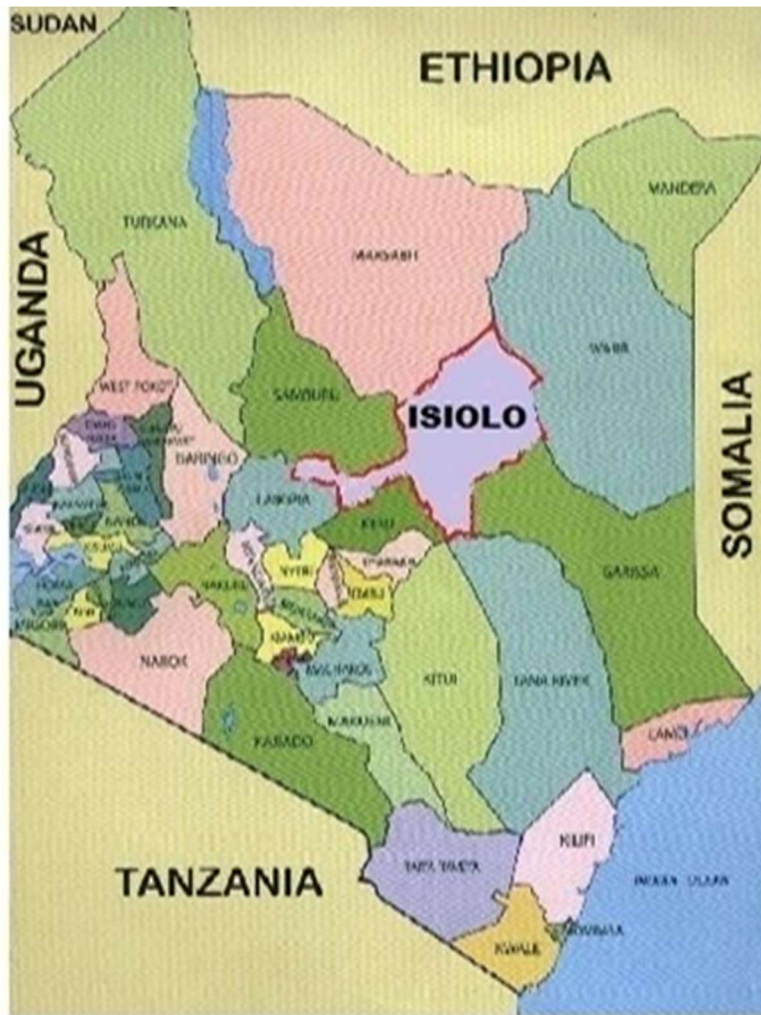


Figure 3:2: Map of Kenya indicating location of Isiolo County

Source: *Isiolo County Integrated Development Plan 2013-2017*

3.2.1.2. Meru County

The county lies to the East of Mt. Kenya whose peak cuts through the southern boundary of the county (Figure 3.3). It shares borders with Laikipia County to the West, Nyeri to the South West, Tharaka/Nithi to the East and Isiolo to the North. It straddles the equator lying within 00 6' North and about 00 1' South, and longitudes 370 West and 380 East. The county has a total area of 6,936.2 km² out of which 1,776.1 Km² is gazetted forest.



Figure 3:3: Location of Meru County in the map of Kenya

Source: *Meru County Integrated Development Plan 2013-2017*

3.3. Administration

3.3.1. Meru County

The County comprises of nine administrative sub-counties which are equivalent to the constituencies namely, Tigania East, Tigania West, Igembe North, Igembe South, North Imenti, South Imenti, Buuri, Igembe Central and Central Imenti. Formerly the administrative units that fall under the boundaries of Meru County are as shown in Table 3.1

Table 3:1: Area of the County by Former Districts and Divisions

District	Area (Km ²)	No. of Divisions	No. of Locations	No. of Sub-Locations
Tigania East	557.6	3	10	25
Tigania West	567.3	4	19	62
Igembe North	939.7	3	20	34
Igembe South	1,879.36		14	45
Imenti North	569.6	2	12	36
Buuri	971.1	2	9	26
Imenti South	661.4	3	24	58
Meru Central	790.2	5	25	65
Total	6,936.228		133	351

Source: Meru County Integrated Development Plan 2013-2017

3.3.2. Isiolo County

The County has three sub-counties, ten wards, 22 locations and 43 sub locations. Isiolo sub-county has the highest number of wards (five) while Garbatulla has the highest number of locations (ten) and sub-locations (19). Merti sub-county is the largest area of 12,612 Km² while Isiolo sub-county is the smallest with an area of 3,269 Km² (Table 3.2 & Figure 3.4).

Table 3:2: Isiolo County Administrative Units and Area

Sub-county	Area (Km ²)	Ward
Isiolo	3,269	Wabera
		Bulla Pesa
		Burat
		Ngaremara
		Oldonyiro
Merti	12, 612	Chari
		Cherab
Garbatulla	9,819	Kinna
		Garbatulla
		Sericho
Total 3	25,700	10

Source: Kenya National Bureau of Statistics, 2013

population is concentrated in the area around the Isiolo T-junction and the four market centres namely Gambella, Ndumuru, Kachuru and Kulamawe.

At the County level, the population for Meru and Isiolo Counties is as discussed below:

3.4.2.1. Meru County

According to Meru County Development Plan 2013-2017, projections from the Kenya 2009 Population and Housing census indicate that the County has a population growth rate of 2.1 per cent. The 2012 projected population of the county stood at 1,443,555, which consist of 713,801 males and 729,754 females as shown in Table 3.3 below. The county population is projected to be 1,536,422 in 2015 and 1,601,629 in 2017 (Table 3.4). The growth in population will strain the available resources such as land.

Table 3.4: Population projections by age cohort

Age Cohort	2009			2012			2015			2017		
	M	F	T	M	F	T	M	F	T	M	F	T
0-4	96,281	94,618	190,899	102,475	100,705	203,180	109,067	107,184	216,251	113,696	111,733	225,429
05-9	92,235	91,013	183,248	98,169	96,868	195,037	104,484	103,100	207,584	108,919	107,475	216,394
10-14	83,925	83,627	167,552	89,324	89,007	178,331	95,071	94,733	189,803	99,105	98,753	197,859
15-19	66,694	68,934	135,628	70,985	73,369	144,353	75,551	78,089	153,640	78,758	81,403	160,160
20-24	58,646	67,282	125,928	62,419	71,610	134,029	66,434	76,217	142,652	69,254	79,452	148,706
25-29	57,824	62,432	120,256	61,544	66,448	127,992	65,503	70,723	136,226	68,283	73,725	142,008
30-34	49,753	47,685	97,438	52,954	50,753	103,706	56,360	54,018	110,378	58,752	56,310	115,063
35-39	38,562	37,611	76,173	41,043	40,031	81,073	43,683	42,606	86,289	45,537	44,414	89,951
40-44	26,851	26,547	53,398	28,578	28,255	56,833	30,417	30,073	60,489	31,708	31,349	63,057
45-49	25,258	25,891	51,149	26,883	27,557	54,440	28,612	29,329	57,942	29,827	30,574	60,401
50-54	19,096	19,901	38,997	20,324	21,181	41,506	21,632	22,544	44,176	22,550	23,501	46,051
55-59	15,455	14,333	29,788	16,449	15,255	31,704	17,507	16,236	33,744	18,251	16,926	35,176
60-64	12,757	13,053	25,810	13,578	13,893	27,470	14,451	14,786	29,238	15,064	15,414	30,479
65-69	7,611	8,234	15,845	8,101	8,764	16,864	8,622	9,328	17,949	8,988	9,723	18,711
70-74	7,305	8,361	15,666	7,775	8,899	16,674	8,275	9,471	17,746	8,626	9,873	18,500
75-79	4,478	4,879	9,357	4,766	5,193	9,959	5,073	5,527	10,600	5,288	5,762	11,049
80+	7,379	10,848	18,227	7,854	11,546	19,400	8,359	12,289	20,648	8,714	12,810	21,524
Age NS	546	396	942	581	421	1,003	619	449	1,067	645	468	1,112
Total	670,656	685,645	1,356,301	713,801	729,754	1,443,555	759,721	776,701	1,536,422	791,965	809,665	1,601,629

Source: Meru County Integrated Development Plan 2013-2017

Table 3.4 provides information on selected age groups which include the population under the age of one, under the age of five years, primary school age, secondary school age, youthful population, reproductive age, labor force and the aged population in the county.

Table 3.5: Population projections for selected age groups

Age Group	2009			2012			2015			2017		
	M	F	T	M	F	T	M	F	T	M	F	T
Under 1	19,502	19,282	38,784	20,757	20,522	41,279	22,092	21,843	43,935	23,030	22,770	45,800
Under 5	90,876	89,267	180,143	96,722	95,010	191,732	102,945	101,122	204,067	107,314	105,414	212,727
Pri. Sch. (6-13)	140,238	139,773	280,011	149,260	148,765	298,025	158,862	158,335	317,197	165,604	165,055	330,659
Sec. Sch. (14-17)	56,602	58,290	114,892	60,243	62,040	122,283	64,119	66,031	130,150	66,840	68,834	135,674
Youth Pop (15-29)	183,164	198,646	381,810	194,947	211,425	406,373	207,489	225,027	432,516	216,295	234,577	450,872
Repr.age – female- (15-49)		336,480	336,480	-	358,127	358,127	-	381,166	381,166	-	397,343	397,343
Labor force (15-64)	375,210	383,767	758,977	399,348	408,456	807,804	425,039	434,732	859,771	443,078	453,183	896,261

Aged Pop (65+)	26,538	32,718	59,256	28,245	34,823	63,068	30,062	37,063	67,125	31,338	38,636	69,974
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Source: Meru County Integrated Development Plan 2013-2017

3.4.2.2. Isiolo County

According to the Isiolo County Integrated Development Plan 2013-2017, the County's population stood at 143,294 as per the 2009 Population Census comprising of 73,694 males and 69,600 females (Table 3.6). The population was projected to rise to 159,797 by the end of 2012 and 191,627 by 2017. The population consists largely of Cushites communities (Oromo- speaking Boran and Sakuye) and Turkana, Samburu, Meru, Somali and other immigrant communities from other parts of the country. The planned massive capital investments under development of the LAPSET Corridor including International Airport, Resort City, and oil storage facilities are expected to boost rapid population growth in the county.

Table 3.6: Population by Gender and Age Cohort

Age Cohort	2009(Census)			2012(Projections)			2015(Projections)			2017(Projections)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0 – 4	12,075	11,228	23,303	13,466	12,521	25,987	15,016	13,963	28,979	16,148	15,015	31,163
5 – 9	10,816	10,345	21,161	12,062	11,536	23,598	13,451	12,865	26,316	14,464	13,834	28,298
10 – 14	9,852	9,242	19,094	10,987	10,306	21,293	12,252	11,493	23,745	13,175	12,359	25,534
15 – 19	8,057	7,711	15,768	8,985	8,599	17,584	10,019	9,589	19,609	10,775	10,312	21,087
20 – 24	6,824	7,002	13,826	7,610	7,808	15,418	8,486	8,708	17,194	9,126	9,364	18,490
25 – 29	5,645	5,607	11,252	6,295	6,253	12,548	7,020	6,973	13,993	7,549	7,498	15,047
30 – 34	4,286	3,931	8,217	4,780	4,384	9,163	5,330	4,888	10,218	5,732	5,257	10,989
35 – 39	3,380	3,188	6,568	3,769	3,555	7,324	4,203	3,965	8,168	4,520	4,263	8,783
40 – 44	2,802	2,545	5,347	3,125	2,838	5,963	3,485	3,165	6,649	3,747	3,403	7,151
45 – 49	2,465	2,157	4,622	2,749	2,405	5,154	3,065	2,682	5,748	3,296	2,885	6,181
50 – 54	2,231	1,833	4,064	2,488	2,044	4,532	2,774	2,279	5,054	2,984	2,451	5,435
55 – 59	1,371	1,033	2,404	1,529	1,152	2,681	1,705	1,285	2,990	1,833	1,381	3,215
60 – 64	1,228	1,130	2,358	1,369	1,260	2,630	1,527	1,405	2,932	1,642	1,511	3,153
65 -69	717	573	1,290	800	639	1,439	892	713	1,604	959	766	1,725
70-74	775	786	1,561	864	877	1,741	964	977	1,941	1,036	1,051	2,088
75-79	414	348	762	462	388	850	515	433	948	554	465	1,019
80+	700	914	1,614	781	1,019	1,800	871	1,137	2,007	936	1,222	2,158
Age NS	56	27	83	62	30	92	70	34	104	75	36	111
Total	73,694	69,600	143,294	82,183	77,614	159,797	91,645	86,554	178,199	98,551	93,073	191,627

Source: Isiolo County Integrated Development Plan 2013-2017

Tables 3.6 and 3.7 shows the population projection by age cohort. The projections indicate that the young population (0-14) account for 44.4 percent of the population in 2012 while the aged 65 and above account for 3.6 percent. Both groups add up 48 percent of the population giving a dependency ratio of 100:187. The large numbers of dependants to the working age population leads to low savings and places a strain on the existing health and education facilities.

Table 3:7: Population projections for selected age groups

Age group	2009 (Census)			2012(projections)			2015(projections)			2017(projections)		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
Under 1	2328	2211	4539	2596	2466	5062	2895	2750	5645	3113	2957	6070
Under 5	12075	11228	23303	13466	12521	25987	15016	13963	28979	16148	15015	31163
6-13 (primary)	16498	16197	32695	18398	18062	36460	20517	20142	40659	22063	21660	43723
14-17 (secondary)	6757	6388	13145	7535	7124	14659	8403	7944	16347	9036	8543	17579
15-29 (youth)	20526	20320	40846	22890	22660	45550	25526	25269	50795	27449	27174	54624
15-49 (female reproductive)		32141			35842			39970			42982	
15-64 (labor force)	38288	36137	74425	42697	40298	82996	47614	44939	92553	51203	48326	99529
Above 65 years	2607	2621	5228	2907	2923	5830	3242	3259	6501	3486	3505	6991

Source: Isiolo County Integrated Development Plan 2013-2017

3.4.3. Human settlements and urban centres

The proposed Isiolo-Kulamawe road alignment will traverse the T-Junction approximately 1km from Isiolo town and four market centres. The T-Junction, which is the project starting point and lies at 0.366503N 37.587902E has a high number of human settlements due to its vicinity to Isiolo town. The four market centres namely Gambella (located at 0.399206N 37.683230E), Ndumuru (0.461698N 7.841246E), Kachuru (0.559207N 38.037834E) and Kulamawe (0.574647 N 38.149048 S) have varying number of human settlements with Kulamawe having the highest (approximately 300 households). Apart from the four market centres, isolated temporary structures and several police camps along the proposed road corridor form additional human settlements. Generally, the larger part of the road alignment passes through unsettled area characterized by nomadic pastoralism.

The human settlements along the project area are largely dictated by availability of water sources. For instance, all the four market centres lie adjacent seasonal rivers/streams and other water points such as boreholes. The entire road corridor is extremely dry and water availability is key for a settled lifestyle. Kachuru market is sandwiched by two streams while Ndumuru market lies adjacent Ndumuru/Ngathu River (Plate 3.1) located at 0.459119N 37.837059E. A borehole that was drilled in 1989 supplies water to inhabitants of Ndumuru market and its environs. County Governments of Meru and Isiolo have also put more efforts to provide water to the market centres by sinking more boreholes, construction of earth pans and earth dams including providing water by water trucks. It is expected that the proposed project activities may create more water points especially where the proponent will drill boreholes and borrow pits that may later act as water collection points. Residents of the market centres noted that the proponent should concentrate new water points within the vicinity of the existing markets to increase water availability.



Plate 3:1 Sections of Ndumuru/Ngathu river adjacent Ndumuru market centre

In the four market centres, only temporary structures will be affected by the road construction works. For instance, in Kachuru market centre, temporary shanties (Plate 3.2) were evident along the road reserve. It is, however, important to note that the owners of the building structures are aware that they are on road reserve and as such are willing to vacate to pave way for the road construction.



Plate 3:2: Temporary structures along the road at Kachuru area

Most of the temporary structures serve as hotels and groceries for residents. The owners of such structures are willing to voluntarily relocate them once the project starts. The cost of demolition of the temporary structures will be minimal. However, the owners will need to buy land within the market centres to put up new structures. This will result to substantial cost implications since land in the four markets is privately owned. A stand-alone Resettlement Action Plan (RAP) for the project has been prepared, and the owners of the structures are expected to be compensated. As such, the expected impact will be minimal.

3.4.4. Infrastructure and access

The proposed project area and its environs lack critical infrastructure such as all-weather roads. It takes up to 5-6 hours to travel from Isiolo to Kulamawe by lorry which is the most common mode of transport. Other modes of transport used along the road are: motorbikes, land-cruisers, buses and animals (camels). The poor road infrastructure has not only retarded development in the area but also made some areas land locked. On monthly basis the locals averagely use the road three times (Howard Humphreys (2017b) Social Impact Assessment Study Report). Some of the road sections (Plate 3.3) are rendered impassable during rainy sections. Most of the water that floods the road originates from the neighbouring Nyambene ranges.



Plate 3:3: A flooded section of Isiolo-Kulamawe road

Table below presents average fares paid between Isiolo and Kulamawe using different modes of transport.

Table 3:8: Common means of transport along the project area and fares paid

Market / settlement	Kilometers	Type of transport			
		Bus	Lorry	Land cruiser	Motorbike
Isiolo – Gambella	8	500	400	700	2,500
Isiolo- Ndumuru	34	300	200	450	1,300
Isiolo- Buulo	44	300	300	450	1,500
Isiolo- Kachuru	60	400	350	500	1,800
Isiolo – YakBarsadi	67	400	350	500	2,000
Isiolo – Kulamawe	78	450	400	600	2,200

Source: Socio-economic survey

The socio-economic survey conducted showed that the fares are relatively highest for Gambella which is the closest to Isiolo town. These was attributed to the fact that transporters do not generally stop to pick or drop passengers at Gambella since most of residents prefer to walk to Isiolo town. Motorbike is the fastest but most expensive however the fares are said to double if the cargo includes camel or goat milk to Isiolo.

3.4.4.1. Roads

Meru County is well served with road network with majority of areas being accessible during the dry season. The county has 1,259.9 km of road network of which 225.7km is bitumen, 266.7 km gravel and 767.5 km of earth surface (Meru County Integrated Development Plan 2013-2017). However, during the rainy seasons, some sections of gravel and earth surface roads are impassable (Plate 3.3). The major tarmac roads in the county includes: Embu-Meru-Maua; Meru – Nanyuki; Meru-Mikinduri; Meru-Githongo; and Meru-Ruiru-Isiolo roads. The sections of the road (Plate 3.3) to be covered by the proposed road upgrading measures approximately 44km in Meru County. Isiolo County has a road network of 975.5 km, out of which only 34 km are bituminised. Gravel and earth surfaced roads account for 22 percent and 75 percent of the total road surface respectively. All the earth surface roads are impassable during the wet season and there is an urgent need for continuous upgrading of these roads to all weather roads standards (Isiolo County Integrated Development plan, 2013-2017). The proposed road upgrading will cover approximately 14km in Isiolo County.

Animals are widely used in the area for transport purposes. Donkeys and camels (Plate 3.4), are used to transport light goods to and from the market centres and for fetching water and firewood. In addition, when shifting to new grazing areas, the donkeys and camels are used to carry luggage over long distances.



Plate 3:4: A donkey carrying supplies for camel herders on transit at Gambella market

3.4.4.2. Postal and telephone services

The nearest postal services at the proposed project area are in Isiolo and Laare towns. Most of the project area has weak or no network at all. The telephone coverage for Isiolo county is 8% (GoK, 2013 a). In Meru County the coverage is 95% but the Meru section covering Isiolo County has no telephone network (GoK, 2013 b). Generally, postal and telecommunication services for Meru and Isiolo Counties are discussed below.

According to Meru Integrated Development Plan 2013-2017, there are six post offices and four sub-post offices with numerous registered stamp vendors in the county. The six post offices are in Meru, Maua, Nkubu, Timau, Muthara and Laare towns which offer mail services and parcel delivery among other services. Most private and public organisations have embraced ICT in the day to day operations. Private entrepreneurs have continued to set up cyber cafes in major towns and trading centres due to high demand for internet services among others. Most of the areas in the county are covered by mobile phone network with the coverage being 95 per cent. Areas without mobile network coverage are mainly sections of Tigania bordering Isiolo. Most of the community members rely on radio, Television and Newspapers as the major sources of information. In Isiolo County, the only post office is situated in Isiolo town and a sub-post office in Garbatulla urban centre. There are about 164 telephone connections (landlines) in the County. Around eight percent (2,090 km²) of the county have mobile network coverage leaving about 92 percent of the County without mobile phone network coverage.

3.4.4.3. Ownership of bank account

According to the socio-economic survey, most household heads 87.3% do not have bank accounts while 12.7% had bank accounts. The poor road network was the main reason for people not having bank account. The nearest bank to most respondents is 30Km away at Mutuati town or Isiolo which is 77Km from Kulamawe (GoK, 2013a). The high road transport costs also deter many people from accessing banks. The Tigania section of Meru facing Isiolo County has no financial institutions (GoK, 2013b).

3.4.4.4. Electricity supply

The proposed Isiolo-Kulamawe road alignment has limited electricity supply from the national grid. Electricity connectivity is only limited to the project starting point at the T-Junction and its environs (Plate 3.5). All the four market centres along the road alignment lack electricity and as such there is heavy reliance on kerosene for lighting among other light duties.



Plate 3:5: Electricity power lines at the T-Junction along the Isiolo-Kulamawe road

Wood fuel is mainly used in form of charcoal and firewood obtained from the expansive savannah woodland vegetation that characterize the road alignment. In Isiolo county, wood fuel is used in more than 90% (GoK, 2013 a) households whereas in Meru county, wood fuel accounts for 86.1% of the cooking energy (GoK, 2013 a). Along the project area, solar energy is used to supply electricity in isolated cases. Solar energy is used to pump water from boreholes in Kulamawe and Gambella markets. For instance, at Gambella market, two solar power points exist (Plate 3.6). One of the solar power systems, located at 0.399206N 37.683230E, is used to pump water in a community borehole while the second solar power system, located at 0353337, 0044050 and 1050m a.s.l, is privately owned and is mainly used to meet several electricity needs.



Plate 3:6: Two solar power points at Gambella market along the project area

As indicated above the section traversed by the proposed alignment in Meru County completely lack electricity and mainly depend on other sources of energy such as fuelwood with isolated investments in solar energy as indicated in Plate 3.6 above in Gambella market, Meru County. Generally, as contained in the Meru County Integrated Development Plan 2013-2017, the main source of energy for cooking by household is wood fuel and charcoal which accounts for 86.1 per cent and 6.6 per cent respectively. The number of households connected to electricity is 13.6 per cent; those using paraffin are 4.5 per cent, gas 2.4 per cent, biogas 0.1 per cent and solar 6.6 per cent. Major public and private institutions are connected to the national grid however; a challenge exists on how to connect the over 85 per cent sparsely located households with electricity.

At Isiolo County, the stretch from the junction all through to Isiolo military base and its environs is well supplied with electricity from the national grid. Generally, the County's main source of energy is wood fuel. Over 70 percent of the households rely on fire-wood as their main source of power. This has led to over-harvesting of trees primarily for charcoal causing extensive land degradation in the county. Of the 31,326 households in the county, only 2,500 have access to electricity. 85 percent of the trading centres, most schools and health facilities are not connected with electricity. Provision of clean sources of alternative energy will be critical in slowing down the cutting of trees. It will further save the time spent especially by women and girls in fetching wood fuel for domestic purposes.

3.4.5. Vulnerable groups

3.4.5.1. Persons with disability

According to the socio-economic survey only 6.2% of the households had a family member with a disability. The types of disabilities reported were: physical 44.4%, psychological 27.89% and visual 27.8%. Only 5.6% of those with disability were registered with the Ministry of Gender and Social Services. Most of the PWDs were in Gambella 26.9%, Kulamawe 19.2%, Ndumuru 15.4%, Isiolo Junction 15.4%, Kachulu 11.5%, and Attir 11.5%.

76.9% of the PWD were registered with MPESA mobile money service. In addition, 50% of the PWDs were married, separated 15.4%, widowed 15.4%, and divorced 3.8% and single 15.4%. In terms of ethnic group, most PWDs were Borana 57.7%, Meru 19.2%, Somali 11.5% and Turkana 11.5%. PWDs derive a livelihood using a variety of ways: begging 42.9%, business 42.9%, farming / livestock keeping 7.1% and remittances 7.1%. Most of them 88.5% live with other family members mainly relatives 42.3%, his /her children 34.6%, spouse 15.4% and grandchildren 7.7%. Only 10.65% of the PWDs are registered with the Ministry of Gender and Social Development and again, 6.1% receive cash transfer from the government. In Igembe North district of Meru County 112 PWDs receive cash transfer (GoK, 2013 b). In Isiolo County 600 PWDs receive cash transfer but the preference was to the severe cases only (Communication with the County Social Development Officer, Isiolo, and November 2017). A total of 78% PWDs regularly use the Isiolo – Kulamawe road. PWD indicated they do not like the road due to: bandit attacks 19.2%, dust 30.8%, high fare 3.8% operators decline to carry them 3.8%, potholes 34.6% and unreliable transport 7.7%. The main challenge to increased registration of PWDs was the poor road network in the project areas.

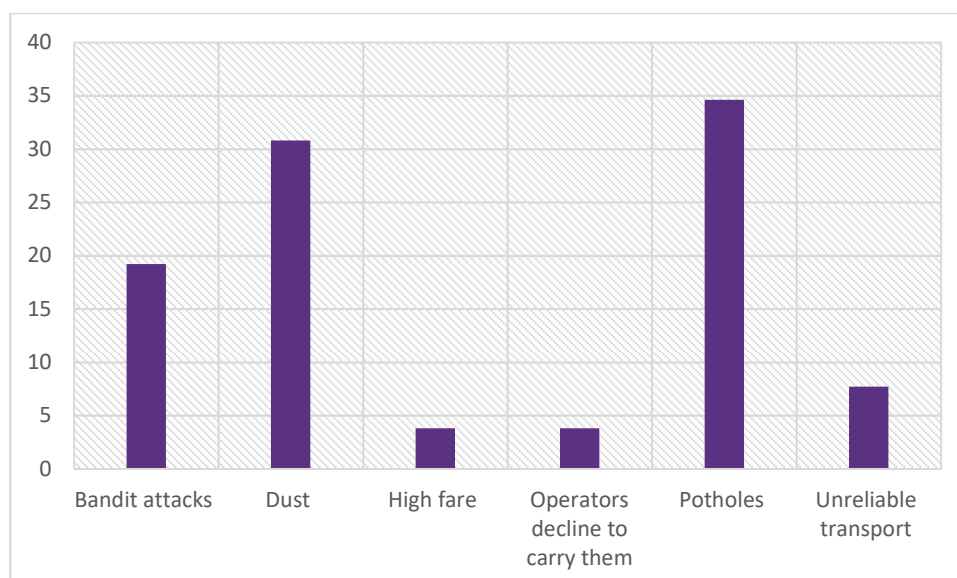


Figure 3:5 Road challenges experienced by PWDs

Whenever PWDs travel, they often use a variety of transport means: public service 26.9%, motorcycle (boda boda) 42.3%, lorry 26.9% and bicycle 3.8%. For PWDs the likely positive impacts of the improved road are: more comfortable movement 56.0%, ease of access to services 10.0% and less time spent on the road 34.0%.

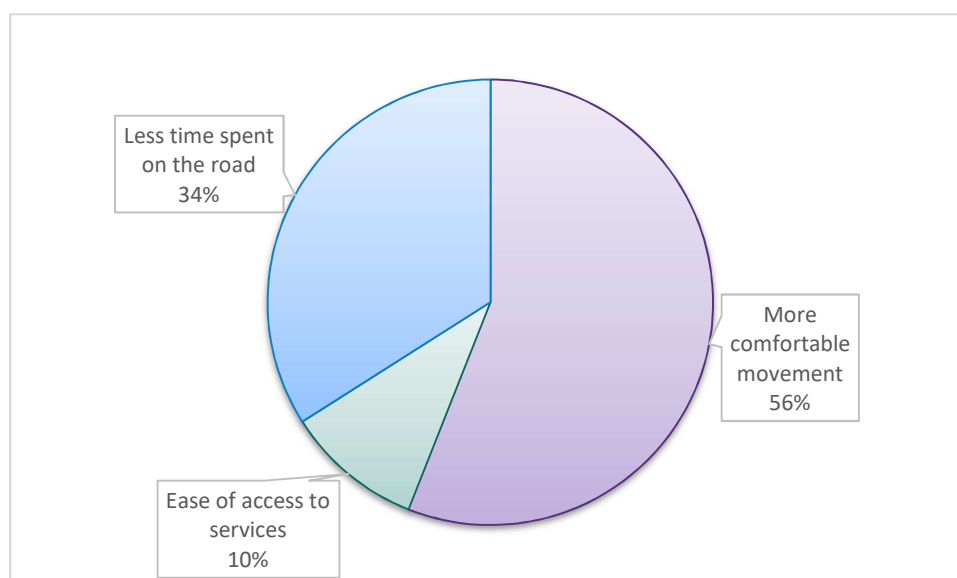


Figure 3:6 Benefits of Improved road for PWD

However, the following concerns were raised by PWDs about the improved road. These were: difficulty in crossing the road 11.5%, increased susceptibility to accidents 26.9%, speeding vehicles 38.5% and loss of buildings 23.1%. PWDs emphasized their readiness and ability to provide labour during road construction. They indicated willingness to perform the following tasks: clerical 37.0%, sensitization of the community 16.0%, cook, and sale of food 47.0%. However, PWDs expressed fears in discrimination, lack of respect and low pay

3.4.5.2. The older persons (70 years and above)

A total of 26 elderly persons were interviewed. They were 42.3% female and 57.7% male. By county level, 61.5% were in Isiolo and 38.5% Meru. They were found in all the eight settlements. Most of them 57.7% were married and 42.3% widowed. They derived a livelihood through a variety of ways: begging 28.0%, business 36.0%, charcoal burning 4.0%, farming 14.0%, herding 14.0% and remittances 4.0%.

By ethnic group majority of the elderly were Borana 46.2%, Meru 30.8%, Somali 7.7% and Turkana 15.4%. At family level, most live with other family members 79.3% particularly: spouse 7.9%, children 31.7%, grandchildren 28.6%, and relatives 31.7%. Farther 15.6% of the elderly also had a disability. Only 18.2% were registered with the Ministry of Gender and Social Services but 22.7% receive regular cash transfer from the government. Records available at the Social development office of Igembe North District show that 719 older persons receive cash transfer. In Isiolo North sub county 1700 older persons receives cash transfer. The problem of poor road network was the main reason for low registration.

Older persons indicated the following problems when using the Isiolo – Kulamawe road. Dust, potholes, insecurity, high fare, long hours, discomfort, and unreliable transport. They however showed the following positive attributes once the road is improved. They include: less hours of travel, easier travel, travel in comfort, reduced fare, ease of access to towns, diversified means of transport and improved security.

3.4.5.3. Pregnant women

A total of 27 pregnant women were interviewed. They were in the following age-brackets: 18-27 years 40.7%, 28-37 years 44.4% and 38 – 47 years 14.8%. Their marital status was 83.9% married and 16.1% divorced. Some showed that they attend health clinics in health facilities which according to 44.4% of them were between 0-2Km but for most 55.6% the facility was more than 2Km away.

In Isiolo county the average distance to health facility is 25 KM, only 5% of the county population access a health facility within 1 KM (GoK, 2013 a). A total of 33.3% were not attending clinic due to long distances. In their last delivery, 44.4% did it in a health facility while 56.6% delivered at home. The nearest health facilities mentioned were: Isiolo Level 4 General Hospital, Kachuru Dispensary, Kulamawe Dispensary and Laare Health Center. This shows that most of the area traversed by the road does not have health facilities.

Challenges faced by pregnant women while traveling to attend clinic include: dusty roads 18.5%, high fare 14.8%, irregular means of transport, 18.5%, lack of vehicles 14.8% and rough roads 33.3%. Pregnant women identified the positive benefits of the improved road in terms of increased comfort, less dust, reduced fares and less time on the road. They indicated the negative effects of the improved road in terms of speeding vehicles 44.4%, increased road accidents 37.0% and ease in procurement of abortion 18.5%.

3.4.5.4. Children

A total of 22 children were interviewed in two FGDs. All children frequently use the road to and from school. The main problem with the current road was dust and mud. Children were eager to see the current road improved to tarmac. The benefits of the tarmac road were: they would get to school clean, they will polish their shoes, no dust or mud. However, children were afraid that the improved road would lead to accidents, speeding of vehicles and that livestock were likely to be hit by speeding vehicles. They proposed that speed bumps be erected near the school, zebra crossings be marked at the school, and road signs be erected and that they be given lessons in schools on use of the new road.

3.4.6. Education

According to socio-economic survey, approximately 48.8% of the household heads have not attended school, primary 27.8%, secondary 19.4% and 4% have attained University education. Further, in the households it was established that a total of 61 (boys 46 and girls 15) under 18 years were not in school. The main reasons for not being in school are presented in Table below.

Table 3:9 Reasons for not being in school

Reason	Percent (%)
Caring for household	3.5
Herding	33.3
Illness / sickness	5.3
Business / charcoal burning etc	12.3
Lack of school fees	7.0
No school in the neighborhood	12.3
Pregnancy	26.3

The road traverses a territory occupied by Borana, Somali, Turkana pastoralists and Meru sections that keep livestock. This explains why herding is a key factor for dropping out of school especially for boys. Herding was more attractive and rewarding compared to school attendance. In the context of early pregnancy being high the main factor is Female Genital Mutilation (FGM). All the communities Borana, Meru and Somali practice it and girls are liable to have sexual intercourse as soon as they get circumcised around 1-15 years.

Although the Turkana do not practice FGM, the allure of early bride wealth is too overwhelming for parents to marry off young girls. The apparent lack of effective government services is a contributory factor. During data collection, it was found that the government administrators were often too weak to enforce the law hence FGM and early pregnancy occur undeterred. Where primary schools were available most of them 77.2% were public, 19.1% private and 3.7 missionary. Apart from Isiolo Junction and Kulamawe all other market centres have no Secondary schools which can be highlighted as a contributor to the low education attainment in the project area.

Table 3:10 Distance to school

Average distance in KMs	Social assessment %
0-2Km	49.8
2-4Km	33.6
4-6Km	6.4
Over 6Km	10.2

In Isiolo County the literacy rate is 44.8% (GoK, 2013 a) while in Meru county it is 53.0 % (GoK, 2013 b). Along the project area, there exist very few educational institutions only restricted at the market centres of Gambella, Ndumuru and Kachulu in Meru County. The education institutions in these centres are mainly privately owned Early Childhood Development Centres (ECD) and primary schools. There is a general lack of secondary schools at the project area.

However, according to the Meru County Integrated Development Plan 2013-2017, the County has 792 Early Childhood Development Centres (ECD), 647 primary schools and 192 secondary schools. The county has 15 education divisions and zones. The introduction of Constituency Development Fund has enabled the construction of various mixed day secondary schools. The fully-fledged universities in the County are: Meru University of Science and Technology (MUST) and Kenya Methodist University (KEMU). Other universities with campuses in the County are: University of Nairobi (UoN), Co-operative University of Kenya, Africa Nazarene University (ANU), Jomo Kenyatta University of Agriculture and Technology (JKUAT) and Mount Kenya University (MKU). In addition, there are two teacher training colleges, namely, Meru and Igoji Teachers Training Colleges. There are five technical institutes and various private colleges most of them offering training in ICT.

Along the project area, education institutions in sections traversed by the project area in Isiolo County are restricted around the T-Junction and its environs as well as Kulamawe market centre. Specifically, apart from Isiolo T-Junction and Kulamawe all other market centres have no secondary schools. This probably contributes to the low education attainment in the project area. In Isiolo County, the average distance to school is 5km (GoK, 2013 a) but in Meru County the average distance is 1km (GoK, 2013 b). Broadly, Isiolo County has 142 public ECD centres and 29 private ones; 115 primary schools of which 93 are public while 22 are private; and 13 public and 2 private secondary schools (Isiolo County Integrated Development Plan, 2013-2017). There are no established colleges or universities in the County but only satellite learning classes for University of Nairobi and Mt Kenya University offering a few courses. In view of the projected increase in the young population, there is need to establish more primary and secondary schools, modern polytechnics and a university campus to meet the county's requirements for educated and technical manpower.

3.4.7. Health and sanitation

The health sector in the project area alignment is poorly developed and characterized by absence of health facilities such as dispensaries including chemists at the key market centres. There is a general lack of public and private investment in the health sector at the project area. Residents are forced to travel long distances to seek medical services. For instance, the inhabitants of Gambella market centre seek medical services from Isiolo town while those from Ndumuru and Kachuru markets must travel to

Maua or Laare towns to get medical services. At the market centres, where most of the human settlements are concentrated, there is extensive use of pit latrines for human waste disposal. Minimal solid and liquid wastes are generated at the human settlements in the market centres. Generally, Meru County has 80 public health facilities, 27 private facilities and 2 facilities run by NGO/missions. The County has 10 level IV hospitals, 26 level III health centers, 46 level II health centers, 46 dispensaries and 24 clinics. According to the 2005/2006 KIHBS, 95.9 per cent of the population must cover more than 5 Km to access a health facility and only 4.1 per cent access a health facility within less than 1Km. The HIV prevalence rate is 0.9 per cent which is lower than the national one at 6.7 per cent. In Isiolo County the HIV prevalence is 4.9 % (GoK, 2013 a). According to the socio-economic survey, 43.4% of the respondents have undertaken a HIV/AIDs test. Further 89.8% were aware of the existence of Sexually Transmitted Infections (STIS). On protection methods, the respondents indicated: use of condom 13.1%, abstinence 30.6% and stick to one partner 56.3%.

Isiolo County is served by 5 doctors, 175 nurses and 625 community health workers. The doctor patient ratio is 1; 132,000 compared to internationally recommended standards of 1: 5,000. The nurse to patient ratio is 1:4,163. The bed capacity is 358. Only 1.2 per cent of garbage generated is collected by the local authority while 0.6 per cent is disposed in a garbage pit, 8.3 per cent in public garbage heap and 89.9 per cent is burned. At least 13.6 per cent of the households have no place for human waste disposal with latrines accounting for 46%.

At the T-junction, which is the starting point of the project area, there is adequate access to health services due to its vicinity to Isiolo town. As such, residents can access both public and private health facilities within Isiolo town. At the extreme end of Kulamawe, which is the terminating point of the project area, access to medical facilities is a challenge. Residents of Kulamawe market and its environs can only get health services either from Garbatulla or Laare towns. Broadly at the County level and as per the Isiolo County Integrated Development Plan 2013-2017, over 70 percent of the county's inhabitants live in the rural areas where health facilities are inadequate, inaccessible, and unaffordable. The county has two level four health facilities (Isiolo and Garbatulla level four hospitals), five level two health facilities and 34 level one health facilities. Most county's public health facilities lack adequate personnel. For example, Garbatulla level two health facility has only one doctor. The doctor: population ratio for the county is 1:20,000.

The five most prevalent diseases in Isiolo County are: malaria, diarrhoea, stomach ache, respiratory diseases and flu respectively. Majority of the cases of diarrhoea and stomach ache are associated with the use of contaminated water especially during the wet seasons.

3.4.8. Ownership of a toilet facility

There is low toilet ownership in the project area. Only 28.3% households had a toilet facility. The types of toilet facilities were as shown below. Compositing toilet 4.7%, flush to pit latrine 12.8%, flush to septic tank 4.3%, pit latrine with slab 77.5% and VIP 0.7%.

In addition, only 23.8% of the households have a rubbish pit or disposal unit for waste. Only 7.4% of the households have a dish rack. Disposal of waste that cannot be recycled or re-used is done in various ways with burning or burying taking precedent at 34.5%, 10.3% dispose in the compound, 12.6% dispose by the roadside, whereas 27.6% composite.

3.4.9. Sources of livelihood

According to the socio-economic survey, the main source of livelihood for household heads along the project route is presented in Table below.

Table 3:11 Main source of livelihood for household head

Main source of livelihood	%
Agriculture / farming livestock keeping	41.1
Formal employment in public sector	6.0
Formal employment in private sector	7.1
Self-employed /business	42.8
Charcoal burning	3.0
Total	100

Table 3:12 Average monthly income

Source of income	Monthly average in Kshs
Crop farming	3,628
Livestock / pastoralism / milk sales	21,578
Business	10,015
Salary	18,561
Wage (casual labour)	5,136
Charcoal / firewood sales	3,466
Selling honey	1,200
Poultry /poultry products	800

Therefore, livestock keeping / pastoralism constitutes the main source of income for most households in the project region.

3.4.10. Land tenure and land use

3.4.10.1. Meru County

Along the project area in Meru County, land is categorized as trust land and privately owned. The entire land in the market centres is privately owned since the land has been surveyed by the County Authority. The land is mostly used communally for nomadic pastoralism. However, some small areas are exclusively under small scale agriculture by individuals or groups.

3.4.10.1.1. Pastoralism

Majority of the people practice nomadic pastoralism where a large portion of the land is used as grazing zones. The larger part of the road alignment traverses' community land in Meru County. Community land in Kenya is vested in the community. In this respect, the term "community" has been defined to mean a consciously distinct and organized group of users of community land who are citizens of Kenya and share any of the following attributes: common ancestry, similar culture or unique mode of livelihood; socio-economic or other similar common interest; geographical space; ecological space; or ethnicity.

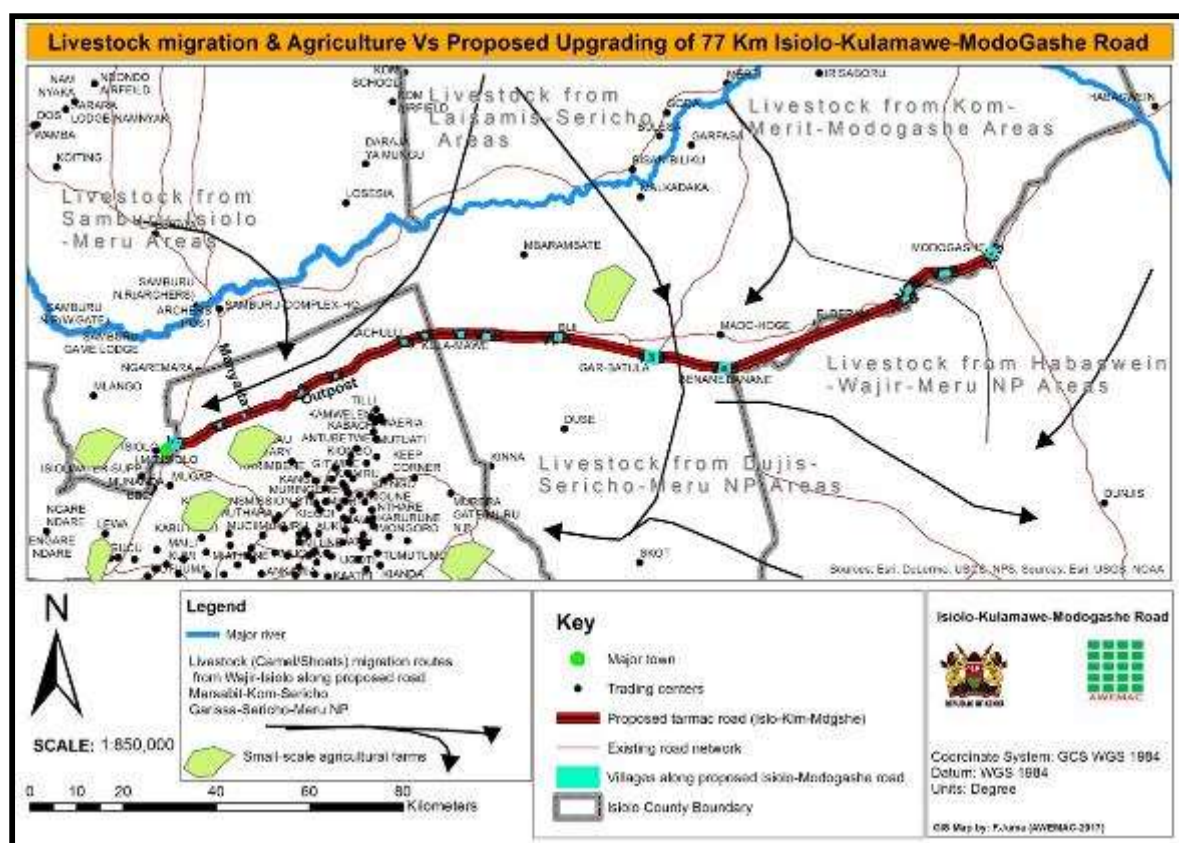


Figure 3:7. Proposed road project versus livestock migration and small-scale agriculture farming zones

Nomadic pastoralism is the most prominent land use and livelihood source in the project area covering more than 90% of land-use in the proposed project area. Over 90% of the total population depends on livestock and livestock products for their livelihood. The road project hence traverses key livestock crossing and migration routes (figure 3.7). At the proposed project area, there are 5 kinds of livestock kept by the local people which include cattle, sheep, goats, camels and donkeys. Interviews conducted along the project area concluded that goats and sheep are the common livestock (Plate 3.7) kept in the proposed project area as evidenced by large herds near the banks of Gambella river (0.397143N 37.679915E). According to residents, goats and sheep are most preferred since they can withstand fodder scarcity better compared to cattle. Donkeys are kept as beasts of burden given the migratory nature of the local people mainly for transporting water and fuelwood. Camels are also used to transport supplies especially when pastoralists are relocating to far-away places in search of pasture and water.



Plate 3:7: Goats and sheep as dominant livestock along the project area

Despite the extensive land, lack of pasture sometimes affects pastoral activities. During drought seasons, the nomads move their animals over long distances in search of pasture and water. However, once the drought is over and luxuriant fodder is available, the pastoralists troops back with their herds as seen in Kachulu and Ndumuru market centres (Plate 3.8).



Plate 3.8: Herds on transit at Kachuru and Ndumuru centres after the end of a drought

The construction and operation phases of the project area will present a relatively sensitive challenge to camel herders due to large herds that use the project area. The herds interfere with vehicular traffic (Plate 3.9) especially when the herds are on transit to far-away places in search of pasture or far away livestock markets. According to residents, construction of a separate path for the livestock will go a long way in reducing incidences of livestock being knocked down by vehicles during construction and operation phases of the project area.



Plate 3.9: A herd of camels block a section of the project area

The recurring drought accelerates the existing web of economic, social and security problems in the region and has the potential of creating serious problems at the national level. It has impacted negatively on livestock production forcing the people to liquidate their only source of income to maintain them and restock when conditions improve. According to residents, when droughts occur, cows are usually the first victims followed by camels then goats and sheep. In the project area, loss of livestock especially goats and sheep to hyenas and foxes is a major challenge to livestock production. Despite many incidences of livestock loss to wild game, the local people rarely report the cases to KWS.

3.4.10.1.2. Crop growing

In Meru County, though the area traversed by the project area is predominantly nomadic pastoralism, isolated cases of food crop growing occurs (figure 3.7). It is, however, important to note that the entire road alignment is extremely dry making it unsuitable for rain-fed agriculture. The potential for irrigated agriculture is huge though its exploitation is curtailed by lack of water. For instance, in areas with substantial supply of water such as Gambella, horticultural farms (Plate 3.10) are located at latitudes and longitudes of 0.399722N 37.683571E respectively. Key horticultural crops grown in the farms are onions, tomatoes, kales, spinach amongst others. The crops are grown for subsistence and commercial purposes.



Plate 3:10: Irrigated agriculture at Gambella along the project area

Rain-fed agriculture takes place away from the project area. For instance, at the neighbourhood of Ndumuru market centre, extensive agricultural farms occur at the foot of Nyambene hills (Plate 3.11). The hills receive adequate rainfall making rain-fed agriculture practical. According to residents of Ndumuru market the mostly grown crops include green grams, beans, *Catha edulis* popularly known as miraa amongst others. Typically, Khat or Miraa is a flowering plant native to the Horn of Africa and the Arabian Peninsula. It contains the alkaloid cathinone, an amphetamine-like stimulant, which is said to cause excitement, loss of appetite, and euphoria. Trade in Khat drives the economy of most of the market centres along the project area. The Merus mainly grow and consume Khat while the Somalis are predominantly consumers of Khat.



Plate 3:11: Slopes of Nyambene hills where rainfed agriculture takes place

3.4.10.2. Isiolo County

3.4.10.2.1. Pastoralism

Nomadic pastoralism is the economic activity at the sections of Isiolo County traversed by the project area. Meat and milk forms the staple diet of the people majority of them who are Boranas. Pasture and water influence the migratory nature of the pastoralists. Livestock movements and grazing are not controlled since the land is community owned with small portions privately owned especially at the market centres. Water availability greatly determines livestock concentrations. Areas that have permanent water points have higher livestock concentrations. Generally, in the larger North-eastern Kenya, the density of livestock varies from one point to another. The density of livestock and wildlife is expressed in Tropical Livestock Units (TLU), an index representing an animal of 250 kg, which allows combining animals of variable body weight. Figure 3.8 shows high livestock densities occur in the area of up to 50 -110 TLU. The availability of water affects the distribution of livestock. Herd composition varies

from cattle-dominated herds in the upper and middle parts, to camel-dominated herds in the lower catchment.

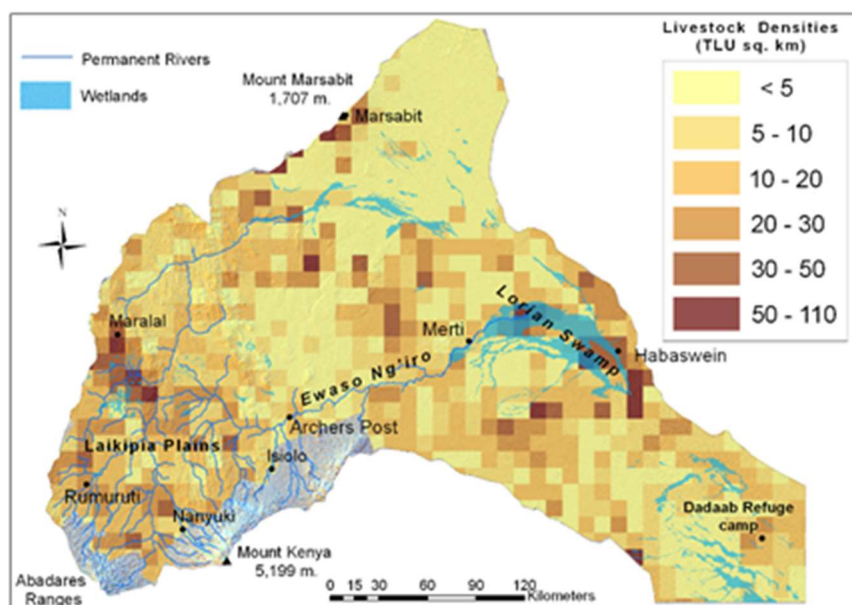


Figure 3:8: Average livestock density 1990–2010(TLU per km²)

Very few water points exist in sections of the road alignment at Isiolo County. Most of the rivers are seasonal while man-made water structures such as earth pans and earth dams are small and end up drying during dry spell. For instance, Kulamawe faces acute water scarcity with high dependence on a borehole at the market centre and sometimes during extended droughts water is transported using trucks to the market centre. According to residents, farmers incur huge livestock losses during dry seasons not only because of lack of fodder but also water. For instance, in grazing fields located at 00°34.310' and 038°11.244' in Kulamawe, remains of dead livestock (Plate 3.12) are a key evidence of effects of the just ended drought in the area.



Plate 3:12: Remains of livestock at Kulamawe at the project area

The main buyers of livestock are local traders who transport them mainly to Nairobi and the other urban centres for slaughter. The local traders also sell them to middlemen. The middlemen control the market. Livestock products like milk and meat are sold locally except hides and skins which are exported and earn substantial income to the locals.

The main cattle breed is the Boran. However, for dairy Production, breeds kept include Sahiwal and mixed crosses of Boran and exotic cattle. Small stocks are kept mainly to provide domestic milk and

meat for the pastoral families. They also provide quick cash to meet short-term financial obligations. Galla goats and black head Persian sheep are the predominant breeds.

3.4.10.2.2. Crop growing

The two extreme ends of the project area fall under Isiolo County and are generally dry to support meaningful rain-fed agriculture. Crop growing in Kulamawe region is not only curtailed by lack of rain but also the rocky nature of the soils. The entire area is characterized by poorly developed soils incapable of supporting even irrigated agriculture. At the T-junction, which serves as the starting point of the project area, the conditions are relatively different from Kulamawe. The area is a lowland thereby receiving a lot of flood waters from the neighboring Nyambene ranges. Local farmers take advantage of the flood waters to carry out agricultural activities. The flood waters carry a lot of silt which is rich in soil nutrients. Extensive farms (Plate 3.13) exist at location (0.364772N 37.683577E) near the T-junction. Similar farming activities occur at a flood plain located at 0.388312N 37.660878E. In the two areas, farmers utilize flood waters coupled with some degree of irrigation to grow crops. Main crops include assorted horticultural crops such as tomatoes, kales, onions, paw paws amongst others.



Plate 3:13: Farming activities in a flood plain near the T-Junction, Isiolo County

Generally, according to the Isiolo County Integrated Development Plan 2013-2017, a large portion of the county is arid and cannot support meaningful crop farming. However, maize, beans, cowpeas, onions are produced in the areas bordering Meru and Laikipia Counties. Mangoes, paw paws and other horticultural crops are produced in the existing private small-scale irrigated farm along rivers.

3.4.11. Bee keeping

Bee keeping presents another untapped economic opportunity at the project area since the entire corridor is predominant by *Acacia tortilis* and *Acacia mellifera* which provide forage for bees. However, according to residents, the nomadic lifestyle curtails investment in apiculture. At the outskirts of Kulamawe market is the Shifaa farm (00°34.310', 038°11.244', 736m a.s.l) that has set up a bee farm (Plate 3.14) characterized by several top bar hives in area measuring 310sq ft.



Plate 3:14: Sections of Shifaa bee farm at the outskirts of Kulamawe centre

3.4.12. Trade

The project area will act as an important corridor connecting Meru and Isiolo Counties. The road is a major traffic distributor not only in the two Counties but also the larger North-Eastern region. Therefore, the road is a strategic regional route which feeds traffic into other lower-class roads which in most cases branch off the road at major towns and market centres. The road traverses in a predominantly pastoral area with isolated built up areas within the four market centres. The road reserves are free of encroachment apart from temporary structures and service lines such as overhead power lines. Main trading activities include livestock auction markets, large and small-scale businesses, transport, jua-kali workshops amongst others. Small scale trading activities exist in the four market centres along the road alignment. Upgrading of the road to bitumen standards will greatly open the area and promote trading activities.

3.4.13. Security

Insecurity is a key factor in the project area. In response there is elaborate security personnel at strategic locations and on the entire road stretch from Isiolo to Kulamawe. Security installations are: Kenya Army at 78 Barracks, Administration Police Camp at Gambella, Rapid Deployment Unit (RDU) at Mbataru, Kenya Police Station at Ndumuru market, Northern rangelands Trust Rangers at Ndumuru Market, Administration Police Unit at Buulo, Administration Police Camp at Kachuru Market and Administration Police Camp at Kulamawe. There is adequate security arrangement in the area, but highway ambushes are common. The area is also regularly used by the Kenya Defense Forces for training. Therefore, the possibility of unexploded devices does exist in the project area.

3.4.14. Inter-ethnic relations

The project area is inhabited by several ethnic groups: Borana, Meru, Turkana, Somali and occasionally the Samburu make forays. There is continuous and sporadic conflict between all the ethnic groups, (Safer World, 2015). The interethnic tensions and conflicts are caused by; disagreements on county boundary, cattle rustling amongst the communities, superiority on administrative positions, land ownership and conflict over pasture.

3.4.15. Vulnerable Marginalized Groups

3.4.15.1. The Borana

The Borana sub-ethnic group of the Oromo people. They are Cushitic speakers of the Afro-Asiatic family. There are predominantly in Isiolo County and occupy Isiolo Central, Merti, Sericho and Garba Tula regions. The most prominent cultural institution is the Gada system. The Gada system consists of elected Men for a period of eight years. They perform judicial, political, ritual and religious functions. Aba Boku is responsible for justice, peace, and rituals. The Aba Duula is responsible for war while Aba Saa is the leader of the cows (Legesse, 1973). The council of Borana elders is led by the Hayu (overall). The Jallab is in charge of several Manyatta while Aba Kaye is the head of a Manyatta. The Borana practice FGM during the rainy season. The Borana detha sytem of grazing is very elaborate and enables them to survive drought.

3.4.15.2. The Turkana

The Turkana are a migrant community in Isiolo and Meru Counties. In Meru County, they occupy Ngare Mara location. In Isiolo County, they are found in Ngare Mara location of Isiolo Central District. They are Nilotic speakers whose main brethren live in Turkana County. According to oral literature, the Somali livestock traders hired Turkana youth to drive their livestock from Turkana to Isiolo livestock market. The herders settled in Isiolo and that explains the origin of the Turkana in the project area. They practice pastoralism and small-scale irrigation farming. Ekiriam (Council of elders) is headed by Ekapolon (chairman). The role of the council is to resolve disputes and preside over ceremonies.

Athapan ceremony is done in June – August during drought period after every two years. This is an age-set ceremony where youth are admitted to elderhood. It is usually marked by Pomp, jubilation and feasting. Aleng'eru (initiation) usually performed in December involves the movement from one age-group to the next. Ngimaki stage 18-22 years is the lowest. It is followed by Ngimoli stage 23-30 years, Ngikurorui stage 35-50 years, Ngichili 50 – 60 years. The last stage is Ngimanike where the elderly are admitted.

3.4.15.3. Somali

The Somali belong to the Cushitic group. In Isiolo County, they live in Isiolo central and have recently occupied parts of Garba Tula, Merti and Sericho. They are also found in selected settlements along the project road. They are a migrant community who first settled in Isiolo central as livestock traders in the colonial period. With time, more Somali have migrated to Isiolo County. The Somali practice FGM.

3.4.16. Structures of residence

Most structures are residences which also function as business premises. Most of them were temporary/ semi-permanent 77.3%. The temporary nature demonstrates the seasonal migration of most residents. Observations made show the blur between residence and business as both are combined. Most of the structures were made of wood wall 50.2%, earth 29.8%, sticks/twigs 11.0% and stone 7.4% the floor was mainly made of earth in 86.3% of the housing structures. Most structures had an average of two rooms. The average rent paid is Kshs. 3,289 per month.

3.4.17. Preferred social amenities

The following were proposed as the preferred social improvements that residents of the project area proposed. In spite of the ethnic, administrative and religious differences there was consensus on the following projects as shown in Table below

Table 3:13 Preferred social amenities

Type of facility	%
Construct /repair school	5.1
Construct school toilets	4.1
Drill borehole / water project	20.0
Construct / improve local health facility	70.6
Total	100%

3.5. Ecological characteristics of the project area

3.5.1. Ecological zones and climate

In Meru County, the project area traverses a predominantly low land zone characterized by flood plains. Generally, the county has varied ecological zones ranging from upper highlands, lower highlands, upper midlands and lower midlands. This has greatly influenced the major economic activities. The upper highland zones cover majority of the county's area ranging from Imenti South, Imenti Central, Imenti North, Tigania East, Tigania West, Igembe North, Igembe Central and Igembe South constituencies. The lower midland zones are only found in lower parts of Buuri and Tigania which border Isiolo County.

The project area traverses through a relatively drier zone of Meru County which borders Isiolo County. The lowland receives low rains but excessive flood waters from the upper highlands. Generally, Meru

County receives moderate amounts of rainfall except for the lower parts of Buuri area bordering Isiolo County which are arid. The distribution of rainfall ranges from 300mm per annum in the lower midlands in the North to 2500mm per annum in the South East. Other areas receive on average 1250mm of rainfall annually. There are two seasons with the long rains occurring from mid-March to May and short rains from October to December. Temperatures range from a low of 8°C to a high of 32°C during the cold and hot seasons respectively (Meru County Integrated Development Plan 2013-2017).

In Isiolo County, the road traverses in relatively dry sections of T-junction near Isiolo town and an extremely dry Kulamawe zone. The T-junction and its environs, which are lowlands receive excessive flood waters from the upper highlands. Broadly, Isiolo County is hot and dry in most months in the year with two rainy seasons. The short rains season occurs in October and November while the long rain occurs between March and May. The rainfall received in the County is usually scarce and unreliable posting an annual average of 580.2 mm. The wettest months are November with an average of 143 mm of rainfall and April with an average of 149 mm of rainfall (Isiolo County Integrated Development Plan, 2013-2017). The erratic and unreliable rainfall cannot support crop farming which partly explains the high food insecurity and food poverty levels recorded in the county. Rain fed crops are grown in Bulla Pesa, Wabera and Kinna wards where the black cotton soil retains moisture long enough to make crops mature.

High temperatures are recorded in the county throughout the year, with variations in some places due to differences in altitude. The mean annual temperature in the county is 29 degrees centigrade. The county records more than nine hours of sunshine per day and hence has a huge potential for harvesting and utilization of solar energy. Strong winds blow across the county

3.5.2. Topography

The project area traverses a lowland which is generally flatland overlooking the Nyambene ranges. The terrain is featureless with isolated hilltops (Plate 3.15) jutting out prominently amidst the expansive plain. In some sections of the proposed road corridor, the lowland forms extensive flood plains that receive excessive waters from the Nyambene ranges and thereby rendering the road impassable. For instance, at Ndumuru market centre, Ndumuru/Ngathu rivers spreads into a flood plain at point 0.476841N 37.849375E, (Plate 3.16) of the project area. Broadly, the county's position on the eastern slopes of Mt Kenya and the equator has highly influenced its natural conditions. Altitude ranges from 300m to 5,199m above sea level. This has influenced the atmospheric conditions leading to a wide variety of microclimates and agro-ecological zones. Due to the flood plain in the project area, the contractor will need to ensure flood design measures and effect a storm water management plan for respective sections.



Plate 3:15: A hilltop at a flood plain along the project area

The drainage pattern in the county is characterized by rivers and streams originating from catchment areas such as Mt. Kenya and Nyambene ranges in the North. The rivers cut through the hilly terrain on the upper zones to the lower zones and drain into the Tana and Ewaso Nyiro Rivers. The rivers form the main source of water for both domestic and agricultural use.



Plate 3:16: Ndumuru/Ngathu River bursts into a flood plain along the proposed road

In Isiolo County, the project area traverses' lowland areas at the T-junction and Kulamawe. The areas are almost flat and subject to periodic flooding due to excessive waters from upper highlands of Nyambene hills. Generally, most of the land in Isiolo County is flat low lying plain resulting from weathering and sedimentation. The plains rise gradually from an altitude of about 200m above sea level at Lorian swamp (Habaswein) in the northern part of the county to about 300m above sea level at Merti Plateau. There are six perennial rivers in the county namely: Ewaso Ngiro North, Isiolo, Kinna, Bisanadi, Likiundu and Liliaba rivers. Ewaso Ngiro North River has its catchments area in the Aberdare ranges and Mount Kenya. It also serves as a boundary mark between Isiolo North and Isiolo South constituencies. Isiolo River originates from Mount Kenya and drains into Ewaso Ngiro River. Kinna and Bisanadi rivers are found in the Southern part of the county and drains into the Tana River. Likiundu and Liliaba originate from Nyambene hills and drains into Ewaso Ngiro North River.

3.5.3. Soils and geology

The proposed project area is characterized by poorly developed soils predominantly young sedimentary rocks and loamy soils with poor drainage in some sections. The terrain is rocky characteristic of soils still under development. The geology of the area is composed of metamorphic rocks and other superficial rocks deposits (Figure 3.9).

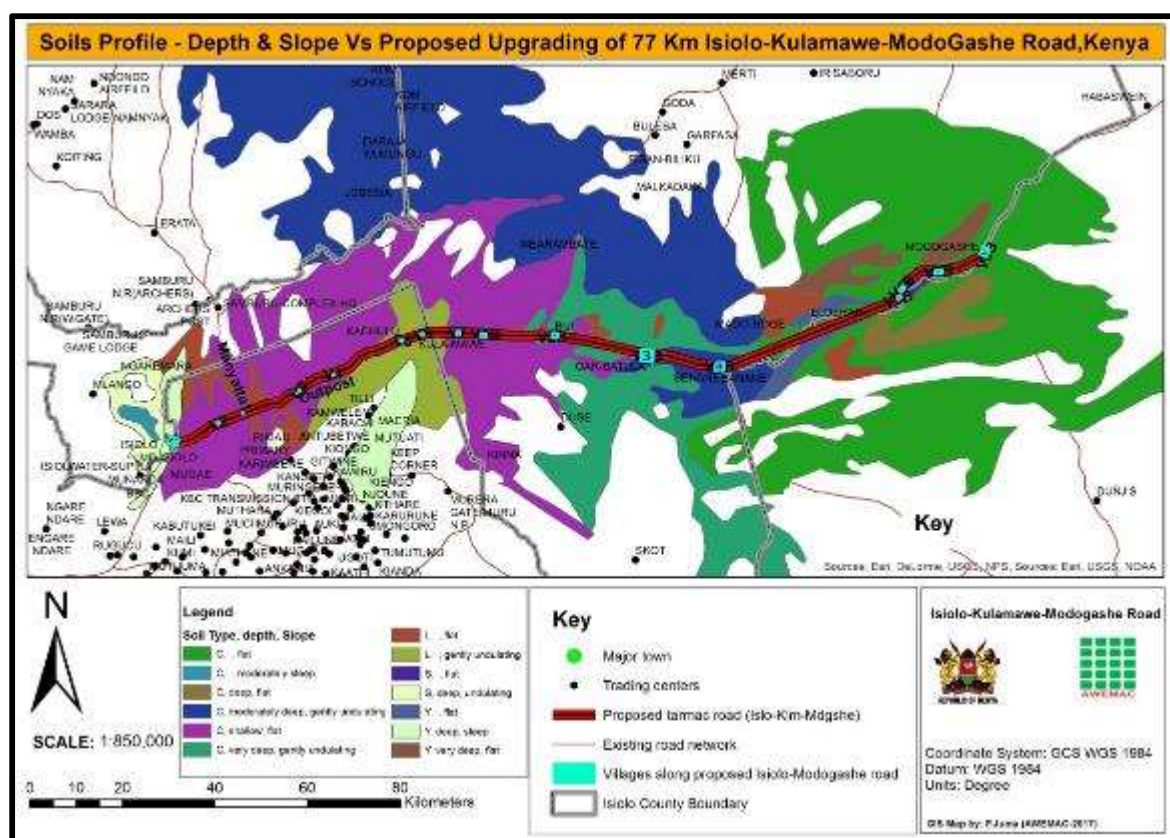


Figure 3:9. Proposed road versus edaphic features- soil profile, type, depth, adorability and slope

The soils at the T-junction of the project area are relatively well developed compared to those of Kulamawe which are poorly developed with rock fragments characterizing the entire terrain. Generally, at the County level, the dominant soils are because of the parent material in the region. The county has a combination of metamorphic rocks and other superficial rock deposits. Tertiary rocks (Olive Basalt) are found in the northern parts of the county, where oil exploration has been going on. The areas covered with tertiary marine sediments that have a high potential for ground water harvesting.

3.5.3.1. Soil quality measurements

The entire project road traverses' diverse geological formations which have interacted with prevailing climate to yield diverse soil types. A larger part that is traversed by the road has undeveloped soils. Soil sampling was not conducted during the ESIA study since the impact on soil was equated to be of a minimal significance. However, soil sampling and testing is recommended for any specific activity during the construction stage that might lead to the contamination of the soil.

3.5.4. Water resources

The project area is water deficient due to its aridity. The main sources of water are presented in Table below.

Figure 3:10 Sources of water

Sources of Water	Percentage
Borehole	45.2 %
Dam / pond	1.7 %
Piped public tap	10.7 %
Piped water into dwelling	15.1 %
Piped water into yard / plot	8.0 %
Protected spring	7.7 %
River/ stream / canal	11.7 %

According to 74.6% of the respondents, water is not available from the main source all the year. The most critical months of water scarcity were March-October during the dry season. In the project area there are functional boreholes at Gambella, Attir, Ndimuru, Kachuru and Kulamawe. At Kachuru market, the borehole is controlled by the Borana who obtains the water free but sells it to the Meru and Somali communities. Access to water is often not guaranteed as any differences between members of the Borana, Somali or Meru often leads to other communities being denied water. The location of a borehole (whether in a Borana or Meru dominated section) of the market has great implications for access by other communities.

On average, a household collects and uses an average of 66 litres of water per day. This translates to 13.2 liters of water per person per day which is far below the recommended. In terms of distance to the nearest source of water, it is greater than 1Km for 46.3% of the households. The high number of households accessing water within 1KM is largely because those who were interviewed were in settlements where the borehole was drilled. At least 5.0% of the households has own tap / connection. The own tap connections are specifically at Isiolo Junction households - supplied by Isiolo Water and Sewerage Company – and Kulamawe shopping Centre – supplied from the community borehole. In Isiolo County the coverage distance to a water point is 4KM and it takes 2 hours to reach the water point (GoK, 2013 a). In Meru County, the average distance to a water source is 1.5KM (GoK, 2013 b).

In Meru County, the project area traverses a region with limited water resources due to arid nature of the locality. Boreholes, roof catchment, earth pans, earth dams, streams and rivers are the main sources of water at the proposed project area and its environs. The entire road alignment is a lowland characterized by flood plains and forming the lower catchment of the region's drainage pattern (Figure below).

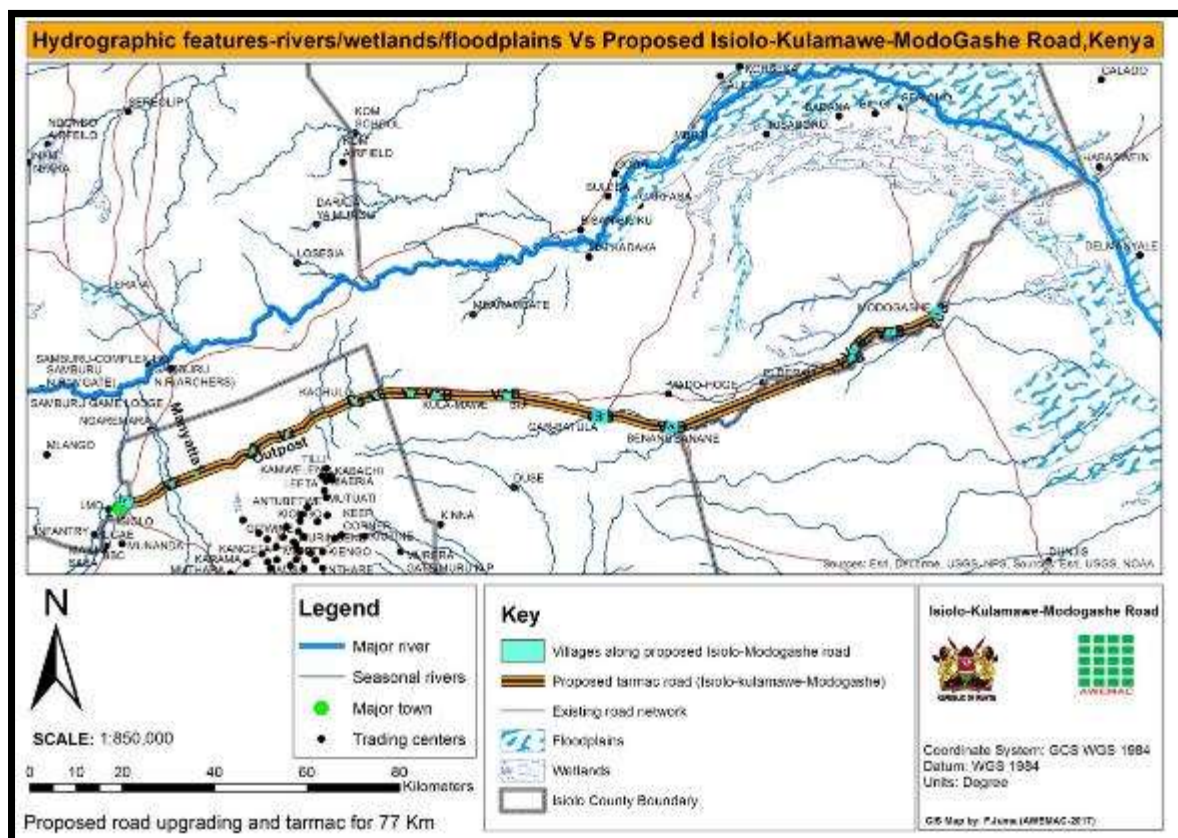


Figure 3:11. Proposed road project verses hydrographical features along the project route

The Nyambene ranges forms the upper catchment of the drainage with most of the rivers/streams crossing the road originating from the ranges. According to the Meru County Integrated Development Plan 2013-2017, the drainage pattern in the county is characterized by rivers and streams originating from catchment areas such as Mt. Kenya and Nyambene ranges in the North. The rivers cut through the hilly terrain on the upper zones to the lower zones and drain into the Tana and Ewaso Nyiro Rivers. The rivers form the main source of water for both domestic and agricultural use. Several streams/rivers

cross the project area before draining into Ewaso Nyiro River. For instance, Gambella stream (Plate 3.17) crosses the project area at point 0.397143N 37.679915E. It is important to note that these streams and rivers are characterized by high flows during rainy season and extremely low or no base flows during the dry seasons. The streams and rivers serve as critical water sources to the pastoralists.



Plate 3:17: Laghlaba stream at Gambella crossing a section of the project area

Further, water points majorly determine livestock distribution and movement patterns. Similarly, the water points dictate human settlements with the main market centres located within the vicinity of a stream or a river. For instance, at Ndumuru market Ngathu river (Plate 3.18) cuts across the project area a few metres from the market. As the water flows from the upper catchments of Nyambene ranges, it is characterized by heavy sediments loads. Most of these sediments are deposited in the lower catchment as the streams and rivers burst into flood plains. Local farmers take advantage of the silt-rich depositions to carry out crop growing activities at the flood plains. Though Kachuru market is sandwiched by two streams located at 0.559742N 38.043064E and 0.559207N 38.037834E a.s.l, the streams are relatively small and characterized by moderate to high flows during the rainy seasons.



Plate 3:18: Sections of Ngathu River at the project area

Water pan also exist along the road alignment. The pans act as key water points for residents, livestock and wild game. For instance, Ariamawoi water pan (Plate 3.19) lies at point (0.364916N 65.474353E.) along the project area. The water pan was constructed recently by the National Government of Kenya. There is need to increase the number of water pans to harvest flood waters in the lowland.



Plate 3:19: Ariamawoi water pan adjacent the project area

Despite the existence of several streams that can act as catchments for earth dams, there is minimal investment towards this end. Only one earth dam was evident along the project area. Ndumuru earth dam (Plate 3.20) was constructed recently by the County Government across Ngathu River (0.456081N 37.840753E). The earth dam has since been washed away and the residents are calling for its immediate repair. It is also important to note that Ngathu River is characterized by extremely high flows during rainy seasons and only a mega dam can withstand such high volumes of water.



Plate 3:20: The damaged Ndumuru earth dam along the proposed project area

Boreholes are the only sustainable source of water along the project area. They provide water for domestic uses in the market centres along the proposed project area. During dry seasons, borehole water is used to water livestock. For instance, at Ndumuru market centre, a borehole (Plate 3.21) located at point (0.460359N 37.839377E) acts as a critical source of water for domestic usage. The borehole was drilled in 1989 and has since been supplying water to the residents.



Plate 3:21: A borehole at Ndumuru market along the project area

According to residents, the boreholes are characterized by occasional breakdowns. In isolated cases, borehole water is used to carry out irrigation activities as was evident at point (0.399722N 37.683571E) at the outskirts of Gambella market where irrigated agriculture takes place. The borehole water is pumped using solar energy to high level concrete/plastic tanks (Plate 3.22) from where it is distributed by gravity using a network of piping systems to the end use points.



Plate 3:22: Water tanks at Gambella and Ndumuru market centres

According to Isiolo County Development Integrated Plan 2013-2017, the County has three big perennial rivers namely Ewaso Ngiro, Isiolo, and Bisanadi which flow through the county. Ewaso Ngiro River has its catchment area from the Aberdare and drains into the Lorian Swamp. The Isiolo River originates from Mt. Kenya and drains into Ewaso Ngiro River. Bisanadi River drains into River Tana. Most irrigation schemes are found along these rivers. Where the site conditions are suitable, floodwater harvesting facilities for communities in the county can be constructed by excavating shallow pans or ponds.

At the project area, specifically at the extreme ends of the T-junction and Kulamawe locality, several streams characterize the zone. At Kulamawe, the streams in the project neighbourhood are very small

and characterized by low to moderate flows during rainy seasons and no base flows during the dry seasons. Several streams exist near the T-junction. The Nyambene ranges acts as the upper catchment of the streams near the T-junction. For instance, one of the streams at the neighborhood of Isiolo military base bursts into a flood plain at point (0.364763N 37.626229E) as it crosses the project area. Local farmers take advantage of the flood waters to carry out farming activities as evidenced by several horticultural farms at the neighborhood of Isiolo Military base.

Boreholes act as a critical source of water at the T-junction as well as Kulamawe locality. According to the residents, borehole water in the region is mostly salty. For instance, at Kulamawe, a borehole at the market centre is the only reliable source of water in the locality. The borehole provides water for both human and livestock consumption. Water from the borehole is pumped into a high level concrete tank (Plate 3.23) at point (00°34.264', 038°11.879', 749m a.s.l) before being distributed from the tank using a network of piping systems to various human and livestock watering points within the market and its environs. According to residents, when the borehole breaks down, the market is plunged into a water crisis since water must be brought all the way from Maua town using trucks. In such cases, a jerrican of 20 litres of water retails between Ksh. 50-60.



Plate 3:23: A high level water tank at Kulamawe market centre along the proposed road

3.5.4.1. Laboratory test results of existing water resources

Environmental baseline survey of the proposed project area was undertaken in November 2017. Water quality samples were collected to provide data that will act as a reference for monitoring water resources in the project area in future (Appendix F). The concentration levels of the analyzed parameters were compared with the first schedule on quality standards for sources of domestic water (GOK 2006). Twenty-three water quality parameters were determined and analyzed from three sampling points giving a representation of surface water and groundwater quality along the project area (Table 3:14). The water quality parameters analyzed, showed that there were variations although generally within the NEMA standards/guideline values and World Health Organization standards (WHO). The pH range was within the acceptable levels in the sampled points. Storm waters such as found at the drainage channel near 78 Barracks were found to contain PH 7.4 whereas Kulamawe Community Borehole had PH 7.9.

The values of Turbidity observed near 78 Barracks (5KM) and River Laghlaba (38Km) are relatively high. In addition, turbidity and total suspended solids concentrations were found to be above the guideline values in the latter two samples. Typically, water flowing in a river may have high concentrations of these parameters when coupled with flooding and erosion events. However, Kulamawe Borehole depicted turbidity and total suspended solids ranges that were within the NEMA guideline values (Table 3:14). Heavy metal concentrations for iron were found to be above WHO and NEMA Guidelines limit in the three samples. Nonetheless, other metals such as Lead, Cadmium and Arsenic were found to be below the detection limit and well below the NEMA standards. However, Arsenic was detected in waters of the drainage channel and River Laghlaba, this could be attributed to runoff from upstream agricultural fields.

Table 3:14 Comparison of water sample results against WHO Standards and NEMA Guidelines

Sampling point/Parameter	Drainage Channel near 78 Barracks (5KM)	River Laghlaba (38Km)	Kulamawe Community Borehole (77Km)	WHO	NEMA Guideline values
GPS- Coordinates	00°21'54.8"N 37°37'47.3"E	00°32'08.9"N 37°59'.04.6"E	00°34'.07.3"N 38°12'26.8"E		
Ph	7.4	7.0	7.9	6.5 – 8.5	6.5 – 8.5
Colour mgPt/l	1750	1750	<5		-
Turbidity (NTU)	4200	1790	2.92	< 5	-
Conductivity (μScm^{-1})	166.9	63.2	1689	< 2500	-
Iron(mgl-1)	6.26	6.13	0.10	<0.3	<0.3
Manganese (mgl-1)	0.1	0.3	<0.01	1	-
Calcium (mgl-1)	36	NIL	41.6	100	-
Magnesium (mgl-1)	2.45	1.94	116.6	100	-
Sodium (mgl-1)	2.3	7.4	76	200	-
Potassium (mgl-1)	3.8	5.8	70	50	-
T. hardness (mgl ⁻¹)	100	8	584	< 500	-
T. alkalinity (mgl ⁻¹)	74	34	680	< 500	-
Chloride	5	NIL	72	250	
Fluoride	0.79	0.54	0.78	<1.5	<1.5
Nitrates (mgl ⁻¹)	0.435	0.415	6.362		10
Nitrites (mgl ⁻¹)	0.02	<0.01	<0.01	< 0.1	0.003
Sulphate (mgl ⁻¹)	<0.3	<0.3	36.9	< 450	1.5
Free Carbon Dioxide	10	6	66	-	-
TDS (mgl ⁻¹)	103.5	39.18	1047	<1500	1200
Arsenic	1.0	1.0	NIL	<10	<0.01
Lead (mgl ⁻¹)	ND	ND	ND		<0.05
Cadmium	ND	ND	ND	<0.003	<0.01
TSS (mgl ⁻¹)	1200	400	NIL	-	30

3.5.5. Habitats and vegetation

The proposed project site is predominantly characterized by both open and closed savannah woodland habitats (Figure 3.12) with different plant formations comprising of several species. Open plain habitat predominated by grasses and isolated stems also exist in some sections of the project area. Riparian habitats exist where streams and rivers cross the project area. The different habitats act as homes for a vast array of plants and animals. Usually, the many species occurring in different habitats have a broader ecological tolerance, and they require a mosaic of different habitat types which are available at the project area. Such tolerances and preferences result to formation of different plant formations or mosaics and animal guilds/associations in each habitat. The habitats at the project area are complex webs of organisms that include plants, animals, microorganism amongst others. The woodland habitat that dominate the proposed project site is typically composed of a complexity of life both plants and animals interacting among themselves and with the physical environment. The interactions make the woodland ecosystem functional and as such perform its various environmental, economic and socio-cultural roles.

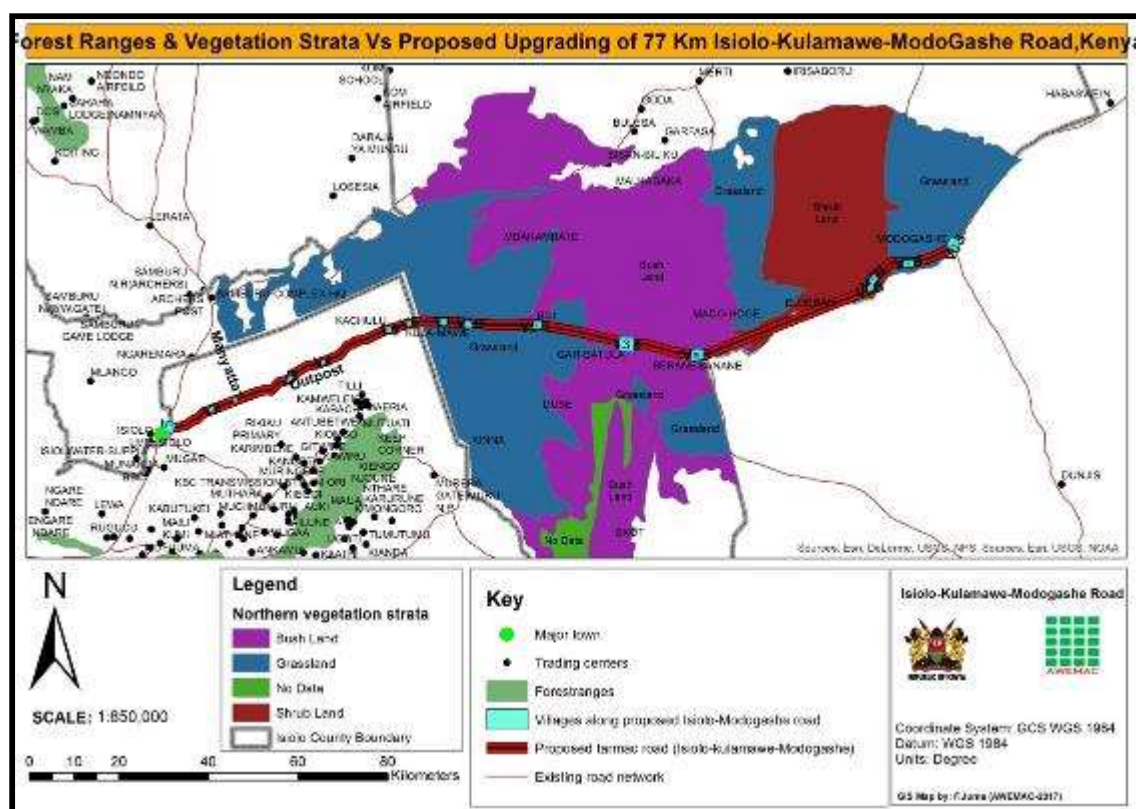


Figure 3:12. Proposed road project verses forest ranges and vegetation strata

3.5.5.1. General habitat description of the project area

The project area traverses typical savannah woodland characterized by closed and open woodlands. An open plain exists amidst the woodland. The plain is mainly composed of grasses, herbs, shrubs and isolated trees. The proposed project area is characterized by several streams and rivers originating from the upper highlands of Nyambene ranges. The streams and rivers are characterized by riverine vegetation. Since the entire road alignment is a lowland, the streams and rivers, in some sections, form flood plains characterized by unique floral composition at the riparian zones. Such flood plains are composed of vegetation that can withstand periodic flooding or periodic water stress. According to the KFS' Meru and Isiolo County Ecosystem Conservators, there are no gazetted forests along the proposed project area. Typically, savannah woodlands and grasslands form suitable habitats for both grazers and browsers. As such, the entire project area and its environs is a habitat for wild game.

3.5.5.2. Types of habitats at the project area

The project area traverses through different habitat types in Meru County namely closed woodland, wooded bushland, open grassland (open plain) and riverine habitats. The closed woodland habitat occurs from Yaqbarshadi (5.746764N 38.116025E) through Kachuru before the formation breaks to an open plain characterized by isolated trees at point (0.532962N 37.966662E). The open plain stretches for several kilometres characterized by isolated trees, several streams and flood plains through Aidaphen police camp (0.493495N 37.909978E) before ending at point (0.491679N 37.868341E) near Ndumuru market. At this point, the open plain gives way back to the closed woodland formation that stretches through Ndumuru and Gambella market centres before entering Isiolo County. The wooded bushland habitat forms a transitional zone (ecotone) between the closed woodland and the open plain (grassland). The riverine habitats are restricted along the streams and rivers along the project area. At Kachuru locality, four streams exist while at Ndumuru, Ngathu river including other seasonal streams exist. The streams, in some sections, burst into flood plains at the project area.

In the project area in Isiolo County, two types of habitats exist namely closed woodland and riverine habitats. The predominant habitat is the closed woodland largely dominating the entire Kulamawe environs and sections of the T-Junction. The riverine habitat is restricted in the neighbourhood of the T-Junction where streams and rivers that drains the upper catchment of Nyambene ranges cross the project area.

3.5.5.2.1. The closed woodland

Woodlands play critical ecological roles such as habitat for wildlife, nutrient cycling, water catchment, erosion control, removal of pollutants among others. This is the dominant habitat type at the project area. It forms savannah woodland typical of ASALs. In mature woodlands, the habitat tends to be characterized by predominant plant mosaics/associations mainly made of the climax species best suited for the locality. Typically, the climax species tends to occupy the upper canopy forming closed woodland especially in areas where disturbances are minimal. The closed woodland habitat was characterized by different plant formations. The plant formations are like plant mosaics/associations where the woodland will tend to be homogenous characterized by one or two dominant species. In typical natural ecosystems, plant formations/mosaics tend to occur in patches which may be isolated or continuously distributed. In the project area, the plant formations/mosaics/associations were predominantly continuous with patchy formations in areas where the woodland was interrupted by open plain. In the project area, three plant formations/mosaics/associations namely *Acacia-Acacia*, *Acacia-Commiphora*, *Acacia-Balanites* formations characterized the project area.

The Acacia-Acacia plant formations/mosaics/associations

Ecologically, species tend to form associations characterized by strong affinity for members of the same or different species. These associations lead to formation of ecological guilds. Broadly, in ecology, a guild is a group of species that exploits the same kinds of resources in comparable ways. The name “guild” emphasizes the fact that these groups are like associations of craftsmen who employ similar techniques in plying their trade. They often are composed of groups of closely related species that all arose from a common ancestor, and they exploit resources in similar ways because of their shared ancestry. Hence, several species within a single genus may constitute a guild within a community though guilds may be made up of unrelated species.

The *Acacia-Acacia* is a typical species association common in the project area. The formation is characterized by either one dominant *acacia* species forming homogenous vegetation stand or two *acacia* species forming heterogenous patch. Two *Acacia-Acacia* formations were evident at the project area. One formation was composed of homogenous stands of *Acacia tortilis*. For instance, at point (0347122, 0040329, 1077m a.s.l) near Isiolo military base, huge *Acacia tortilis* line up both sides of the project area and its environs forming pure stand of the species (Plate 3:24). The second formation was *Acacia tortilis* – *Acacia mellifera* formation where two *acacia* species dominated the woodland forming homogenous/uniform stand though made of two species. This formation characterizes sections of Kulamawe and Kachuru areas.



Plate 3:24 *Acacia tortilis* formation along the project area near Isiolo military base

The Acacia-Commiphora plant formations/mosaics/associations

This is another plant formation that characterizes some sections of the project area. The formation is characterized by two *acacia* species namely *Acacia tortilis* and *Acacia mellifera* intermixing at varying levels with two species of *Commiphora* species namely *Commiphora myrrh* and *Commiphora holticiana*. For instance, at Yaq Barshadi (0402123, 00635287, 852m a.s.l), the *Acacia-Commiphora* plant formation characterizes the locality. In the formation, the *acacias* and the *commiphora* species coexist harmoniously and exploit the same niche in a comparable way. It is important to note that members the *acacia* and *commiphora* genus are typical dryland species. Where they form an

association, it basically means that both have similar competitive ability in exploiting the niche. In ecology, members of the same association/guild can be competitors in exploiting a similar habitat and forging a variety of interspecific interactions.

The *Acacia-Balanite* plant formations/mosaics/associations

The *Acacia-commiphora* plant formation gives way to *Acacia-Balanite* formation in Kachuru (0.559207N 38.037834E). The formation stretches along the road alignment before breaking at a stream (0374071, 0054356, 1034m a.s.l) to give way to an open plain. The plant mosaic is characterized by two species of *acacias* namely *Acacia tortilis* and *A. mellifera* intermixing with *Balanites aegyptica* to form homogenous vegetation. Along the project area, the *Acacia tortilis-Balanites aegyptica* forms a strong formation (Plate 3:25) at the outskirts of Ndumuru market at point (0.461698N 37.841246E) towards Ngathu River. The three species in this formation have strong affinities for each other not only because they are dryland species but are also climax species in ASALs. Typically, as climax species, they tend to compete and occupy the upper canopy of woodlands and thereby form homogenous formation. In ecology, for example, tree guilds will have some species that concentrate on occupying the upper canopy by competing for available resources such as light, nutrients amongst others.



Plate 3:25 An *A. tortilis*–*B. aegyptiaca* plant association along the project area

3.5.5.2.2. Wooded bushland habitat

This type of habitat characterized some sections of the project area especially where the closed woodland transits into an open plain (grass land) or where the open plain transits back into a closed wood land. Ecologically, the wooded bush land formed an ecotone. In ecology, ecosystem boundaries rarely form abrupt edges; rather, ecotones and mosaic habitats bound them. As a typical ecotone, the wooded bushlands at the project area was composed of the species found at the closed woodland and the open plain. It is characterized by open woodland with shrubs dominating the habitat. The shrubs form a major diet to livestock and wild game at the proposed project area. Ecologically, such bushlands are said to be in the process of succession and are characterized by an intermix of pioneer species, follower species and few climax species. In ecological succession, the pioneer and follower species act as nurses to the climax species by ensuring the climax species germinate and get recruited under their shade/canopy.

Ecologically, given enough time and in absence of major disturbances, the climax species will replace all the pioneer and follower species in the succession process and the wooded bushland will become a closed woodland devoid of bushes in the long run. Most of the shrubs and invasive species along the project area belong to the *Solanaceae* family. Members of the *Solanaceae* family are found throughout the world. While some of the members are food crops others are extremely poisonous invasive plants. The poisonous alkaloids present in some species of the family have given the members its sombre vernacular name of “nightshade.”

Though many members of the family are known to have high economic value as food crops or drugs, the family contains deadly nightshade, the source of belladonna (*Atropa belladonna*); the poisonous jimsonweed (*Datura stramonium*) and nightshades (*Solanum nigrum*, *Solanum dulcamara*, *Solanum incanum*, *Solanum sachuminianum* amongst others). Along the project area and especially in bushlands, two members of the nightshades *Solanum incanum*, *Solanum sachuminianum* (2:26) were common. Though the two species produce fruits which are extremely poisonous just like the other nightshades, the leaves are palatable by livestock and wild game.



Plate 3:26 Bush land invasive species along the project area

3.5.5.2.3. Open plain (grassland) habitat

This forms a unique habitat at the project area by forming an expansive open plain overlooking the Nyambene ranges. The open plain, which is dominated by a wide range of grasses and isolated trees, starts at point (0385014, 0058918, 1007m a.s.l). It stretches for several kilometres characterized by grassland, isolated trees, several streams and flood plains through Aidaphen police camp (0378705, 0054556, 1041m a.s.l) before ending at point (0.491679N 37.868341E) near Ndumuru market. At this point, the open plain gives way to a wooded bushland (ecotone) before transiting back to a closed woodland formation. The plain is almost featureless forming a typical flatland with the Nyambene ranges at the background. The few stems characterizing the plain (Plate 3.27) do not form a coherent plant formation but a sparse intermix of *A. mellifera*, *A. tortilis*, *Balanite aegyptica* and *commiphora* sp. Despite the few number of trees in the plain, it forms a suitable grazing site for livestock and wild game.



Plate 3:27 Sections of an open plain along the project area

3.5.5.2.4. Riverine habitat

This type of habitat occurs in areas where streams and rivers cross the project area. Since the entire road alignment falls in a lowland, some of the streams/ rivers burst their banks, especially during peak

flows forming typical flood plains. The riparian ecosystem of the key rivers is characterized by key riverine species. Key among such species is the yellow-barked *Acacia xanthophloea* (Plate 3:28) also called fever tree or Naivasha thorn. It is a typical savannah woodland species mainly found in riparian ecosystems and in areas with raised water table. In ecology, the species is an indicator of raised water table. It forms a key food resource for livestock and wild game. However, it is always targeted for charcoal production in many ecosystems due to its high-quality charcoal. The riverine vegetation (Plate 3:28) along the banks of the streams and rivers in the proposed project area provide protection against soil erosion, collapse of stream banks and provide a habitat for amphibians and reptiles.



Plate 3:28 Riverine vegetation protecting the banks of one of the streams at the project site

It is important to note that the drainage pattern of the project area is characterized by rivers and streams originating from catchment areas such as Nyambene ranges. The rivers cut through the hilly terrain on the upper zones to the lower zones and drain into the Tana and Ewaso Nyiro Rivers. The proposed project site forms part of the lowland for the rivers and streams and as such many of them burst into flood plains. In areas along the project area where such flood plains exist, the vegetation changes to herbs, shrubs and isolated trees (Plate 3:29). At the flood plains, no coherent river banks and riparian vegetation. Only species that can withstand periodic or prolonged flooding or water stress can survive in this locality.



Plate 3:29 Wetland vegetation in a flood plain along the project area

3.5.5.2.5. Key plant species in different habitats

Different dry land species characterize the entire road alignment. The key species that make the major plant formations/associations/mosaics include *Acacia tortilis*, *Acacia mellifera*, *Commiphora holtiziana*, *Commiphora myrrh*, *Balanites aegyptica* and *Prosopis juliflora*. Other species along the proposed road corridor include *Adansonia digitata*, *Salvadora persica*, *Boscia spp.*, *Boswellia microphylla*, *Cordia sinensis*, *Acacia Senegal*, *Grewia villosa*, *Grewia tembensis*, *Capparis tomentosa*, *Vernonia species*,

Boscia minimifolia, *Terminalia spinosa*, *Albizia anthelmintica* amongst others. Below is a description of some of the key species along the proposed road corridor.

Acacia tortilis

The species (Plate 3:30) is dominant in the *Acacia-Commiphora* plant formations along the proposed project area. *A. tortilis* is a typical dryland species with a wide distribution in Kenya. The species is an important livestock and wildlife tree providing a wide range of benefits such as forage, fuel, shelter to birds and shade to humans, livestock and wild game. The pods of the species provide excellent fodder to both big and small livestock and wild game during dry seasons. The pods are usually ready for consumption during the months of August-September when most parts of the country are not only dry but also facing acute fodder shortage. When temperatures are extremely high, the big acacia trees come at hand by providing shade to the wild game and livestock thereby reducing the effects of heat stroke. Its umbrella shaped crown makes the species suitable for shade provision. At Kachuru market (00033.547', 038002.326' 969m a.s.l), the species is used for public meetings due to its extensive shade (Plate 3:30). The species forms excellent bird nesting and breeding zones as seen in Kachuru market (Plate 3:30). The species is also important for honey production although the residents at the project area do not practice bee keeping. According to Wesonga *et al* (2016), the species is important for forage, timber, charcoal and fuelwood.



Plate 3:30 Acacias providing a shade and nesting site at Kachuru along the road alignment

Acacia mellifera

A. mellifera (Plate 3.31) is another dominant species in the *Acacia-Commiphora* and *acacia-Balanites* plant formations. The species is a typical ASALs species with a wide distribution in Kenya. The leaves and the pods are highly nutritive to livestock and wild game. Though it grows to be a big tree upto 20m in height, sometimes heavy browsing can prevent it from growing tall and instead form dwarf trees as seen in Kachuru locality. The dwarfed trees many a times form a heavy impenetrable thicket with intimidating thorns. The thicket may hinder generation of grasses but form good feeding grounds for browsers.

Ecologically, Continuous browsing of the *Acacia mellifera* trees may hinder them from being recruited into high canopy trees but remain as thicket of dwarfs. This is in consistent with Mwangi *et al* (1991) who singled out the case of grazing as a major disturbance that greatly affect recruitment of species from seedlings to sapling and then to mature trees. Disturbances have also been known to promote regeneration (Mutangah *et al*, 1993 and Fausto, 1997) but suppress recruitment (Mutiso *et al*, 2011). The diversity of species may also be curtailed by disturbances such as grazing. Similarly, Sapkota *et al* (2010) noted species diversity reduction in response to increase in disturbances. Further, Fashing *et al* (2003) document that recurrently browsing and trampling of undergrowth by cattle creates persistent light gaps which facilitates the success of pioneer species and prevent the emergence of shade-tolerant later successional species.

Among the many *acacia* species, *A. mellifera* is known to produce excellent honey. Due to its intimidating thorns, the tree branches are used to fence cattle bomas in many African communities. According to the residents, *A. mellifera* produces excellent charcoal and fuelwood.



Plate 3:31 A thicket of *A. mellifera* along the project area

Balanites aegyptiaca

B. aegyptiaca (Plate 3:32) dominated the *Acacia-Balanite* plant formation along the project area. It is a dryland species with wide geographic distribution in Kenya. The species is hardy and drought resistant capable of achieving excellent natural regeneration in dry conditions. The leaves form excellent fodder for both browsers and grazers. The fruits are palatable and as such come at hand to provide fodder during dry seasons. The fruits form a key diet to a wide range of wild game such as *Colobus guezzeras*, buffalo (*Syncerus caffer*), dikdik (*Madoqua kirkii*), Impala (*Aepyceros melampus*), giraffe (*Giraffa camelopardalis tippelskirchi*), Burchell's zebra (*Equus burchellii*), Grevy's zebra (*Equus grevyi*), lesser kudu (*Tragelaphus imberbis*), squirrels amongst others. The fruits are also eaten by human during periods of food scarcity. At the project area, apart from providing livestock and wild game fodder, the species is used for provision of shade as seen at Gambella market centre (Plate 3:32) hence suitable for holding public meetings. It is important to note that the species is always evergreen even during extremely dry seasons thus providing multiple benefits to the ASALs residents. At point (0353327, 0044014, 1056m a.s.l) along the project area, natural regeneration of *B. aegyptiaca* has out-competed the other native species. Pure stands of the species were evident in Ndumuru and its environs.



Plate 3:32 *Balanites aegyptiaca* being used as a site for public meeting at Gambella market

Commiphora myrrh* and *Commiphora holticiana

The *Commiphora*-*Acacia* plant formations at the project area are basically composed of two *Commiphora* species namely *Commiphora myrrh* and *Commiphora holticiana*. The two species of *Commiphora* are common in drylands of Kenya. The species produce good quality gum especially for export market. According to the Kenya Forest Service (KFS) Ecosystem Conservator, Meru County, the full economic potential of the *Commiphora* species is yet to be exploited in the region. In the neighboring Wajir County, the Kenya Forest Service (KFS) Ecosystem Conservator, asserted, in a different study, that gum from *Commiphora* species is the second largest export after livestock in Wajir County. For instance, according to the Wajir Ecosystem Conservator of Forest, gum from *Commiphora myrrh* retails at 800 shillings per Kg while *Commiphora holticiana* goes for 400 shillings per Kg. The gum is usually exported to China and Far East countries mainly to be used in pharmaceutical, paint, cosmetic and confectionaries industries amongst others. According to Wesonga *et al* (2016), gum from *Commiphora holtiziana* retails for Ksh. 100 while for *Commiphora myrrh* goes for Ksh. 500 in Isiolo.

The leaves of *Commiphora* species are not widely eaten by livestock such as cattle, goats, sheep and even many wild game. However, during periods of severe scarcity, they can act as fallback resource. The fruits are edible by a wide range of bird species, monkeys and other small game. At the project area, *Commiphora* species formed part of the diet for camels (Plate 3:33). Generally, camels tend to be generalized in food selection and this behavior affords them a wide range of food base even during periods of scarcity. This assures them high chances of survivorship during drought seasons compared to cattle which tend to be specialized mainly on grasses. According to the residents, during severe droughts, cattle are usually the first victims while camels are usually the last to be affected.



Plate 3:33 Camels browsing on *Commiphora* species along the project area

It is important to note that *Commiphora sp* can be regenerated through vegetative methods by use of cuttings. As such, one of the key uses of the species by the local community at the proposed project area is provision of live fence. The local use the species cuttings to erect live fence around human settlements such as Manyattas. The cuttings are also used as boundary markers. For instance, at Ndumuru market, parcels of land/plot are demarcated using *Commiphora* cuttings (Plate 3:34). Once the cuttings develop roots, they form a permanent boundary fence.



Plate 3:34 *Commiphora* cuttings used as boundary markers at Ndumuru market

***Adansonia digitata* (Baobab tree)**

Adansonia digitata commonly called the baobab tree or African tree of life or *dead-rat tree* (from the appearance of the fruits) or *monkey-bread tree* (the soft, dry fruit is edible) or *upside-down tree* (the sparse branches resemble roots) or in Swahili *mbuyu*, is a dryland tree species native in Africa. It is one of the indigenous tree species highly respected among many African communities due to its cultural importance. In many African communities, it is used as a shrine where different cultural and religious rituals are undertaken. At the project area, only two stems of the species were evident at point (0393517, 001877, 958m a.s.l) near Kachuru market centre. The two trees are very important to the two major ethnic groups (Borans and Merus) along the project area. According to the residents, the tree species is called Yak in Boran and Mitinamba in Meru. The two trees are very important to the two ethnic groups since all the names of their forefathers/ancestors are written on the two trees. Residents were very categorical that under no circumstances should the two trees be cut. Though the two trees are close to the road alignment, they may not be affected by the road construction works.

Prosopis juliflora

At the project area, the species was found intermixed in *Acacia* dominated plant formations at the extreme ends of the project area at the T-Junction and Kulamawe market centre. At Kulamawe, the species occurred as isolated stems or as a cluster of several stems at point (00°34.190', 038°12.006', 729m a.s.l). At the T-Junction (0342856, 0040522, 1087m a.s.l), *Prosopis juliflora* seemed to be aggressively colonizing open spaces around the junction (Plate 3:35).

It is important to note that *P. juliflora* is a dryland species that was introduced into the country in 1980s to combat desertification in dryland regions of Kenya such as the entire North-Eastern Kenya, Baringo, Tana river amongst others. The species has since become invasive in the country. As a typical invasive species, it aggressively colonizes any open gaps or disturbed environments and out-competes the native vegetation in the long run. This explains the reason why the species at the proposed project area is colonizing urban environments of the T-Junction and Kulamawe, which are typically disturbed by human activities. The species is also known to invade water ways causing rivers and streams to change their courses. Though a very important fodder and excellent ground cover in drylands, many local people have a negative attitude towards the species due to its intimidating thorns/spikes, effects on animal teeth and aggressive colonization of grazing lands by replacing native vegetation. When the species invades road sides, it increases the cost of road maintenance because of requirements



Plate 3:35 A thicket of *Prosopis juliflora* at the T-Junction of the project area

3.5.5.3. Farm forestry

In sections of Isiolo County where the project area passes, farm forestry was only evident, around the T-Junction where agricultural farms exist. At Kulamawe locality and its environs, the areas are devoid of farm forestry. Though majority of the residents practice nomadic pastoralism, farm forestry is largely hindered by extreme dry conditions which makes rainfed agriculture a difficult investment. At point (0347122, 0040329, 1077m a.s.l) near the Isiolo military base, agricultural farms exist. The farms are characterized by intercrop of food crops and assorted agroforestry species (Plate 3.35). Key agroforestry species at the farms include *Azadirachta indica* (Mwarobaini), *Mellea volkensii*, *Senna siamea* including fruit trees such *Carica papaya* (pawpaw), *Citrus sinensis* (oranges), *Mangifera indica* (mangoes) amongst others.



Plate 3:36: Farm forestry near Isiolo military base along the project area

3.5.5.4. Urban forestry

In Isiolo County, the project area passes through some sections characterized by tree planting typical of urban forestry. In Kulamawe and its environs, tree planting is only restricted within the market centre. The planted trees appear like isolated stems (Plate 3.37) along the project area. Due to the harsh climatic conditions within the locality, only one species; *Azadirachta indica* (Mwarobaini) and *Mellea volkensii* can survive in the area.



Plate 3:37: Isolated urban forestry trees along the project area at Kulamawe

Around the T-Junction, the section is characterized by intensive urban forestry (Plate 3.38). Heavy urban forestry cover is largely attributed to development activities within the locality. Assorted urban tree species have been planted in residential premises, along the roads and institutions within the vicinity of the T-Junction. The density of urban trees increasing substantially as one moves from the T-Junction towards Isiolo town. However, from the T-Junction towards Kulamawe, urban forestry does not go beyond the Isiolo military base.



Plate 3:38: Urban tree planting at the T-Junction along Isiolo-Kulamawe road

3.5.6. Wildlife resources

According to Ojwang et al (2017), the proposed project area falls under the greater Ewaso Ecosystem which contains large wildlife population of diverse species. The wildlife is concentrated largely within the Laikipia-Samburu-Isiolo-Meru landscapes, which support a diversity of 4-13 species per 25 KM, but landscapes in the rest of the ecosystem hold low wildlife densities and species diversity. The project area falls in a typical savannah woodland/grassland. Such ecosystems form suitable habitats for both big and small game. While the woodland vegetation forms a food source for browsers, the grasslands/open plains provide suitable food source for grazers, hunting sites for carnivores and ecologically suitable niches for bird species. In the two Counties where the project area traverses, wild game exists.

Meru County Integrated Development Plan 2013-2017, notes that Meru National park is one of the gazetted parks in Kenya and a major tourist centre. The Lewa Downs ranch which is privately owned attracts tourists and competitive sports like the cross country, rhino charge and marathon. There are a variety of wildlife such as white elephant, baboons, giraffe, gazelle, buffalos, rhino, cheetah, zebras and different birds' species. These wildlife species are mainly found in the gazetted game parks and forests such as the Meru National Park, Mt. Kenya National Park and Imenti forest. According to KWS warden, Meru County, the proposed project area falls under a wildlife rich zone. Though there exists no gazetted

wildlife reserve in the proposed project area, wild game roam freely in the expansive woodland. Meru National Park lies approximately 90 Km from the proposed project area. Lewa Downs is about 25 km away whereas Shaba National Reserve and Buffalo springs are approximately 30Km and 50Km respectively away from project area. While the Meru National Park is secured by electric fence (Plate 3:39) to reduce human-wildlife conflicts, at the proposed project area, the wild game roam freely and as such, pose challenges to the residents. The Meru National Parks adjoins three national reserves namely Bisanadi, Kora and Mwingi National Reserves.



Plate 3:39 A section of electric fence at Meru National Park

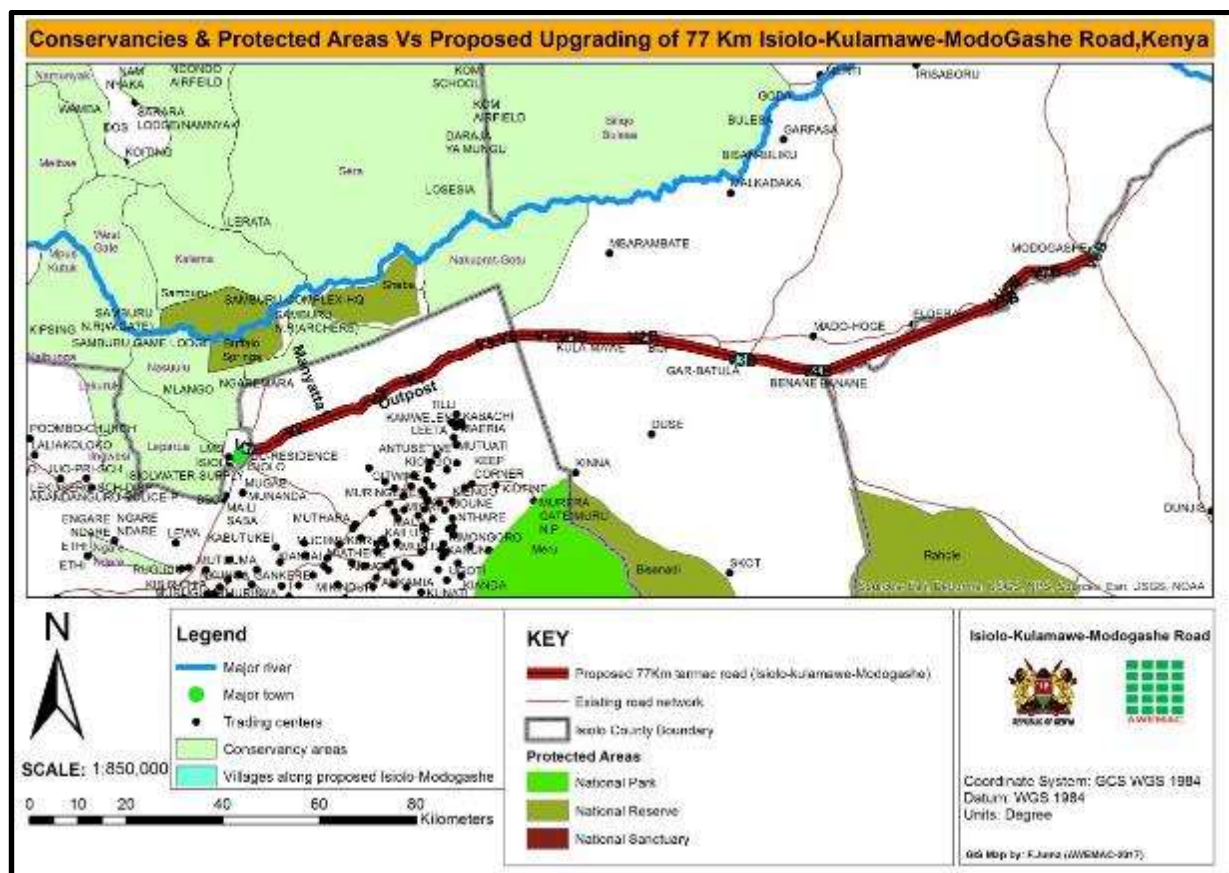


Figure 3:13 Proposed road project verses Conservancies and Protected areas-National Parks, National Reserves

As indicated by Figure 3:13 and 3.14, Isiolo County is generally rich in wildlife resources. The neighborhood Counties of Wajir and Marsabit are equally rich in wildlife resources. According to KWS Warden in Isiolo County, though the project does not pass through gazetted game parks and reserves there are private conservancies under Northern Rangeland Trust and National Reserves – Shaba National reserve and Samburu National- that exist on the outskirts of the project area. According to the Warden, both small and big game disperse and exist outside these protected areas hence can be found in the community land where the project area traverses. According to Isiolo Integrated Development Action Plan 2013-2017, the county has several ranches. Borana Wildlife Conservancy – approximately 50 Km from project area -neighbours Lewa Wildlife Conservancy. The group ranch is used as a breeding ground of Black Rhinos and is a home to 50 indigenous tree families and over 300 species of bird life. Its unique geographic situation makes the 35,000 hectares ranch a haven for a wide diversity of wildlife: buffalo, eland, Jackson's hartebeest and herds of Grant's gazelle, the highly endangered species grevy gazelle, impala and Burchell zebra roam its plains. Other similar conservancies include Leparua Community Conservancy – 20 Km away from the road project, Lekurruki Conservation Trust amongst others.

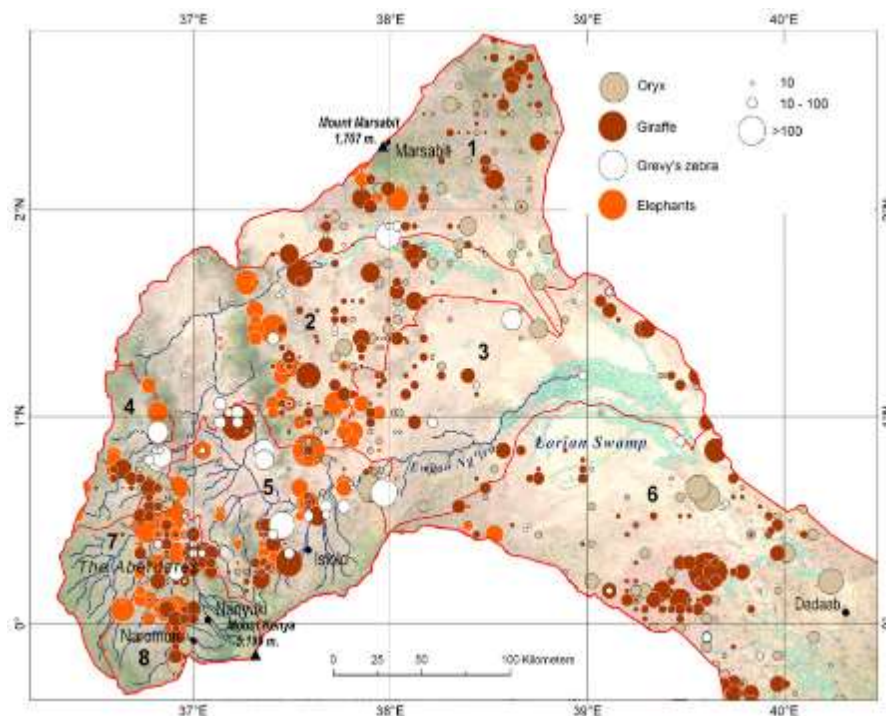


Figure 3:14 Average observed wildlife numbers between 1990–2010

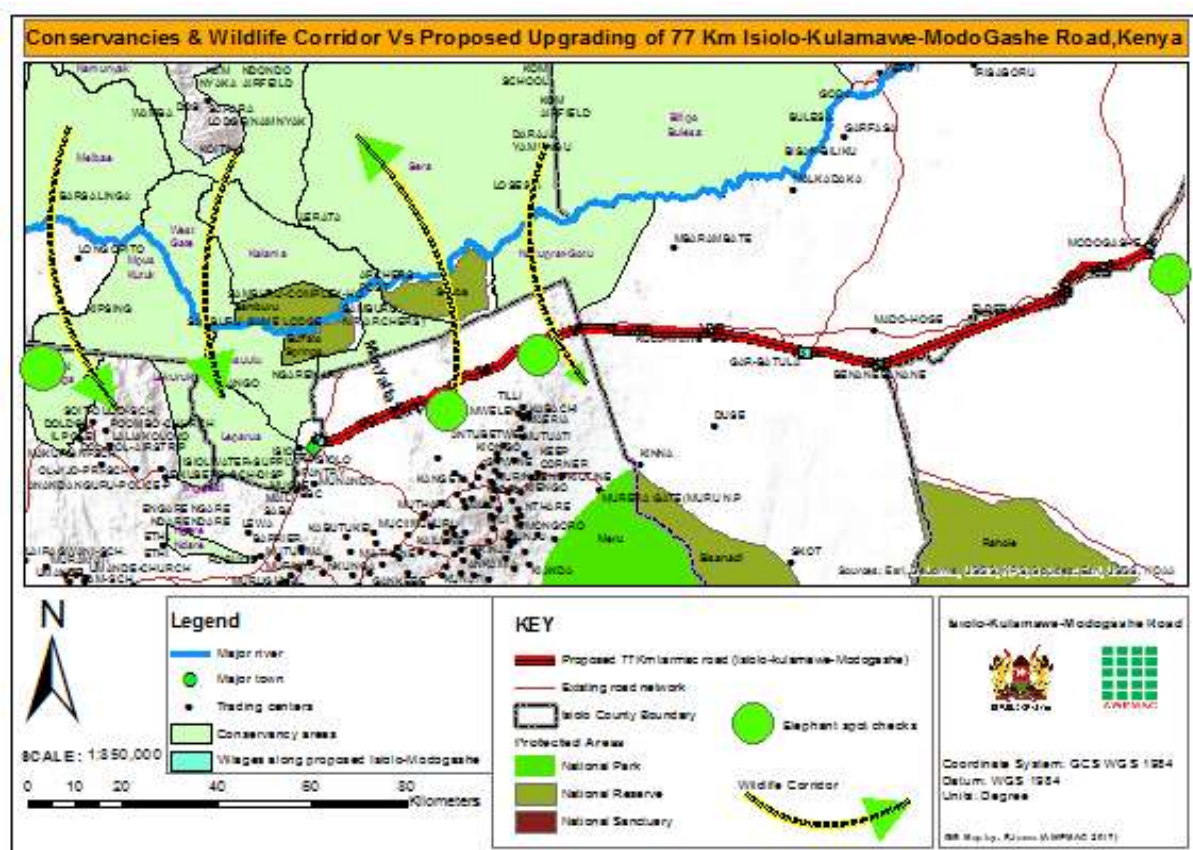


Figure 3:15 Proposed road project showing Wildlife corridors and Wildlife Protected areas

3.5.6.1. Larger wild game

Along the project area, big game freely roams in the locality. Some of the key big game include rhinos, elephants, buffaloes, lions, giraffes, zebras amongst others. Most of the big game traverses the proposed project area occasionally, especially during seasonal migrations from one conservation area to another. In other cases, according residents, big game traverses the project area in search of water.

3.5.6.2. Large wild game diversity and distribution

According to KWS Warden, Isiolo County, the neighborhood conservancies have high diversity of large wild game. Many of the wild game in the conservancies stray to the neighborhood community woodlands occasionally. As such, the density and diversity of large game at the project area and its environs keeps on changing based on wild game movements. The distribution of the big game also depends on the seasonal movements. For instance, during dry seasons when food availability is low in the forests, wild game tends to move out and stray in the neighboring farmlands in search of food. According to the residents, elephants tend to use specific corridors at the project area. Water points also dictates the distribution of the big game. For instance, many big game tend to concentrate along permanent water points such as Ewaso Nyiro River. This distribution is consistent with Ojwang et al (2017) who document that elephant distribution is strongly influenced by resource availability of forage and water, patterns of human land use, and competition and/or conflict with humans.

3.5.6.3. Large wild game seasonal movement

Large game at the project area and its environs have seasonal pattern of movement. The movement is dictated by food and water availability. According to the residents, during dry seasons, big game tends to move from the protected areas to farmlands in search of food. However, during the rainy season when there is luxuriant fodder in the forests, they retreat and are rarely seen in settled areas and farmlands. Similarly, during dry seasons, especially when many areas are facing acute water shortage, big game such as elephants and buffaloes traverse the expansive woodland to Ewaso Nyiro River. Elephants use specific corridors during their movement. For instance, at Ndimuru locality, residents said an elephant corridor exists near Ngathu River (0.459119N 37.837059E). Similarly, at Gambella

locality, residents said two elephant corridors exist shortly before and after the market centre along the project area.

It is important to note that elephants require extensive habitats for survival. According to Ojwang et al (2017), large, contiguous habitats linked by dispersal areas and corridors that provide a high degree of connectivity are critical in sustaining larger elephant populations, which need to be able to migrate between range patches that offer important ecological resources. In Kenya, in most cases, an elephant population's range extends beyond conservation area boundaries, while some populations also have cross-border ranges extending into neighboring countries, including Tanzania, Uganda, South Sudan, and Somalia. Habitat fragmentation driven by development projects and other land use changes poses a serious challenge to continued existence of continuous habitats. According to Ojwang et al (2017), sweeping land use changes over recent decades have affected many ecosystems in Kenya, resulting in the fragmentation and/or loss of wildlife habitats and sharp declines in species populations.

3.5.6.4. Open plains wild game occurrence

An expansive open plain occurs at the project area. The plain is characterized by assorted grass species and isolated trees. Typically, such a plain form a suitable site for a wide range of grazers due to abundant fodder. The open plain is used as a grazing ground by the local people. According to residents, different wild game such as zebras, antelopes (onyx), gazelles, dikdik are common at the open plain (Figure 3.15). The presence of herbivores (livestock and wild game) attracts carnivorous animals thereby completing an ecological food chain. According to the residents, hyenas are the most dominant wild animals at the open plain posing a major challenge to the pastoralist. Wild dogs are also prevalent preying on small livestock and wild game.

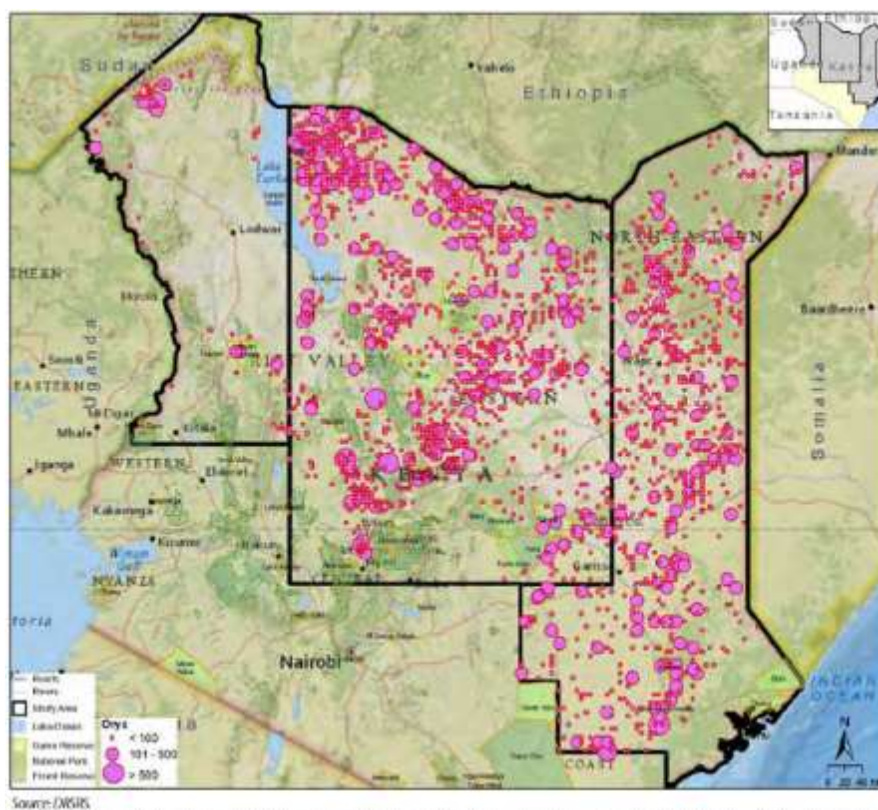


Figure 3:16 Distribution of oryx in the Turkana-Mt. Elgon landscape, the greater Ewaso ecosystem, the north-eastern rangelands, and the north coast terrestrial ecosystems between 1978 and 2011

3.5.6.5. Individual large wild game

3.5.6.5.1. Elephants

Elephants tend to roam freely across the project area. However, the occurrence and population differ based on seasons (Figure 3.16). For instance, during dry seasons when there is scarcity of food resource in the neighbouring parks and conservancies, elephants move out and stray into farmlands.

For instance, at the slopes of Nyambene ranges, farmlands exist. According to residents, during such invasions, elephants cause extensive crop losses. The elephants not only cause damage to crops but also pose dangers to the lives of the locals. For instance, in 2016, an 18-year young man was killed by an elephant in Kulamawe. Similarly, in Ndumuru, a lady was killed by a stray elephant along Ngathu River at the project area. The noted human-elephant conflicts are in line with Ojwang et al (2017) who assert that elephant movement is mainly dictated by availability of food resources and water and sometimes it is difficult to define their range boundaries. For instance, where there are 'hard edges' such as fences or abrupt changes in habitat or land use, it may be possible to define the limits of a population's range, often in relation to incidences of wildlife-human conflict.

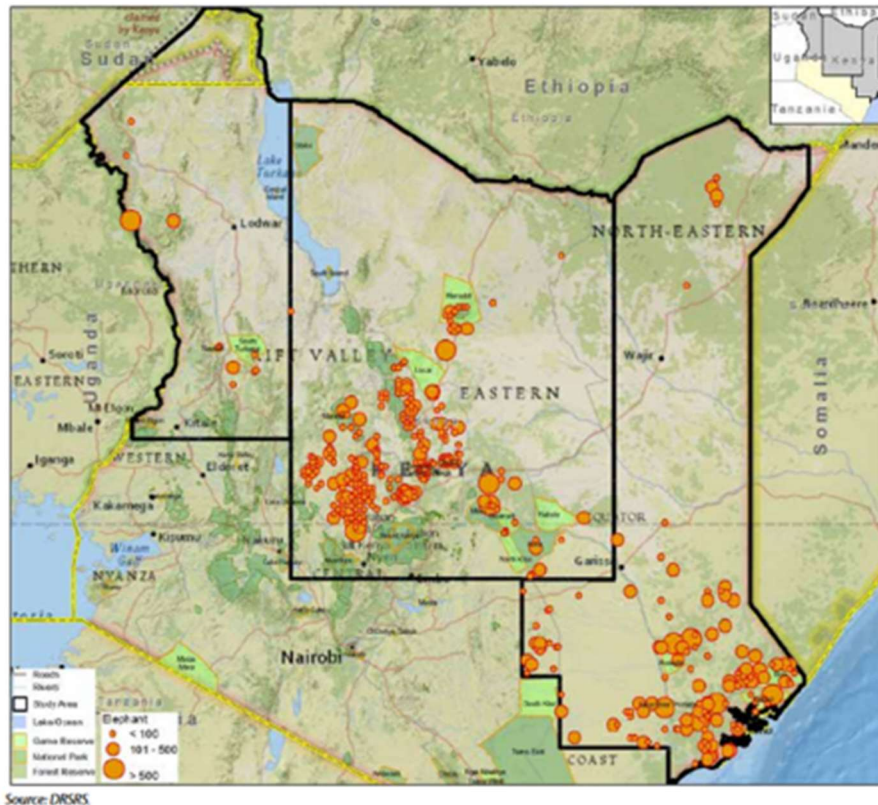


Figure 3:17 Distribution of elephant in the Turkana-Mt. Elgon landscape, the greater Ewaso ecosystem, the north-eastern rangelands and the north coast terrestrial ecosystems between 1978 and 2011

3.5.6.5.2. Buffaloes (*Syncerus caffer*)

The Isiolo County Buffalo Springs and Shaba National Reserves are very rich in terms of buffalo population. Occasionally, the buffaloes move out of the protected areas in search of food and water. During drought seasons, the buffaloes stray to woodlands including farmlands in the locality. Stray buffaloes pose danger to the lives of residents.

3.5.6.5.3. Rhinos

According to residents, rhinos are rarely seen at the proposed project area. However, the neighbourhood Lewa and Borana community conservancies are rich in rhino populations. The Borana Community Conservancy is mainly dedicated to conservation of the black rhino. Lewa is a vast, internationally recognised Unesco World Heritage Site that straddles Meru, Laikipia and Isiolo counties. The Lewa-Borana landscape is the biggest *rhino* sanctuary in Africa with 84 black and 72 white rhinos.

3.5.6.5.4. Giraffes (*Giraffa camelopardalis tippelskirchi*)

Reticulated giraffes roam freely in the expansive woodland that characterizes the project area. The dominant tree species in the woodland such as *Acacia tortilis*, *A. mellifera*, *Balanites aegyptica*, *Commiphora myrrh*, *C. holtiana* amongst others form a key food base for the giraffe. The parks and conservancies in the neighbourhood are rich in giraffe populations.

3.5.6.5.5. Lions

According to the residents, lions occasionally stray in the project area. The lions stray from the Buffalo Springs conservancy and Shaba National Reserve which act as homes not only for the lions but also for the other members of the big five. Stray lions pose danger to livestock and the lives of the residents.

3.5.6.5.6. Small wild game diversity and seasonal occurrence

The project area has a high diversity of small game. Common small game includes gerenuk, antelopes, oryx, lesser kudu, greater kudu, impalas, leopards, wild dogs, baboons, velvet monkeys, bush babies, squirrels and several species of bird life. Small game such as squirrels (Plate 3:40) could be seen crossing the project area.



Plate 3:40 A squirrel crossing the project area at Ndumuru area

Among the small games, hyenas have the highest seasonal fluctuations. Their numbers at the proposed project area tends to be high during periods of extreme droughts. When such droughts occur, extensive livestock deaths occur. The presence of livestock carcasses attracts many hyenas in the proposed project site. According to KWS Warden, Isiolo County, the presence of large groups of hyenas during such drought presents a major challenge since they not only prey on dead livestock but also attack the weakened ones. At Kulamawe locality, according to the residents, a more recent drought resulted to the death of many livestock and thereby attracting many hyenas at the locality. For instance, in grazing fields located at 00°34.310' and 038°11.244' in Kulamawe, remains of dead livestock (Plate 3:41) are a key evidence of effects of the just ended drought in the area.



Plate 3:41 Remains of livestock at Kulamawe at the project area

3.5.6.6. Aquatic wildlife

Aquatic animals such as crocodiles, hippos and fish are restricted in Ewaso Nyiro river. According to residents, Ewaso Nyiro river is one of the permanent water point that supports the wild game during dry seasons. All the streams and rivers that cross the project area are seasonal characterized by extremely high flows during rainy seasons and extremely low or no base flow during dry seasons. However, these seasonal streams and rivers house a wide range of small aquatic animals such as frogs, toads, turtles amongst others. These animals can survive in such seasonal water bodies due to their ability to go into hibernation (i.e capable of over-summering and over-wintering) until conditions returns to normal.

3.5.6.7. Avifauna

Broadly, the proposed project area and its environs are rich in avifauna (Figure 3.17). While some of the bird species are native in the proposed project area, others are migratory species that originate from birdlife sites in the neighbourhood Counties. For instance, Lorian swamp is one among such sites rich in bird species. Other similar sites include Ewaso Nyiro river and the famous Buffalo Springs National Reserve which is rich in species such as Yellow golden palm weaver, rock thrush and the vulturine Guinea fowl amongst others.

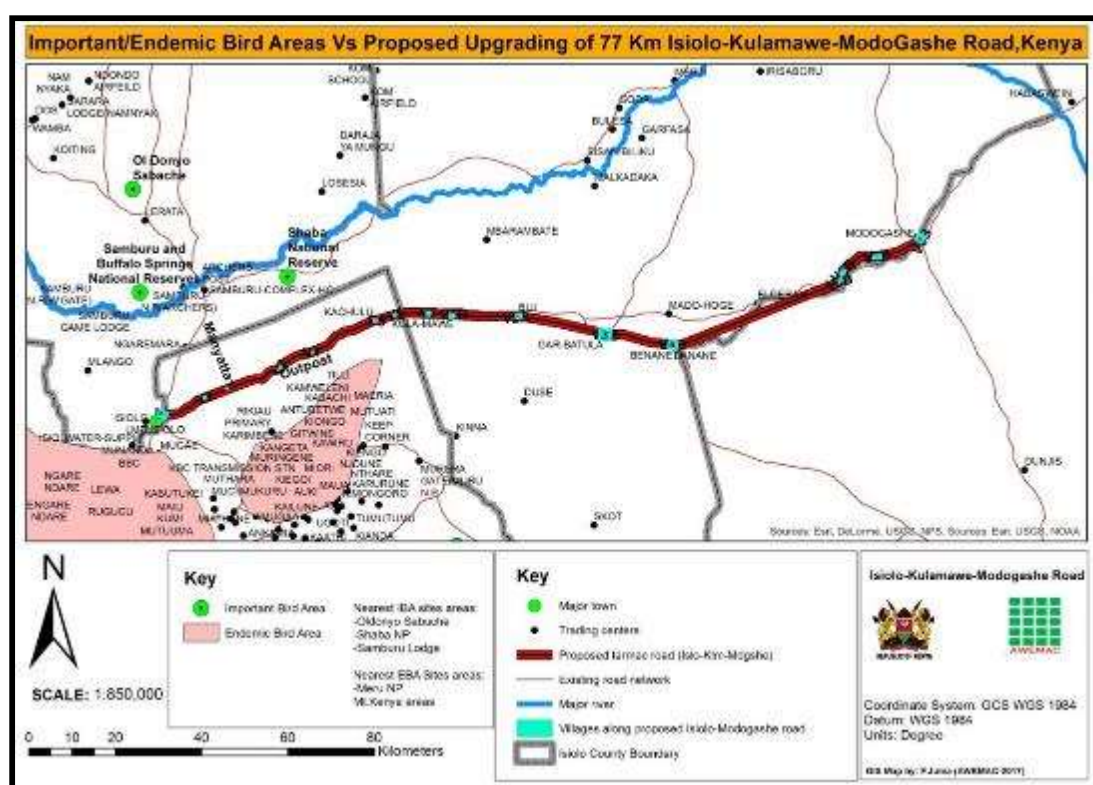


Figure 3:18. Proposed road project verses important and endemic bird areas

3.5.6.7.1. Important bird species

Key bird species in the project area and its environs include Baya weaver (*Ploceus philippinus*), White-browed Coucal (*Centropus superciliosus*), African Cuckoo (*Cuculus gularis*), White-bellied Go-away-bird (*Corythaixoides leucogaster*), Nubian Woodpecker (*Campethera nubica*), Red-bellied Parrot (*Poicephalus rufiventris*), Common Ostrich (*Struthio camelus*), Somali Ostrich (*Struthio molybdophanes*), Somali Bee-eater (*Merops revoilii*), White-throated Bee-eater (*Merops albicollis*), Lilac-breasted Roller (*Coracias caudatus*), Grey-headed Kingfisher (*Halcyon leucocephala*), Laughing Dove (*Streptopelia senegalensis*), Ring-necked Dove (*Streptopelia capicola*), Speckled Pigeon (*Columba guinea*), Emerald-spotted Wood-Dove (*Turtur chalcospilos*), Namaqua Dove (*Oena capensis*), White-headed Mousebird (*Colius leucocephalus*), Yellow-billed Stork (*Mycteria ibis*), Saddle-billed Stork (*Ephippiorhynchus senegalensis*), African Openbill (*Anastomus lamelligerus*), Gray Crowned-Crane (*Balearica regulorum*), Black-faced Sandgrouse (*Pterocles decoratus*), Lichtenstein's Sandgrouse (*Pterocles lichtensteinii*), Common Hoopoe (*Upupa epops*), Northern Red-billed Hornbill (*Tockus erythrorhynchus*), Von der Decken's Hornbill (*Tockus deckeni*), Helmeted Guinea fowl (*Numida*

meleagris), Vulturine Guinea fowl (*Acryllium vulturinum*), Crested Francolin (*Dendroperdix sephaena*), Yellow-necked Francolin (*Pternistis leucoscepus*), Marsh Sandpiper (*Tringa stagnatilis*), Greater Painted-snipe (*Rostratula benghalensis*), Spur-winged Lapwing (*Vanellus spinosus*), Crowned Lapwing (*Vanellus coronatus*), African Spoonbill (*Platalea alba*) amongst others.

3.5.6.7.2. Important bird sites at the project area

An expansive open plain predominated by grasses and isolated trees exist along the project area. The open plain starts at 0.532962N 37.966662E and ends at 0.491679N 37.868341E thus covering several kilometres (Plate 3:42). The plain is a featureless lowland with some sections forming flood plains. The plain provides a suitable habitat for assorted bird species by providing feeding, breeding and sheltering sites.



Plate 3:42 Sections of an expansive open plain at the project area

Ecologically, birds prefer open plains to closed canopy forests due to a number of reasons. One, open plains are characterized by grasses whose seeds form a big part of the birds' diet while the grasses are important for making nests. Secondly, during breeding seasons, male birds prefer open plains with isolated trees on which they can perch and perform dancing and singing rituals to attract the females for mating. Lastly, because of abundance of grasses, open plains are inhabited by a wide range of animals (livestock and wild game) the animals are attacked by a wide range of insects such as ticks, flies amongst other. The insects form another diet for various bird species. In summary, an open plain provides three basic requirements for habitation: food, shelter and breeding.

3.5.6.7.3. Important tree species for bird breeding

Many bird species are very selective in choosing nesting sites. For instance, some species such as Baya weaver (*Ploceus philippinus*), which is the most dominant at the project area, give special preference to *Acacia tortilis* as nesting sites. Female Baya weaver birds are also very selective in choosing male mates. Females go for males that can choose best nesting site and weave a well-crafted nest. This choosiness puts a lot of mating selection pressure on the males to provide good breeding nests to the females. At the project area, nests on acacia trees (Plate 3:43) characterize the entire site. It is important to note that the International Finance Corporation (IFC) has developed comprehensive set of guidelines for safe working *procedures* for relocating bird species during project construction phase. Due to the high presence of nesting sites along the project area, application of the World Bank Safeguards Policies may become important.



Plate 3:43 Baya weaver (*Ploceus philippinus*) nesting on acacia along the road alignment

3.6. Noise quality measurements

During the baseline study and survey conducted, there were no significant noise polluting activities within the project area. For instance, there are no industries along the project area which could otherwise pose noise pollution. Vehicle traffic within the project area is also extremely low and only characterised by motorbikes hence does not pose noise pollution. However, residential and upcoming commercial areas; Kulamawe, Kachuru, Ndumuru and Gambella centres should be monitored due to the several settlements within these areas. The only possible noise pollution would be attributed to land excavations and heavy moving machinery likely to be use during the construction stage. Nonetheless, at the construction stage, it is expected that background noise levels will be monitored periodically both at day and night at sensitive areas such as near schools. Sound level values will be computed and compared with the legal standard permissible limits. These has however been considered and mitigated under the environmental and social management plan and hence will be of minimal impact.

3.7. Air quality

The baseline study and survey conducted established that there were no current air polluting activities within the project area. For instance, vehicle traffic within the project area is extremely low hence does not pose air quality risk. Further, there are no industries along the project area which could otherwise pose air quality risks. The only possible air quality contaminants from the project are dust emissions and Greenhouse gases likely to occur during the construction phase. Dust emissions would be attributed to land excavations and heavy moving machinery whereas Greenhouse gases are likely to be emitted by heavy machinery to be used. These will however be mitigated under the environmental management and social plan and hence be of minimal impact. Nonetheless, it is expected that the effects will not adversely affect the baseline air quality of the project area.

3.8. Radiological baseline measurements

The earth contains natural background radiations originating from terrestrial and cosmic sources. National radiation levels can be significantly modified by human activities and the levels so modified can impact adversely on human health and the environment. In Kenya, research on levels of radionuclides has shown both high and low background radiation levels in different parts of the country. Natural radioactivity varies from one place to another and in other places, there are wider deviations of radioactivity from the normal levels because of abundance of minerals and local geology of each region (UNSCEAR, 2000; Mohanty et. al., 2004). The presence of naturally occurring radionuclides in the environment may result to an external and internal dose received by a population exposed to them directly and via the ingestion and inhalation pathways. Studies (Mohanty et al., 2004) have shown that there are few regions in the world, which are known for high background radiation due to the local geology and geochemical effects that cause enhanced levels of terrestrial radiation.

Radioactivity measurement in the environment is very important in setting the standards and guidelines for the use of soil, building materials, water and vegetation and in assessing the radiation hazard associated with them. The potential health effects associated with exposure to high levels of ionizing radiations have made it necessary for continuous environmental monitoring to ascertain the radioactivity concentrations of ^{226}Ra , ^{232}Th , ^{238}U and ^{40}K in the environment to create awareness to the public and policy makers to ensure that exposure to radiation is as low as reasonably achievable. Due to the absence of existing baseline radiological data in the region, the analysis of the Kenya geological map (1942) showed that there is granitic intrusion on the southern slopes of Nyambene ranges. As such, the geology of the area suggests that the Isiolo-Kulamawe road project will not trigger any known radiological impacts. However, should any radionuclides be detected along the project area due diligence will be followed as per existing legal requirements.

4. Policy legal and institutional framework

4.1. Introduction

The Government's policy on road transport is to provide efficient and reliable road network to spur Socio-economic development and improve security. Under the administrative framework, the National Environment Management Authority (NEMA) is responsible for ensuring that Environmental Impact Assessments (EIAs) are carried out for new projects and environmental audits on existing facilities as per the requirements of the Environmental Management and Coordination Act (EMCA, Cap 387). Projects subject to this requirement are specified in the Second Schedule of the EMCA, Cap 387.

The financing institution (The World Bank) has also developed policies on social and environmental sustainability that calls for positive development outcomes in the public and private sector. To achieve this, the World Bank has developed Safeguards Policies and Procedures against which projects are reviewed and monitored during implementation and operation. The thrust of the Safeguards Policies and Procedures is to ensure that projects financed by the bank are developed in a manner that is socially responsible and reflect sound environmental management practices.

In Kenya, it is a legal requirement that any proposed project of the scale described in this report should undergo an Integrated Environmental and Social Impact Assessment. These requirements are stipulated in the Environmental Management and Coordination Act (EMCA, Cap 387) and EIA/EA Regulations 2003. This section outlines the Policy, Legal and Institutional framework pertaining to the proposed road development project.

4.2. Policy and institutional framework

4.2.1. The Constitution of Kenya of 2010

The Constitution of Kenya has taken onboard various issues that are related to environmental management. Article 42 of the Bill of Rights contained in the Constitution provides that 'every Kenyan has the right to a clean and healthy environment, which includes the right to have the environment protected for the benefit of present and future generations through legislative and other measures'.

Chapter 5 of the Constitution is dedicated to land and the environment. The Constitution requires that land be used and managed in a manner that is equitable, efficient, productive and sustainable. Part 2 of Chapter 5 of the constitution is dedicated to Environment and Natural Resources. Article 69 in Part 2 provides that the state shall provide encourages efforts towards sustainable of natural resources, increasing of the national forest cover public participation in the management, protection and conservation of the environment, protection of genetic resources and biodiversity, environmental impact assessment, environmental audit and monitoring of the environment, etc. The proposed project should ensure compliance with the constitutional requirements in as far as equitable sharing of the resources between various stakeholders is concerned on matters of sustainability of livelihoods and biological resources public participation Resettlement Action Plan among others.

The Kenyan constitution also gives prominence to public participation; as a general national value in environmental protection. Article 69(1) states that the State shall encourage public participation in the management, protection, and conservation of the environment.

4.2.2. National policy framework

The Republic of Kenya has a policy, legal and administrative framework for environmental management. The broad objectives of the national environmental policy in Kenya are: -

- To ensure optimal use of natural resources while improving environmental quality.
- To conserve natural resources such that the resources meet the needs of the present without jeopardizing future generations in enjoying the same.

- To develop awareness that inculcates environmental stewardship among the citizenship of the country.
- To integrate environmental conservation and socio-economic aspects in the development process.
- To ensure that national environmental goals contribute to international obligations on environmental management and social integrity.

To achieve the above policy objectives, it is a policy directive that appropriate reviews and evaluations of all forms of developmental project plans and operations are carried out to ensure compliance with the environmental policy and legal frameworks. The following section provides details on the relevant policies in the country.

4.2.2.1. Sessional Paper No. 10 of 2012 on Kenya Vision 2030

Kenya Vision 2030 is a comprehensive national development plan for period 2008 to 2030. The plan was developed following successful implementation of the Economic Recovery Strategy for Wealth and Employment Creation which ensured the country's economy was back on the path for realization of rapid economic growth since 2002. The country's GDP growth rose from 0.6% to 7% in 2007, but declined to 1.7% and 1.8% in 2008 and 2009, respectively. The objective of the Vision 2030 is to transform Kenya into a middle-income country with a consistent annual economic growth of 10 % by the year 2030. The 2030 goal for urban areas is to achieve "a well-housed population living in an environmentally-secure urban environment." This goal is expected to be achieved by developing basic infrastructure services such as roads, street lights, water and sanitation facilities, storm water drains, footpaths, and others while ensuring that the country has a clean, secure and sustainable environment by 2030 through reduction of pollution and improvement of waste management. The proposed road project will contribute to the realization of the goals of Vision 2030 through improvement of a reliable and efficient road infrastructure facility, provision of employment opportunities, and provision of faster and efficient mode of transport, among others.

4.2.2.2. Environment and Development (Sessional Paper No. 6 of 1999)

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

4.2.2.3. Sessional Paper No. 10 of 2014 on the National Environment Policy

The policy seeks to provide the framework for an integrated approach to planning and sustainable management of natural resources in the country. It recognizes the various vulnerable ecosystems and proposes various policy measures not only to mainstream sound environmental management practices in all sectors of society throughout the country but also recommends strong institutional and governance measures to support achievement of desired objectives and goals.

4.2.2.4. National Environmental Action Plan (NEAP) of 2009-2013

The 1992 Earth Summit held in Rio de Janeiro came up with various recommendations, among them Agenda 21, a Global Environmental Action Plan. The theme of the Summit focused on how nations could attain sustainable development. The Government of Kenya embraced this idea by developing the first National Environment Action Plan (NEAP) in 1994. The NEAP report addresses environmental issues from various sectors in an integrated manner and their significance in development planning. It proposed a strategy for achieving sustainable development in line with Kenya's quest to meet the Millennium Development Goals (MDGs), Vision 2030 and Medium-Term Plan (MTP). The report brings out several proposed interventions, legal and institutional framework to be incorporated into sectoral development plans and programmes. Its implementation is monitored through the Annual State of the Environment Reporting.

4.2.2.5. The National Poverty Eradication Plan (NPEP) of 1999

The National Poverty Eradication Plan (NPEP) was formulated with an objective of reducing the high levels of poverty in Kenya by 50 percent by the year 2015, as well as to strengthen the capabilities of the poor and vulnerable groups to earn income. The plan also aimed at reducing gender and geographical disparities in order to create a healthy, better-educated and more productive population. The formulation of the plan was guided by the goals and commitments agreed during the World Summit for Sustainable Development (WSSD) of 1995. The plan therefore focuses on the delivery of four WSSD themes of poverty eradication; reduction of unemployment; social integration of the disadvantaged people and creation of an enabling economic, political, and cultural environment through development of transport and communication sector. The plan is implemented by the Poverty Eradication Commission (PEC) that was established in collaboration with various Government Ministries, bilateral and multilateral donors, the private sector, Community Based Organizations (CBOs) and Non-Governmental Organizations (NGOs). The NPEP is relevant since the proposed road will create an enabling environment that will contribute immensely in the enhancement of economic growth in Kenya. The proposed project would also impact businesses, agricultural and tourism related activities that have great relevancy to poverty eradication in the country.

4.2.2.6. The Poverty Reduction Strategy Paper (PRSP) of 2000

The Poverty Reduction Strategy Paper (PRSP) for Kenya has the broad objective of reducing poverty and promoting economic growth. This policy articulates Kenya's commitment and approach to tackling endemic poverty through involvement of the poor communities in both rural and urban areas in various socio-economic development activities. The proposed project, during and after implementation will offer various employment opportunities to Kenyans and will therefore contribute directly towards the realization of the broad national goal of reducing poverty in the country. In addition, the project would stimulate economic development by creating an enabling environment for other key sectors of the economy to thrive.

4.2.2.7. The National Biodiversity Strategy of 2000

The National Biodiversity Strategy and Action Plan (NBSAP) was formulated to enable Kenya address national and international commitments defined in Article 6 of the Convention on Biological Diversity (CBD). The strategy is a national framework of action for ensuring that the present rate of biodiversity loss is reversed, and present levels of biological resources are maintained at sustainable levels for posterity. The general objectives of the strategy are to conserve Kenya's biodiversity; to sustainably use its components; to fairly and equitably share the benefits arising from the utilization of biological resources among the stakeholders; and to enhance technical and scientific cooperation nationally and internationally, including the exchange of information in support of biological conservation. The proposed road project will need to comply with the requirements of this strategy since the project may lead to loss of biodiversity in some sections along the proposed route e.g. the Lorian swamp.

4.2.2.8. Sessional Paper No. 3 of 2009 on National Land Policy

The Land Policy in Kenya is guided by the environmental management principles which are aimed at restoring the environmental integrity through introduction of incentives and encouragement of use of technology and scientific methods for soil conservation, among others. The policy further requires fragile ecosystems to be managed and protected by developing a comprehensive land use policy bearing in mind the needs of the surrounding communities. The policy also requires zoning of catchment areas to protect them from degradation and establishment of participatory mechanisms for sustainable management of fragile ecosystems. The policy also called for development of procedures for co-management and rehabilitation of forest resources while recognizing traditional management systems and sharing of benefits with contiguous communities and individuals. Lastly, all national parks, game reserves, islands, front row beaches and all areas hosting fragile biodiversity are declared as fragile ecosystems under the policy.

The policy recognizes that sustainable management of land based natural resources depends largely on the governance system that defines the relationships between people, and between people and resources. To achieve an integrated approach to management of land-based natural resources, all policies, regulations and laws dealing with these resources need to be harmonized with the framework established by the Environmental Management and Coordination Act (EMCA Cap 387).

The policy also addresses land management particularly in Section 3.4.3.2 on ecosystem protection (including wetlands). Measures for protection are required for fragile ecosystems. The policy also calls

for the protection of watersheds, lakes, drainage basins and wetlands. The policy prohibits settlement and agricultural activities in water catchment areas and calls for identification, delineation and gazettement of all water courses and wetlands.

4.2.2.9. Sessional Paper No. 8 of 2012 on National Policy for the Sustainable Development of Northern Kenya and other Arid Lands

In Kenya, the ASAL occupy 89% of the country and are home to about 36% of the population, 70% of the national livestock herd and 90% of the wild game that supports the country's tourism industry. Arid lands of Northern Kenya cover close to 400,000 km² of land but have less than 700 km of tarmac road, most of which is in disrepair. This has an impact on the attraction of investment and communication in the region

Since 2003 the Government has demonstrated renewed commitment to the ASALs, for example through the Economic Recovery Strategy launched in 2003, which recognized 'the important contribution the ASALs can make to national development'. The Government of Kenya is committed to putting in place a holistic policy framework that facilitates and fast-tracks sustainable development in the region, reducing levels of inequality with the rest of Kenya and releasing its potential for the benefit of the nation.

The Government recognizes that Kenya will not achieve sustained growth in her economy and progress as a nation if the ASALs are not appropriately factored into national planning and development. Trickle-down benefits from areas which already have more favourable investment climates have not worked across the country; moreover, the potential for significant growth in these areas is now limited. The Government also recognizes that Kenya will not achieve the goals of Vision 2030 or meet international commitments such as the Sustainable Development Goals (SDGs) if regional inequalities are not addressed. Poverty, inequality and insecurity in one part of the country negatively affect the country as whole. Accelerated investment in ASALs is necessary if all Kenyans are to have an equal chance of sharing in the promise and benefits of Vision 2030. Through appropriate financing, the Government will provide leadership in mobilizing and allocating resources necessary for strengthening the foundations for development, including roads, energy, ICTs, water, education, health and security in ASAL areas.

4.2.2.10. Forestry Policy of 2014

This policy of the government is intended to ensure forests in the country are protected from wanton destruction. The goal of the policy is to increase the area under forest to 10% of the total land area in the country. The proposed road project will therefore be required to be consistent with the Kenya's forest policy. Where clearance of forests or sections of forests is envisaged, it would be important to put in place appropriate mitigation measures such as those specified in the preliminary environmental management plan of this ESIA report.

4.2.2.11. Wildlife Policy of 2011

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

4.2.2.12. Wetlands Policy of 2013

The wetlands policy is intended to promote protection of wetlands in Kenya. The policy sets out strategic measures for the protection of existing wetlands in Kenya. The proposed road has potential of impacting some local wetlands. It would be important to undertake appropriate mitigation measures to minimize or avoid degradation of wetlands.

4.2.2.13. Physical Planning Policy

The current policy governs the development and approval all building plans as provided for in the Physical Planning Act (Cap 286). The proposed project will be subjected to the provisions of this policy and legislation.

4.2.2.14. Public Health Policy of 2014

The public health policy calls upon the project proponents to ensure that buildings are adequately provided with utilities so that they are fit for human habitation. The workers camps must be provided with all amenities/utilities that are essential for safeguarding public health for all people using the facilities.

4.2.2.15. Occupational Health and Safety Policy of 2012

This policy is intended to protect safety and health of workers in work places. The proposed road project will provide employment opportunities to many workers at various categories. The contractor will be expected to comply with the requirements of this policy when engaging workers in various construction activities. The preliminary environmental management provides mitigation measures that can be undertaken to ensure compliance with the requirements of this policy.

4.2.2.16. HIV/AIDS Policy of 2009

The policy identifies HIV/AIDS as a global crisis that constitutes one of the most formidable challenges to development and social progress. The Pandemic heavily affects the Kenyan economy through loss of skilled and experienced manpower due to deaths, loss of man hours due to prolonged illnesses, absenteeism, reduced performance, increased stress, stigma, discrimination and loss of institutional memories, among others. Due to the large number of workers who will be involved in the project and the associated social issues with projects of such as scale, HIV/AIDS has been considered as one of the proposed impacts, but adequate mitigation measures have also been proposed to that effect.

4.2.2.17. Kenya National Policy on Gender and Development (NPGD), 2000

The purpose of the Gender Policy is to institutionalize The Kenya National Policy on Gender and Development (NPGD), within Gender, Children and Social Development. It articulates the policy approach of gender mainstreaming and empowerment of women at the ministry level. The policy seeks a society where women, men, children and persons with disabilities enjoy equal rights, opportunities and a high quality of life. This report has in depth addressed matters to do with gender and development and in the concession period the entire project period the project shall be governed under this principle.

4.2.2.18. The Kenya National Climate Change Response Strategy of 2010

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

4.2.2.19. KeNHA's Environment and Social Safeguards Policy, 2018

The revised policy is set within KeNHA Vision of quality, safe and adequate National Trunk Roads network. It contains the actions KeNHA will take so as to ensure that the Authority activities don't negatively harm the environment and adversely affect the social fabric in communities where it works. Working in an environmentally and socially responsible and safe manner are conditions of employment of contractors for various projects. This policy is therefore targeting all its staff, contractors and other service providers.

4.2.3. Environmental Guidelines

In line with the Kenyan Constitution, NEMA has developed a number of guidelines which are part of a series of environmental management tools for environmental management in Kenya under the Environmental Management and Coordination Act, CAP 387 of the Laws of Kenya. Below is a highlight of the key project relevant guidelines;

4.2.3.1. National Solid Waste Management Strategy, NEMA, 2014.

NEMA developed the National Solid Waste Management Strategy in 2014 as a framework for implementing the Vision 2030 flagship project. The Strategy establishes a common platform for action between stakeholders to systematically improve waste management. It introduces a new approach for improved waste management in Kenya to create wealth, employment and reduce pollution of the environment.

The proposed road project is anticipated to produce waste; the proponent will be required to manage waste as guided by this strategy but in line with Waste Management regulations of 2006 and other relevant legislative frameworks. In general, the project proponent should ensure waste management activities are 7R oriented, by Reducing; Rethinking; Refusing; Recycling; Reusing; Repairing and Refilling waste.

4.2.3.2. Technical guidelines on the management of used oil and oil sludge in Kenya (NEMA, 2014)

The main objective of the guidelines is to ensure effective and efficient collection and transportation systems for used oil. These guidelines target government agencies (responsible for decision making, formulating policies and enforcing health and safety aspects of used oil and oil sludge management in the country), small generators, bulk generators of used oil and oil sludge, garages, used oil treatment plants, recycling and disposal facilities, and other interested stakeholders. The Proponent is envisioned to use heavy machinery which will require servicing hence producing used oil. These guidelines provide direction on safe management of used oil and oil sludge in Kenya and are a main regulatory reference material for management of used oil in Kenya and hence will be used as a key reference point to create awareness on hazards associated with handling used oil and to provide guidance on infrastructure for management of used oil.

4.2.3.3. National sand harvesting guidelines, 2007

These Guidelines apply to all sand harvesting activities in Kenya. This is deemed key to ensure sustainable utilization of the sand resource and proper management of the environment. Since the road project will require use of sand, it is expected that the contractor's sand harvesting activities will be conducted in line with respective legal requirements and guided by these sand harvesting guidelines.

4.3. National environmental legal framework

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

4.3.1. Environmental Management and Coordination Act (EMCA, Cap 387)

The Section Part VI of EMCA, Cap 387 Part II states that every person is entitled to a clean and healthy environment and has the duty to safeguard the same. To achieve this goal, the projects listed under the Schedule No. 2 of EMCA must be subjected to Environmental Impact Assessment (EIA). The aim of EIA is to reduce negative environmental outcomes of the listed projects by implementing mitigation measures. The proposed project falls within the Second schedule and must therefore comply with EMCA requirements in as far as EIA is required. There are also several regulations that have been formulated within the framework of EMCA, Cap 387 that are applicable to the proposed project.

Under EMCA, Cap 387 NEMA has gazetted legal tools that govern conduct of EIAs and general environmental protection. The Proposed Road project has been screened against these tools with results outlined in the table 4.1 below. Detailed analysis of the trigger mechanism and modalities for mitigation are provided in Chapter 7 of this report.

Table 4:1 Analysis of Key EMCA, 1999 Relevant Regulations

Legal Tool	Status	Trigger mechanism/ Relevance to the project
<i>Environmental Management and Co-ordination (Environmental Impact Assessment and Audit) Regulations, 2003</i>	Triggered	ESIA Study must conform to these rules. The proposed project must comply with the requirements of the regulations that also include conducting continuous monitoring and annual audits on the proposed project.
<i>Environmental Management and Co-ordination (Waste Management Regulations, 2006)</i>	Triggered	Construction of the project will generate solid waste hence proper disposal of wastes will need to be observed by the contractor in key areas such as workers camps and the road works.
<i>Environmental Management and Co-ordination (Water Quality) Regulations, 2006</i>	Triggered	Water for construction will be drawn from Rivers and boreholes and there will also be work over rivers when constructing bridges and box culverts
<i>Environmental Management and Co-ordination (Fossil Fuel Emission Control) Regulations, 2006</i>	Triggered	There will be use of vehicles, machinery and equipment that depend on fossil fuel as their source of energy hence contractor must comply with emission levels as highlighted by the regulations.
<i>Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006</i>	Triggered	The proposed road traverses' areas with diverse ecosystems which will need to be protected as per the requirements of this regulation.
<i>Environmental Management and Coordination (Air Quality) Regulations 2014</i>	Triggered	Construction activities, construction crew and facilities such as asphalt and concrete batching plants and quarries are likely to cause air pollution. The Proponent shall implement the mitigation measures proposed to comply with the provisions of these Regulations.
<i>Environmental Management and Co-ordination (Controlled Substances) Regulations, 2007</i>	Triggered	The project contractors will need to ensure that the requirements of this regulation are observed to ensure that equipment, machinery, vehicles and chemicals containing controlled substances are not imported into the country for use in the proposed project
<i>Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009</i>	Triggered	The road crosses the wetlands, and river banks which are valuable water resources along the route. The contractor will need to employ measures for the preservation and conservation of these wetlands and river systems.
<i>Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009</i>	Triggered	The project will involve use of heavy earthmoving equipment and trucks which can generate excessive noise and vibrations. The contractor of the road will have to ensure that no excessive noise and vibrations are made during the construction of the road.

Specifications of these guidelines would require to be captured in the Contracts for Construction to ensure that contractors are legally bound to undertake mitigation alongside general construction work. The EMCA, 1999 regulations likely to be triggered and their relevance in the proposed construction of the road are further reviewed below.

4.3.1.1. Environmental Management and Co-ordination (Environmental Impact Assessment and Audit) Regulations, 2003

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

4.3.1.2. Environmental Management and Co-ordination (Water Quality) Regulations, 2006

The EMCA (Water Quality) Regulations, 2006 provide guidelines on the use and management of water sources to safeguard quality of water for domestic use and irrigation, among others. The proposed project will need to comply with the requirements of this regulation to ensure water sources along the route are protected from pollution and over abstraction. The project will also need to comply with the regulations that prohibit undertaking of development within a minimum of 6m from the highest ever recorded flood level of a river system. Section 4(2), 6 and Section 24 of the regulation prohibits pollution of water bodies and requires that all substances discharged into the water bodies should meet the standards set under the Third Schedule of the regulation.

Everyone is required to refrain from any actions, which directly or indirectly cause water pollution, whether the water resource was polluted before the enactment of the Environmental Management and Coordination Act (EMCA Cap 387). It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings. In response to the above, the project design team should be advised on the requirements of this regulation and appropriately incorporate the regulations in the project design document.

4.3.1.3. Environmental Management and Co-ordination (Fossil Fuel Emission Control) Regulations, 2006

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

4.3.1.4. Environmental Management and Co-ordination (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006

The EMCA (Conservation of Biological Diversity and Resources, Access to Genetic Resources and Benefit Sharing) Regulations, 2006 provides that no person shall engage in any activity that may have an adverse impact on any ecosystem; may lead to the introduction of any exotic species or to unsustainable use of natural resources, without an Environmental Impact Assessment License issued by the Authority under the Act.

The regulation requires NEMA in consultation with the relevant lead agencies, to impose bans, restrictions or similar measures on the access and use of any threatened species to ensure its regeneration and maximum sustainable yield. The proposed road traverses' areas with diverse ecosystems which will need to be protected as per the requirements of this regulation.

4.3.1.5. Environmental Management and Co-ordination (Waste Management Regulations, 2006)

The Waste Management Regulations are basically aimed at streamlining the handling, transportation and disposal of various types of wastes. The broad goal of the regulations is to protect human health and the environment. The regulations place emphasis on waste minimization, cleaner production and segregation of waste at source. The regulations have also classified various types of waste and recommended appropriate disposal methods for each waste type. Under the regulations, NEMA is supposed to license transporters, incinerators, landfills, composers, recyclers and transfer stations. Facilities to be licensed include local authorities, transporters and handlers of various types of waste. The licensing employs a risk-based approach by concentrating on facilities considered to pose a high risk to the environment. The regulations also provide an opportunity for investment in various aspects of waste management. During the construction of the proposed road, proper disposal of wastes will need to be observed by the contractor at the workers camps and the road works. This will ensure good hygiene and healthy working environment for workers. All waste collectors/ handlers will be required to obtain relevant permits/ licenses from NEMA.

4.3.1.6. Environmental Management and Co-ordination (Controlled Substances) Regulations, 2007

The EMCA (Controlled Substances) Regulation is aimed at controlling the production, consumption and, exports and imports of controlled substances. Controlled substances are grouped into three lists as indicated below:

- Group 1 list consists of halogenated fluoro-chemicals with ozone depleting substances.
- Group 2 list consist of hydrobromofluorocarbons with ozone depleting substances.
- Group 3 list consist of bromochloromethane with ozone depleting substances.

Products containing controlled substances include air conditioners, air coolers, refrigerants, portable fire extinguishers, heat pump equipment, dehumidifiers, insulation boards, panels and pipe covers, pre-polymers, etc. The project contractors will need to ensure that the requirements of this regulation are observed to ensure that equipment, machinery, vehicles and chemicals containing such components are not imported into the country for use in the proposed project.

4.3.1.7. Environmental Management and Co-ordination (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009

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

The Act requires wetland resources to be utilized in a sustainable manner compatible with the continued presence of wetlands and their hydrological, ecological, social and economic functions and services. The Act requires special measures to be undertaken to preserve and maintain knowledge innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity in wetlands.

The regulation also calls for sustainable use of wetlands through integration into the national and local land use plans to ensure sustainable use of wetlands in the country. The road crosses the Ewaso Nyiro wetland, among others, which are valuable wetlands and water resources along the route. The contractor will need to employ measures for the preservation and conservation of these wetlands and river systems.

4.3.1.8. Environmental Management and Co-ordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009

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

4.3.1.9. Environmental Management and Coordination (Air Quality) Regulations, 2014

The objective of this regulation is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. It provides for the establishment of emission standards for various sources, including as mobile sources (e.g. motor vehicles) as outlined in the Environmental Management and Coordination Act, Cap 387. It also covers any other air pollution source as may be determined by the Minister in consultation with the Authority.

Emission limits for various areas and facilities have been set. In specific, first schedule of the regulations sets the emission limits of particulate matter for persons operating construction equipment or handling construction material. The regulations provide the procedure for designating controlled areas, and the objectives of air quality management plans for these areas. The Proponent for the road project shall observe policy and regulatory requirements and implement the mitigation measures proposed in this document to comply with the provisions of these Regulations on abatement of air pollution.

4.3.2. The Wildlife Management and Conservation Act 2013

The Wildlife and Conservation Act deals with the conservation and management of wildlife in Kenya. The Act provides that wildlife should be conserved to yield optimum returns in terms of cultural, aesthetic, scientific and economic benefits. The Act requires that full account be taken of the inter-relationship between wildlife conservation and land use. The Act controls activities within the national parks, which may lead to the disturbance of wild animals. Unauthorized entry, residence, burning, damage to objects of scientific interest, introduction of plants and animals and damage to structure are prohibited under this law.

The proposed road traverses' important wildlife areas. The road construction will need to make provisions for the free passage of wildlife. Passage provisions will need to be integrated into the design of the road. The contractor will also need to provide free wildlife passages such as culverts so that the road project does not affect wildlife negatively. KWS shall be consulted on the best road signage and infrastructure that may be required.

4.3.3. Forest Conservation and Management Act, 2016

The Forest Conservation and Management Act, 2016 gives effect to Article 69 of the Kenyan 2010 Constitution about forest resources; to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes. The Act applies to all forests on public, community and private lands. The principles of the Act lay emphasis on (a) good governance in accordance with Article 10 of the Constitution; (b) public participation and community involvement in the management of forests; (c) consultation and co-operation between the national and county governments; (d) the values and principles of public service in accordance with Article 232 of the Constitution; (e) protection of indigenous knowledge and intellectual property rights of forests resources; and (f) international best practices in management and conservation of forests. 5. Public Forest Policy (1) The Cabinet Secretary shall, in consultation with the county government. Further, the act forms the baseline to develop a national forest policy and formulate a public forest strategy for the

sustainable use of forests and forest resources. In addition, the Act, establishes the Kenya Forest Service to conserve, protect and manage all public forests in accordance with the provisions of this Act.

The road project traverses' patches of urban and farm forestry, it is therefore important to ensure community participation as provided for under the Act. The most appropriate would be initiation of participatory forest management in these forest sections so that the local community can have a significant input with Kenya Forest Service (KFS) office playing a coordination role. No trees along the route will be cut before necessary permits are obtained from KFS or county governments.

4.3.4. The Water Act 2016

The Water Act No. 43 of 2016 was assented to on 20th September 2016. The new Act repealed the water Act 2002. The enactment of this law aimed at aligning national water management and water services provision with the requirements of the Constitution of Kenya 2010 particularly on the clauses devolving water and sanitation services to the county governments. Consequently, the new law retained some and established other new institutional arrangements including, Ministry of Water and Irrigation as the sector coordinator, Water Services Regulatory Board (WASREB) for regulation of water services' providers, Water Resources Regulatory Authority (WRA formerly WRMA) for water resource use regulation, National Water Harvesting and Storage Authority for major water infrastructural development, Water Tribunal for dispute resolution, Water Sector Trust Fund for water services development towards the un-served and poor segments of the society in peri-urban and rural areas, Water Works Development Agencies to replace the Water Service Boards, and Basin Water Resources Committees to replace Catchment Advisory Committees (CAACs)

The Act vests provision of water and sanitation services with the county governments through Water Services Providers (WSPs) whose operations must be in accordance with a Service Agreement entered between each WSP and WASREB.

The Act stipulates that a permit shall be required in all cases of proposed diversion, abstraction, obstruction, storage or use of water, with minor exceptions relating to use for domestic purposes (Section.36). Under the Water Act (General) Rules, it is stated that any rights acquired under the permit are subject to the Public Health Act and the Malaria Prevention Act, in addition to the Water Act itself. The Public Health Act has wide-ranging provisions on pollutant discharges, which are set out below.

The Water Act (General) Rules make provision for discharges in a number of respects, as follows:

- Effluent shall not be returned to any body of water unless it has been purified. Further, it must not contain poisonous or injurious matter or excess silt, gravel or boulders.
- Water used for pulping, mulling or washing of coffee shall be efficiently screened.

In line with earlier Acts, Section 36 provides that a permit is required for regulation of water rights and works. A permit is therefore required for any of the following purposes;

- (a) any use of water from a water resource, except as provided by section 37;
- (b) the drainage of any swamp or other land;
- (c) the discharge of a pollutant into any water resource; and
- (d) any other purpose, to be carried out in or in relation to a water resource,

It is however notable that there are instances when a permit is not required. These include the same as before: (a). abstraction or use of water, without the employment of works; from any water resource for domestic purposes by any person having lawful access to the water resource; (b). abstraction of water in a spring which is situated wholly within the boundaries of the land owned by any one landholder and does not naturally discharge into a watercourse; abutting on or extending beyond the boundaries of that land; or (c). storage of water in, or the abstraction of water from a reservoir constructed for the purpose of such storage and which does not constitute a watercourse for the purposes of the Act.

The regulating authority may determine the potential prejudicial effects of the pollutant discharges and order the removal already made. It is an offence to allow effluent discharges, either domestic or industrial, if this would harm fish, and a fish warden may order its removal. Plans for rendering such effluent innocuous shall be submitted to and approved by the enforcing authority.

Additionally, the applicant for a water permit is required to outline the methods to be used for treating effluent before discharge (Form WAB 13, question 18). The permit would only be issued subject to satisfactory provision being made for the treatment of effluent. The Water Act, apart from the Rules, makes only limited provision for controlling water pollution. The provision is limited to the pollution of drinking water.

Under section 145, the water undertaker may make regulations to control polluting activities, which may threaten its source of water. It may itself construct the necessary works for intercepting, treating or disposing of foul water (s.149). Section 158 makes it an offence to pollute such waters. Similarly, under section 169, it is an offence to throw or convey polluting matter into a body of water. All project boreholes and direct extraction from the rivers will require permits from WARMA.

4.3.5. The Agriculture, Fisheries and Food Authority Act of 2013

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

The Act requires the Authority in consultation with the county governments to among others promote best practices. The Cabinet Secretary is required under the Act with the advice of the Authority, and in consultation with the National Land Commission, to provide general guidelines applicable in respect of any category of agricultural land. These land development guidelines are to be implemented by the county governments. In a like manner, the Cabinet Secretary is given powers to make general rules for the preservation, utilization and development of agricultural land and aquatic resources and prescribe national guidelines for soil conservation. Each county government is required to keep a register of land development orders and land preservation orders, which they may issue under this Act. The Act also provides for participation by farmers. This law is important because the project cuts through livestock keeping/ pastoral areas.

4.3.6. Energy Act, 2006

This is an Act of Parliament to amend and consolidate the law relating to energy, to provide for the establishment, powers and functions of the Energy Regulatory Commission and the Rural Electrification Authority, and for connected purposes. 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 of these purposes. This Act is relevant to the proposed road project due to the need to relocate some of the petrol stations situated along the route.

The Act establishes a Commission known as the Energy Regulatory Commission, that among other roles, is expected to regulate (i) importation, exportation, generation, transmission, distribution, supply and use of electrical energy, (ii) importation, exportation, transportation, refining, storage and sale of petroleum and petroleum products; (iii) production, distribution, supply and use of renewable and other forms of energy.

4.3.7. Land Act, 2012.

The Land Act was enacted by Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land-based resources, and for connected purposes. The Act applies to all land declared as (a) public land under Article 62 of the Constitution; (b) private land under Article 64 of the Constitution; and (c) community land under Article 63 of the Constitution and any other written law relating to community land.

The Land Act guarantees security of tenure for land under (a) freehold; (b) leasehold; (c) such forms of partial interest as may be defined under the Act and other law, including but not limited to easements; and (d) customary land rights, where consistent with the Constitution and guarantees equal recognition

and enforcement of land rights arising under all tenure systems and non-discrimination in ownership of, and access to land under all tenure systems.

Under the Lands Act 2012, The Wayleaves Act, Cap 292 and The Land Acquisition Act, Cap. 295 have been revoked but Sections 8 and 9 allow for Compulsory Acquisition as an option in acquiring land for public utility.

4.3.8. The Land Registration Act, 2012

This is an Act of Parliament that revises, consolidates and rationalizes the registration of titles to land, to give effect to the principles and objects of devolved government in land registration, and for connected purposes. The Act requires that there is proper marking and maintenance of boundaries. An interested person who has made an application to the Registrar for his/her boundaries to be ascertained, the Registrar shall give notice to the owners and occupiers of the land adjoining the boundaries in question of the intention to ascertain and fix the boundaries. With regard to the maintenance of boundaries, the Act requires every proprietor of land to maintain in good order the fences, hedges, stones, pillars, beacons, walls and other features that demarcate the boundaries, pursuant to the requirements of any written law.

4.3.9. The National Land Commission Act, 2012 (No. 5 of 2012)

The National Land Commission of Kenya is an independent government commission whose establishment was provided for by the Constitution of Kenya to, amongst other duties, manage public land on behalf of the national and county governments, initiate investigations into present or historical land injustices, recommend appropriate redress, monitor and have oversight responsibilities over land use planning throughout the country. It was officially established under The National Land Commission Act, 2012. The mandate of the National Land Commission is drawn from the National Land Policy of 2009, Constitution of Kenya 2010, National Land Commission Act, 2012, the Land Act 2012 and the Land Registration Act of 2012. Under the National Land Commission Act, the Commission shall among other duties monitor the registration of all rights and interests in land and ensure that public land and land under the management of designated state agencies are sustainably managed for their intended purpose and for future generations. Also, the commission is required to manage and administer all unregistered trust land and unregistered community land on behalf of the county government and develop and encourage alternative dispute resolution mechanisms in land dispute handling and management. The Commission is also required in consultation and cooperation with the national and county governments, to establish county land management boards for the purposes of managing public land.

4.3.10. Community Land Act 2016

The Community Land Act, No. 27 of 2016 (the Act) came into force on 21 September 2016. The Act aims at: 1. Giving effect to Article 63 of the Constitution of Kenya, 2010 (the Constitution) which provides for a classification of land known as community land. To this end, the Constitution provides that community land shall vest in and be held by communities. 2. Providing for;

- The recognition, protection and registration of community land rights.
- The management and administration of community land.
- The role of county governments in relation to unregistered community land and related matters.

The Act repeals the Land (Group Representatives) Act (Chapter 287 of the Laws of Kenya) and the Trust Lands Act (Chapter 288 of the Laws of Kenya). This project shall uphold the requirement of all the relevant land legislations, involving key administrative stakeholders and the affected parties (i.e. the community) facilitating in coexistence with the surrounding community. Most of the land within the project route is community land. Community consultations and consent will be critical during project construction period.

4.3.11. The Environment and Land Court Act, 2011

This is an Act of Parliament to give effect to Article 162(2) (b) of the Constitution to establish a superior court to hear and determine disputes relating to the environment and the use and occupation of land. The Environment and Land Court is one of the Courts contemplated by article 162(2). It is a Superior Court and has the same status as the High Court. The court is established under section 4 of the Environment and Land Court Act No. 19 of 2011. It has jurisdiction to hear any other dispute relating to

environment and land. The jurisdiction of the court is provided under section 13 of the Act. The Court has original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2) (b) of the Constitution and with the provisions of the Act or any other written law relating to environment and land. The court has powers to deal with disputes relating to land administration and management. The court is also empowered to hear cases relating to public, private and community land and contracts or other instruments granting any enforceable interests in land. The court also exercises appellate jurisdiction over the decisions of subordinate courts or local tribunals in respect of matters falling within the jurisdiction of the Court. The court further exercises supervisory jurisdiction over the subordinate courts, local tribunals, persons or authorities in accordance with Article 165(6) of the Constitution.

4.3.12. The County Governments Act 2012

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

4.3.13. Occupational Safety and Health Act 2007

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

Section 16 provides that no person shall engage in any improper activity or behavior at the workplace, which might create or constitute a hazard to that person or any other person. It is thus recommended that all Sections of the Act related to this project, such as provision of protective clothing, clean water, and insurance cover are observed to protect all from work related to injuries or other health hazards. The project shall be registered as a work place for regular inspections from DOSH inspectors. A healthy and safety committee shall be established to undertake implementation of all the provisions of the law.

4.3.14. The Public Health Act (Chapter 242) of Revised Edition 2012

The Public Health Act (Chapter 242) is an Act of Parliament that provides for securing and maintaining good health of citizens. The Act contains directives that are focused on ensuring protection of human health. There are provisions within the Act that deal with water, air and noise quality as they pertain to human health. An environmental nuisance includes the emission from premises of waste waters, gases and smoke which could be regarded as injurious to health. The owner and/or occupier of premises responsible for such nuisances are liable to prosecution under the Act. The construction of the proposed road has potential pollution risks related to water and air. The contractor will need to ensure that air and water pollution is controlled and does not affect people living along the road and even workers residing in various construction camps established all along the route

4.3.15. The Valuers Act (Cap 532), 1985

The revised edition 1985 of the Valuers Act Cap 532 makes provisions for the relevant charges and conducts of valuers in relation to valuation of assets. The Act also provides the relevant regulations and guidelines in the undertaking of the valuation works. The Act requires that adequate valuation is carried out to help meet the actual compensation measures and the market rates and reduce any acts of malice in the exercise. A competent valuer will have to be deployed to site to carry out the professional valuation of assets for compensation.

4.3.16. Physical Planning Act (Cap. 286)

This Physical Planning Act, Cap. 286 provides for the preparation and implementation of physical development plans. Section 36 of the Act provides for environmental impact assessments and states that 'if in connection with a development application a local authority is of the opinion that proposals for industrial location, dumping sites, sewerage treatment, quarries or any other development activity will have injurious impact on the environment, the applicant shall be required to submit together with the

application an environmental impact assessment report'. The proponent and contractors of the proposed road will need to comply with the requirements of this Act

4.3.17. The Penal Code (Cap. 63)

The Penal Code (Cap. 63) chapter on "Offences against Health and Conveniences" strictly prohibits the release of foul air into the environment, which affects the health of other persons. Any person who voluntarily violates the atmosphere at any place, to make it noxious to health of persons in general dwelling or carrying out business in the neighborhood or passing along public ways is guilty of misdemeanor and shall be subjected to imprisonment not exceeding two years with no option of fine. Under this code, any person who for trade or otherwise makes loud noise or offensive awful smell in such places and circumstances as to annoy any considerable number of persons in the exercise of their rights, commits an offence, and is liable to be punished for a common nuisance, i.e. imprisonment not exceeding one year with no option of fine. The contractor of the proposed road will therefore need to ensure that all emissions are controlled during the construction phase of the project to avoid interference on health of the local communities and the workers.

4.3.18. The Employment Act, 2007

The Employment Act, 2007 defines the fundamental rights of employees including the basic conditions of employment of workers. It also regulates employment of children. The contractor on site will have to employ casual labourers probably from the communities where the road traverses during construction.

The basic conditions of employees should be observed to avoid unnecessary conflicts during the construction works. The Contractor shall pay the entire amount of the wages earned by or payable to the workers. Payment of such wages should be done at the end of a working day at or near the place of work. The Contractor shall also ensure that all statutory deductions are submitted without delay to appropriate government agencies e.g. Kenya Revenue Authority, NSSF, NHIF, among others.

4.3.19. Work Injury Compensation Benefit Act (WIBA) 2007

The Work Injury Compensation Benefit Act 2007 provides guideline for compensating employees on work-related injuries and diseases contacted during employment. The Act also requires provision of compulsory insurance for all employees. The Act defines an employee as any worker on contract of service with employer. It will be important for the Contractor of the proposed project to ensure that all workers contracted during the project implementation phase are provided with appropriate insurance covers so that they can be compensated in case they get injured while working.

4.3.20. Public Roads and Roads of Access Act Cap 399

The Public Roads and Roads of Access Act Cap.399 Act states that a public road is any road which the public has a right to use immediately before the commencement of this Act, or all proclaimed or reserved roads and thoroughfares being or existing on any land sold or leased or otherwise held under the East Africa Land Regulations, 1897, the Crown Lands Ordinance, 1902, or the Government Lands Act at any time before the commencement of this Act and all roads and thoroughfares hereafter reserved for public use. The construction of the proposed road will need to take note of the provisions of this Act.

4.3.21. The Traffic Act Cap 403

The Traffic Act reserves the use of the road corridor for road facilities only. Any vegetation grown to protect the road edges should not cause problems during maintenance. Encroachment along the road corridor will have to be checked especially during the operational phase of the project. The Act also spells out conditions for use of roads by motorists, among others. The contractor's vehicles shall comply to all traffic rules in Kenya.

4.3.22. Building Code 2009

This by-law recognizes the county governments as the leading planning agencies. It compels potential developers to submit development applications for the approval. The county governments are hence empowered to approve or disapprove any plans if they do or don't comply with the law, respectively. Any developer who intends to erect a building must give the respective local authority a notice of inspection before the erection of the structure. On completion of the structure, a notice of completion shall be issued by the local authority to facilitate final inspection and approval. No person therefore shall occupy a building whose certificate of completion has not been issued by the county government.

Section 214 of the by law requires that any public building where the floor is more than 20 feet above the ground level should be provided with firefighting equipment that may include one or more of the following; hydrants, hose reels and fire appliances, external conations portable fire appliances, water storage tanks, dry risers, sprinkler, drencher and water spray spring protector system.

Section 194 requires that where sewer exists, the occupants of the nearby premises shall apply to the local authority for a permit to connect to the sewer and all the waste water must be discharged to the sewers. Finally, section 196 provides that the county government may refuse to admit to sewer any trade waste or any other effluent unless it has been treated in an approved manner. In this regard, the county government may cause the occupier of the premise to construct an approved manhole connected to the pipe conveying such effluent. In the development of the project, the proponent will have to comply with the provisions of this Act by complying to the Building code provisions.

4.3.23. The Kenya Roads Act, 2007

This is an Act of Parliament that provided for the establishment of Kenya Road Agencies i.e. Kenya National Highway Authority (KeNHA), the Kenya Urban Roads Authority (KURA) and the Kenya Rural Roads Authority (KeRRA), and provided powers and functions of the authorities.

KeNHA is mandated to manage, develop, rehabilitate and maintain all national roads. Other function vested to this authority relevant to the proposed project are: controlling national roads and road reserves and access to roadside developments; implementing road policies in relation to national roads; ensuring adherence to the rules and guidelines on axle load control prescribed under the Traffic Act (Cap. 403) and under any regulations under this Act; ensuring that the quality of road works is in accordance with such standards; in collaboration with the Ministry responsible for Transport and the Police Department, overseeing the management of traffic and road safety on national roads; collecting and collating all such data related to the use of national roads as may be necessary for efficient forward planning under this Act; monitoring and evaluating the use of national roads; planning the development and maintenance of national roads and liaising and coordinating with other road authorities in planning and on operations in respect of roads.

4.3.24. The Kenya Roads Board Act, 1999

The Act was assented in January 2000. Establishing a board to oversee the road network in Kenya and thereby coordinate its development, rehabilitation and maintenance and to be the principal adviser to the Government on all matters related to Road Development.

The Standard Specifications for Road and Bridge construction has guidelines on environmental protection and mitigation. Standard Specification Clauses 116,117,125,135,137 specifically address protection of the environment, with regard to water, health, safety and accidents, water supply, maintenance of the engineers' staff houses, offices, laboratories, and attendance upon the engineer and his staff. The provisions of these standards and codes must not be contravened during project implementation. These provisions are largely supportive of EMCA, Cap 387 and forms part of the legal basis for environmental mitigation, avoidance, prevention, compensation, restoration and enhancement.

4.3.25. HIV / AIDS Act, 2006

Section 3 of The Act indicated the purpose of the legislation including public awareness and rights to people living with HIV/AIDS. Public awareness shall be achieved through education, public campaigns even at workplaces. This Act's provisions then give the guidelines unto which the project shall follow in educating workers and staff and providing of incentives to combat HIV/AIDs.

4.3.26. Urban Areas and Cities Act No 13 of 2011

This is an Act of Parliament to give effect to Article 184 of the Constitution, to provide for the classification, governance and management of urban areas and cities and to provide for the criteria of establishing urban areas. The Act also provide for the principle of governance and participation of residents of towns and cities. Under the Act a town is an urban area with a population of at least ten thousand residents. Also, under the Act the management of a city and municipality is vested in the county governments. The County Governments may impose such fees, levies and charges for delivery of services by the municipality or the city

4.3.27. The National Gender and Equality Act, 2011

National Gender Equality Commission is a constitutional Commission established by an Act of Parliament in August 2011, as a successor commission to the Kenya National Human Rights and Equality Commission pursuant to Article 59 of the Constitution. NGECE derives its mandate from Articles 27, 43, and Chapter Fifteen of the Constitution; and section 8 of NGECE Act (Cap. 15) of 2011, with the objectives of promoting gender equality and freedom from discrimination.

Gender mainstreaming in road projects ensures that the concerns of women and men form an integral dimension of the project design, implementation, operation and the monitoring and evaluation ensures that women and men benefit equally, and that inequality is not perpetuated.

4.3.28. The Sexual Offences Act, 2006 and its amendment 2012

Observing a standard work ethic is recommended to ensure persons from both genders are not subjected to sexual offences. Ample working environment should prevail in all work places in the project, to be enhanced through implementation of a Sexual Misconduct Policy.

4.3.29. Matrimonial Property Act (No. 48 of 2013)

Matrimonial property is property owned or obtained by either or both married spouses before or during their marriage. It is sometimes called 'matrimonial assets.' Matrimonial property includes the matrimonial home; the home that the couple lived in during their marriage. It also includes many other things, not just physical property like land or houses but also things like the contents of the home, furniture and appliances, vehicles that a couple owns while married, and sometimes other things as well. It may include work pensions that either spouse may have, and certain debts that the parties have.

The law that deals with matrimonial property in Kenya is called the *Matrimonial Property Act*. This act only applies to married couples, or couples who are in a Registered Domestic Partnership. This act does not apply to common law couples.

When a married couple separates, either person can apply to the court to divide property, pensions, or debts. These issues, though, are usually dealt with during a divorce. It is important to speak to a lawyer for advice before dividing property, pensions, or debts. Once a couple is divorced, these issues are usually finished. You usually can't re-open them in the future if you've made a mistake. Compensation during resettlement needs to follow the legal provisions.

4.3.30. Persons with Disability Act, Chapter 133

This act protects the rights of people with disabilities ensuring they are not marginalized and that they enjoy all the necessities of life without discrimination. The act guarantees that (1) No person shall deny a person with a disability access to opportunities for suitable employment. (2) A qualified employee with a disability shall be subject to the same terms and conditions of employment and the same compensation, privileges, benefits, fringe benefits, incentives or allowances as qualified able-bodied employees. (3) An employee with a disability shall be entitled to exemption from tax on all income accruing from his employment.

A person with disability is entitled to exemptions which apply with respect to exemptions and deductions as described in Schedule 42 subsection (2) of the act, among other provisions within this act that should be complied with all parties involved.

4.3.31. Security Laws (Amendment) Act, 2014

This act entails a legal framework and jurisdiction on security matters. It is a constitutional entitlement to live and feel secure from agents that may compromise one's life and safety. Security measures are vital in this project following past terrorist experiences reported in the area; the contractor shall embark on a community policing program to be executed by a competent security firm. It is recommended that the government takes keen interest in providing adequate support to enhance the security of persons involved in this project and the community at large, which will translate to provision of critical intelligence that will trigger a review of the existing security measures and tactics, among other advantages such as security expertise and artillery.

4.4. National institutional / Administrative framework for the proposed project

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

4.4.1. The National Environment Management Authority

The National Environmental Management Authority (NEMA) exercises general supervision and, co-ordination of all matters relating to the environment. NEMA is also the principal instrument of the government in the implementation of all policies relating to the environment. The Authority reviews EIA project and study reports for the proposed projects, visits the project sites to verify information provided in the report and issues EIA licenses if it considers that all the issues relevant to proposed projects have been identified and mitigation measures to manage them have been proposed.

4.4.2. The County and Sub-County Environment Committees

The County and Sub-County Environmental Committees contribute to decentralization of activities undertaken by NEMA. This has enabled local communities to have greater access to environmental management information. It has also enabled the County and Sub-County Environment Committees to conduct quick site visits and review of reports of proposed projects. Since the proposed project traverses through several Counties, the review of the report will be done at a National level for issuance of EIA license. However, it is also recommended that the EIA report should also be reviewed in each of the counties to create awareness and obtain ownership at county level. In fact, it is a practice and legal requirement that the review at County level be done before the ESIA Report is approved to NEMA.

4.4.3. Ministry of Transport, Infrastructure, Housing and Urban Development (MoTIHUD)

MoTIHUD is charged with the responsibility of providing basic infrastructure facilities to the public. These infrastructure facilities include development, rehabilitation and maintenance of the road network in the country. The Ministry will provide funding mechanisms and general guiding policies for this project.

4.4.4. The Kenya Roads Board

The Kenya Roads Board was established in 2000 through an Act of Parliament (The Kenya Roads Board, 1999, No. 7) and mandated to do these functions, among others, to: co-ordinate the implementation of all policies relating to the development, rehabilitation and maintenance of the road network; co-ordinate the development, rehabilitation and maintenance of the road network with a view to achieving efficiency, cost effectiveness and safety; administer the funds derived from the fuel levy and any other funds that may accrue to it; monitor the operations or activities undertaken by road agencies in the development, rehabilitation and maintenance of roads and evaluate, by means of technical, financial and performance audits, the delivery of works and many other.

4.4.5. Kenya National Highways Authority (KeNHA)

The Kenya National Highways Authority (KeNHA) is a State Corporation established under the Kenya Roads Act, 2007 with the responsibility for management, development, rehabilitation and maintenance of national roads of class A, B and C. The proposed road will be managed by KeNHA since it's classified as Class A.

KeNHA has an established Environmental and Social Management Department to facilitate compliance of road projects with the requirements of environmental laws and regulations. This office advises KeNHA projects on various compliance issues. The office also has established linkages with NEMA. Projects contracts should be reviewed by this office directly or through the environment supervisor. Regarding the implementation of the social and economic aspects of the ESMP, it is proposed that the Resident Engineer works closely with the Environmental and Social Manager of KeNHA to ensure compliance to national policies and guidelines.

4.4.6. Directorate of Occupational Safety and Health Services (DOSHS)

The Directorate of Occupational Safety and Health Services (DOSHS) is one of departments within the Ministry of Labour and East African Community Affairs, whose primary objective is to ensure safety, health and welfare of all workers in all workplaces. Unsafe and unhealthy work environment causes accidents, diseases, disasters and environmental pollution that occasion huge economic and social burdens to individuals and enterprises thereby stifling economic and social growth. DOSHS will provide OSH permits for workplaces of the project including campsites and quarries.

4.4.7. Kenya Wildlife Service (KWS)

KWS is a state corporation that was established with the mandate to conserve and manage wildlife in Kenya, and to enforce related laws and regulations. It undertakes conservation and management of wildlife resources across all protected and unprotected areas systems in collaboration with stakeholders. KWS will guide and monitor road construction through animal migratory routes.

4.4.8. Water Resources Authority (WRA)

Water Resources Authority (WRA) is a state corporation established under Section 11 of the Water Act, 2016. Pursuant to Section 6 of the Act, the Authority is an Agent of the National Government responsible for regulating the management and use of water resources. The Water Act, 2016 makes extensive provisions on the Authority's role in regulating the use and management of water resources. WRA was operationalized on 21st of April, 2017 vide Gazette Notice No. 59. However, the Authority has been in existence for 12 years following its establishment under the Water Act, 2002 as Water Resources Management Authority (WRMA). WRA will provide the necessary borehole and water extraction permits from local streams.

4.4.9. Kenya Forest Service (KFS)

KFS is a corporate body established under the Forest Conservation and Management Act of 2016. The Act which was operationalized on 31st March 2017, gave the Service's mandate as "to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socioeconomic development of the country and for connected purposes". The revegetation of areas cleared for the project and material sites will be guided by regional KFS officers, especially in terms of the best tree species.

4.4.10. The National Museums of Kenya (NMK)

Is a state corporation established by an Act of Parliament, the National Museums and Heritage Act, 2006 no. 6 of 2006. NMK is a multi-disciplinary institution whose role is to collect, preserve, study, document and present Kenya's past and present cultural and natural heritage. This is for the purposes of enhancing knowledge, appreciation, respect and sustainable utilization of these resources for the benefit of Kenya and the world, for now and posterity. NMK will provide guidelines in case any discoveries or existing cultural and natural heritage resources within the project area.

4.4.11. National Land Commission (NLC)

NLC manages public land on behalf of the national and county governments, initiates investigations into present or historical land injustices and recommend appropriate redress, and monitor and have oversight responsibilities over land use planning throughout the country. It will undertake a key role in delivering land acquired through compulsory acquisition for the project.

4.4.12. Development partners

The Government of the Republic of Kenya (GoK) has applied for credit from the World Bank towards the cost of the North-Eastern Transport Improvement Project ("NETIP"). The World Bank has existing safeguard policies on social and environmental sustainability that calls for positive development outcomes in the public and private sector. To achieve this, the World Bank has set up operational policies on environmental and social sustainability as well as general and industry specific environmental, health and safety guidelines against which projects are reviewed. As such, this project will follow the Word Bank safeguard policies on environmental and social sustainability to the later.

4.5. World Bank Group Environmental, Health, and Safety Guidelines for Toll Roads

The EHS Guidelines for Toll Roads include information relevant to construction, operation and maintenance of large, sealed road projects including associated bridges and overpasses. Issues associated with the construction and operation of maintenance facilities are addressed in the General EHS Guidelines. Issues associated with sourcing of construction materials are presented in the EHS Guidelines for Construction Materials Extraction, while those related to vehicle service areas are included in the EHS Guidelines for Retail Petroleum. The two important parts of these guidelines are:-

- *Section 1.0 — Industry-Specific Impacts and Management*
- *Section 2.0 — Performance Indicators and Monitoring*

4.6. World Bank Group Operational Policies

The proposed project has been rated Category B under the World Bank Operational Policy on Environmental Assessment (OP4.01), requiring a partial Environmental Assessment (EA). A proposed project is classified as Category B if the potential impacts on the environment are typically site-specific, reversible in nature; less adverse than those of Category A projects and for which mitigatory measures can be designed more readily. Reference has been made to the World Bank Safeguard Policies, and the World Bank Environmental Assessment Source Book Volume II, which provides the relevant sectoral guidelines including the Banks Operation Policies/Bank Procedures.

The objective of the World Bank's 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. Operational policies have often provided a platform for the participation of stakeholders in project design and have been an important instrument for building ownership among local populations.

An analysis of possible triggers of the WB Safeguard Policies by the road project (Table 4.2 below) indicates that the project will trigger 5 out of 11 WB safeguards.

Table 4.2: Analysis of potential triggers to World Bank safeguard policies

World Bank Safeguard Policy	Triggers	Trigger Mechanism
Environmental Assessment (OP4.01)	Triggered	<p>Project must undergo mandatory EIA as specified by OP4.01. The ESIA scoping of the project interventions suggests that the potential environmental and social impacts (especially social) will be moderate substantial due to the nature of proposed activities. The anticipated impacts include impacts on natural habitat, poor air quality, increased noise levels at the project sites, soil pollution and erosion and localized flooding, construction camp impacts, impacts related material sourcing. Road safety concerns (traffic accidents) during construction are likely to be North Eastern Transport Improvement Project (significant, as well as related health and safety construction related impacts.</p> <p>The project is likely to result in land acquisition for road reconstruction and other associated infrastructure. These acquisitions could be public and community land to which the new Community Land Act of 2016 will apply. The World Bank Environmental Assessment category assigned this project is Category B since anticipated impacts are not expected to be sensitive, irreversible and unprecedented; they are likely to be localized, not cumulative and easily manageable. Although the proposed road project alignment is known, the specific sites for</p>

		other ancillary/associated projects such as road side social amenities are yet to be defined.
Natural Habitats (OP 4.04)	Triggered	Project passes a wildlife dispersal area/ wildlife migratory routes for especially elephants
Forestry (OP 4.36)	No trigger	Project does not pass natural forest; likely to affect urban and farm forestry only.
Pest Management (OP 4.09)	No trigger	Project has no known interaction with this trigger
Physical Cultural Resources (OP 4.11)	Triggered	The ESIA has indicated there are Physical Cultural Resources such as Baobab trees, graves and mosques / shrines which the local consider important areas of cultural interest and the project should avoid.
Indigenous Peoples (OP4.10)	Triggered	<p>The project will be implemented in Isiolo and parts of Meru Counties which are geographically and historically marginalized and underserved. The project route is inhabited by pastoralists, and these are regions that exhibit relatively high levels of poverty and social indicators such as access to education, water, mortality rates, etc. that are well below the national average. The project is located in areas where the Government of Kenya considers as vulnerable and marginalized. Given that the majority of the people in these three counties are classified as Vulnerable and Marginalized Groups (VMGs).</p> <p>There are also indigenous communities predominantly identified along the project route: the Meru, the Borana, Somali, and Turkana communities. In this regard, the World Bank Safeguard Policy OP4.10 (Indigenous Peoples) will apply.</p>
Involuntary Resettlement (OP 4.12)	Triggered	<p>The anticipated impacts include land take and involuntary resettlement at the project route, potential loss of employment in nearby commercial facilities, disruption of transportation and utility services, etc.</p> <p>There are people earning their livelihood on the road reserve, which require to be physically relocated or may lose their livelihoods due to project activities. A RAP Report has been prepared which outlines all resettlement issues.</p>
Safety of Dams (OP 4.37)	No Trigger	Project will not involve construction of dams
Projects on International Waters (OP 7.50)	No Trigger	No project activities are planned for in International Waters
Projects in Disputed Areas (OP.60)	No Trigger	There are no internationally disputed sites in the project area.

The safeguard documents already prepared this Environmental and Social Impact Assessment (ESIA) study report and Environmental Management Plans (EMPs) for the project cycle (construction, operation and decommissioning) and a Resettlement Action Plans (RAP) for the road section.

4.6.1. World Bank Operational Policy 4.01-Environmental Assessment

The environmental assessment process provides insights to ascertain the applicability of other World Bank safeguard policies to specific projects. This is especially the case for the policies on natural habitats, pest management, and physical cultural resources that are typically considered within the

Environmental Assessment (EA) process. The policy describes an EA process for the proposed project. The breadth, depth, and type of analysis of the EA process depend on the nature, scale, and potential environmental impact of the proposed project. The policy favors preventive measures over mitigatory or compensatory measures, whenever feasible. The operational principles of the policy require the environmental assessment process to undertake the following:

1. Evaluate adequacy of existing legal and institution frameworks, including applicable international environmental agreements. This policy aims to ensure that projects contravening the agreements are not financed;
2. Stakeholder consultation before and during project implementation;
3. Engage service of independent experts to undertake the environmental assessment;
4. Provide measures to link the environmental process and findings with studies of economics, financial, institutional, social and technical analysis of the proposed project;
5. Develop programmes for strengthening of institutional capacity in environmental management.

The requirements of the policy are like those of EMCA Cap 387, which aim at ensuring sustainable project implementation. Most of the requirements of this safeguard policy have been responded to in this report, by evaluating the impact of the project, its alternatives, existing legislative framework and, conducting public consultations and by proposing mitigation measures for the potential impacts identified.

4.6.2. Bank Operational Policy 4.04-Natural Habitats

This operational policy requires that the EIA study applies the precautionary principle approach to natural resource management to ensure environmental sustainability. The policy requires conservation of critical habitat during project development. To ensure conservation and project sustainability, the policy requires project alternatives to be sought when working in fragile environment areas and key stakeholders to be engaged in project design, implementation, monitoring and evaluation including mitigation planning.

The requirements of this policy were observed as much as possible during the EIA study. The consulting team engaged several stakeholders during project impact assessment process so as to incorporate their concerns and views in the ESIA and Environmental and Social Management Plan. This policy is important because some sections of the proposed project route directly fall within critical and/or protected area category e.g. Ewaso Nyiro flood plain

4.6.3. Bank Operational Policy 4.10: Indigenous Peoples

This policy contributes to the World Bank's mission of poverty reduction and sustainable development by ensuring that the development process fully respects the dignity, human rights, economies, and cultures of Indigenous people. The project planning therefore must involve in-depth consultations with the public all the involve key stakeholders in ensuring the objectives of this policy are attained by (a) avoiding potentially adverse effects on the Indigenous Peoples' communities; or (b) when avoidance is not feasible, minimize, mitigate, or compensate for such effects. The project should also be designed to ensure that the indigenous people receive social and economic benefits that are culturally appropriate and gender and inter-generationally inclusive.

The communities predominantly identified along the transport corridor are: the Meru, the Borana, Somali, and Turkana communities.

4.6.4. Bank Operational Policy 4.11-Physical Cultural Resources

This policy guides in preserving physical cultural resources and helps reduce chances of their destruction or damage. The policy considers Physical Cultural Resources (PCR) to be resources of archaeological, paleontological, historical, architectural, and religious (including graveyards and burial sites), aesthetic or other cultural significance.

The policy is not triggered by this project as during the study there were no observed physical or cultural resources to be affected by the project. Nevertheless, the Contractor is responsible for familiarizing themselves with the following “Chance Finds Procedures”, in case culturally valuable materials are uncovered during excavation, including:

1. Stop work immediately following the discovery of any materials with possible archaeological, historical, paleontological, or other cultural value, announce findings to project manager and notify relevant authorities;
2. Protect artifacts as well as possible using plastic covers, and implement measures to stabilize the area, if necessary, to properly protect artifacts
3. Prevent and penalize any unauthorized access to the artifacts
4. Restart construction works only upon the authorization of the relevant authorities.

4.6.5. Bank Operational Policy 4.12-Involuntary Resettlement

The objective of this policy to avoid where feasible, or minimize, exploring all viable alternative project designs to avoid resettlement. This policy is triggered in situations involving involuntary taking of land and involuntary restrictions of access to legally designated parks and protected areas. The policy aims to avoid involuntary resettlement to the extent feasible, or to minimize and mitigate its adverse social and economic impacts.

This policy covers direct economic and social impacts that both result from Bank-assisted investment projects. The policy is applicable if there will be (a) the involuntary taking of land resulting in (i) relocation or loss of shelter; (ii) loss of assets or access to assets, or (iii) loss of income sources or means of livelihood, whether the affected persons must move to another location; or (b) the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons.

The policy prescribes compensation and other resettlement measures to achieve its objectives and requires that borrowers prepare adequate resettlement planning instruments prior to project appraisal of proposed projects. The objective of this policy to avoid where feasible, or minimize, or explore all viable alternative project designs, to avoid resettlement.

The policy requires the displaced persons and their communities, and any host communities receiving them, are provided timely and relevant information, consulted on resettlement options, and offered opportunities to participate in planning, implementing, and monitoring resettlement. Appropriate and accessible grievance mechanisms should be established for these groups. In new resettlement sites or host communities, infrastructure and public services are provided as necessary to improve, restore, or maintain accessibility and levels of service for the displaced persons and host communities.

This policy will be triggered as the project causes the involuntary taking of land and other assets resulting in:

1. Relocation or loss of shelter;
2. Loss of assets or access to assets;
3. Loss of income sources or means of livelihood, whether the affected persons must move to another location;
4. Loss of land.

4.6.6. World Bank policy on access to information

The World Bank Policy on Access to Information sets out the policy of the World Bank on public access to information in its possession. This Policy supersedes the World Bank Policy on Disclosure of Information, and took effect on July 1, 2010. This Policy is based on five principles:

1. Maximizing access to information;

2. Setting out a clear list of expectations;
3. Safeguarding the deliberative process;
4. Providing clear procedures for making information available;
5. Recognizing requester's right to an appeals process;

In disclosing information related to member countries/borrowers in the case of documents prepared or commissioned by a member country/ borrower (in this instance, safeguards assessments and plans related to environment and resettlement: OP/BP 4.01, Environmental Assessments, and OP/BP 4.12 Involuntary Resettlement) the Bank takes the approach that the Country/Borrower provides such documents to the Bank with the understanding that the Bank will make them available to the public.

4.6.7. Alignment of WB and GOK Policies relevant to this ESIA

Both the World Bank safeguards and Government of Kenya (GoK) legislation are generally aligned in principle and objective:

- i. Both require Environmental Impact Assessment before project design and implementation. This also includes an assessment of social impacts.
- ii. Both require public disclosure of EIA reports and stakeholder consultation during preparation.
- iii. While OP 4.01 of World Bank stipulates different scales of EIA for different category of projects, EMCA Cap 387 requires EIA for all sizes of projects listed in Schedule 2.
- iv. Where EMCA Cap 387 requires Strategic Environmental Assessments, OP 4.01 requires that an Environmental Assessment be conducted depending on the project category while an ESMF should be prepared for municipal projects.
- v. EMCA recognizes other sectorial laws while WB has safeguards for specific interests;
- vi. The Bank requires that stakeholder consultations be undertaken during planning, implementation and operation phases of the project which is consistent to the requirements of EMCA.
- vii. Additionally, statutory annual environmental audits are required by EMCA.

In Kenya, it is a mandatory requirement under EMCA Cap 387 for all development projects (listed in Schedule Two) to be subjected to an EIA study. Thus, under the Laws of Kenya, environmental assessment is fully mainstreamed in all development process consistent with World Bank policies. However, since EMCA provides no minimum size threshold, all projects are screened at identification stage to determine level of environmental assessment required under EMCA. Further, to fully insure against triggers to World Bank safeguard policies, individual investments are screened against each policy as part of the EIA Study.

4.7. International conventions and guidelines

There are number Multi-Lateral Environmental Agreements (MEAs) that are relevant to the proposed project. These are described in the following section.

4.7.1. Vienna Convention on the Protection of the Ozone Layer

This was an Intergovernmental negotiation for an international agreement to phase out ozone depleting substances concluded in March 1985 which saw the adoption of the Vienna Convention for the Protection of the Ozone Layer. This Convention encourages intergovernmental cooperation on research, systematic observation of the ozone layer, monitoring of CFC production, and the exchange of information.

4.7.2. United Nations Convention on Biological Diversity (UNCBD)

The purpose of this convention is to ensure the conservation and sustainable use of biodiversity. Kenya signed the convention on 5th June 1992 and ratified the same on 26th July 1992. The National Environment Management Authority (NEMA) is the National Focal Point to this Convention. The provisions of this Convention have been integrated in many laws of Kenya.

4.7.3. African Convention on the Conservation of Nature and Natural Resources

This convention reaffirms the importance of natural resources both renewable and non-renewable, particularly the soil, water, flora and fauna. The main objective is to facilitate sustainable use of the above resources. The convention was adopted in Algiers on 15th September 1968 and came into force on 16th June 1969.

4.7.4. Convention on International Trade in Endangered Species

This Convention was adopted on 3rd March 1973 and came into force on 1st July 1975. The purpose of the Convention is to regulate the international trade in wild plants and animals that are at risk of extinction because of trade. The Convention seeks to control trade not only in live species but also in dead specimen and their derivatives. The Kenya Government ratified CITES on 13th December 1978. The lead agency for the CITES in Kenya is the Kenya Wildlife Service (KWS).

4.7.5. The World Commission on Environment and Development (The Brundtland Commission of 1987)

The Commission in its 1987 report dubbed "Our Common Future" focused on the environmental aspects of development, the emphasis on sustainable development that produces no lasting damage to the biosphere and to ecosystems. In addition to environmental sustainability is economic and social sustainability. Economic sustainable development is development for which progress towards environmental and social sustainability occurs within available financial resources. While social sustainable development is development that maintains the cohesion of a society and its ability to help its members work together to achieve common goals, while at the same time meeting individual needs for health and well-being, adequate nutrition, and shelter, cultural expression and political involvement. The key aspect of sustainability is the interdependence of generations.

4.7.6. The Ramsar Convention for the conservation and sustainable utilization of wetlands

The Ramsar Convention (formally known as the Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. The proposed Isiolo - Kulamawe road has potential of impacting several wetlands. Appropriate mitigation measures will need to be implemented as detailed in the Environmental Management Plan.

4.7.7. United Nations Convention to Combat Desertification (UNCCD)

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

4.7.8. The 1992 United Nations Framework Convention on Climate Change (UNFCCC)

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

4.7.9. The Paris Agreement

This agreement was adopted on 12th December 2015 at the 21st session of the Conference of the Parties to the United Nations Framework Convention on Climate Change in Paris, it then came into force on 4th November 2016 after meeting the ratification threshold. The Agreement provides the framework to address climate change for a safer and sustainable future, it has an objective of preventing a global temperature increase above 1.5 degrees Celsius relative to pre-industrial levels by reduction of Greenhouse gas emissions. Kenya ratified the Paris Agreement and welcomed it into force on 28th December 2016. As at now a total of 171 parties out of 197 have ratified the agreement.

4.7.10. Rio Declaration on Environment and Development

The Rio Declaration on Environment and Development, often shortened to Rio Declaration, was a short document produced at the 1992 United Nations "Conference on Environment and Development" (UNCED), informally known as the Earth Summit. The declaration aimed at establishing a new and equitable global partnership through the creation of new levels of co-operation among States, key sectors of societies and people, working towards international agreements which respect the interests of all and protect the integrity of the global environmental and developmental system, recognizing the integral and interdependent nature of the Earth, our home. The Rio Declaration consisted of 27 principles intended to guide countries in future sustainable development. It was signed by over 170 countries.

Principle 17 of the Rio Declaration provides key relevance to the proposed project; the principle denotes that environmental impact assessment as a national instrument shall be undertaken for proposed activities that are likely to have a significant impact on the environment and are subject to a decision of a competent national authority.

4.7.11. Earth Summit on Sustainable Development Agenda 21

Agenda 21 is a non-binding, voluntarily implemented action plan of the United Nations regarding sustainable development. It is a product of the Earth Summit (UN Conference on Environment and Development) held in Rio de Janeiro, Brazil, in 1992. It is also regarded as an action agenda for the UN, other multilateral organizations, and individual governments around the world that can be executed at local, national, and global levels. The "21" in Agenda 21 refers to the 21st Century. Agenda 21 Section I on Social and Economic Dimensions is directed toward combating poverty, especially in developing countries, changing consumption patterns, promoting health, achieving a more sustainable population, and sustainable settlement in decision making.

Section II on Conservation and Management of Resources for Development Includes atmospheric protection, combating deforestation, protecting fragile environments, conservation of biological diversity (biodiversity), control of pollution and the management of biotechnology, and radioactive wastes.

Section III focuses on strengthening the Role of Major Groups including the roles of children and youth, women, NGOs, local authorities, business and industry, and workers; and strengthening the role of indigenous peoples, their communities, and farmers. Kenya continues to implement Agenda 21 to support sustainable development through the integration of environmental concerns into the national development policies, plans, and programmes. Also relevant is the implementation of Agenda 17. The proposed project would need to be consistent with the objectives of Agenda 21.

4.7.12. Convention on the Rights of the Child

The Convention on the Rights of the Child (CRC), 1989 is the most comprehensive compilation of international legal standards for the protection of the human rights of children. The CRC is also the most widely ratified international human rights treaty, ratified by all countries in the world, apart from two.

The Convention acknowledges children as individuals with rights and responsibilities according to their age and development (rather than the property of their parents or as victims), as well as members of a family and community. Underlying the Convention are four main principles: non-discrimination, the best interests of the child, the right to life, survival and development and the right to participation.

4.7.13. Convention on the Elimination of all forms of Discrimination against Women

The Convention on the Elimination of all forms of Discrimination against Women (CEDAW) places explicit obligations on states to protect women and girls from sexual exploitation and abuse. Universal Declaration of Human Rights (Article 7), the UN Charter (Articles 1, 13, 55, and 76) and the International Covenant on Civil and Political Rights (Article 24) reaffirm the freedoms and rights of all children, including internally displaced children.

4.7.14. International Labour Organization

The International Labour Organization (ILO) is built on the constitutional principle that universal and lasting peace can be established only if it is based upon social justice. The ILO has generated such

hallmarks of industrial society as the eight-hour working day, maternity protection, child-labour laws, and a range of policies which promote workplace safety and peaceful industrial relations.

The ILO has four principal strategic objectives:

- To promote and realize standards, and fundamental principles and rights at work.
- To create greater opportunities for women and men to secure decent employment.
- To enhance the coverage and effectiveness of social protection for all.
- To strengthen tri-parties and social dialogue.

The key ILO Conventions applicable to the proposed road project include:

- Equal Remuneration Convention (1951) (No. 100) - Calls for equal pay and benefits for men and women for work of equal value.
- Discrimination (Employment and Occupation) Convention (1958) (No. 111) - Calls for a national policy to eliminate discrimination in access to employment, training, and working conditions, on grounds of race, colour, sex, religion, political opinion, national extraction or social origin, and to promote equality of opportunity and treatment.
- Minimum Age Convention (1973) (No. 138) - Aims at the abolition of child labour, stipulating that the minimum age for admission to employment shall not be less than the age of completion of compulsory schooling.
- Worst Forms of Child Labour Convention (1999) (No. 182) - Calls for immediate and effective measures to secure the prohibition and elimination of the worst forms of child labour which include slavery and similar practices, forced recruitment for use in armed conflict, use in prostitution and pornography, any illicit activity, as well as work which is likely to harm the health, safety, and morals of children.

4.7.15. Sustainable Development Goals (SDGs)

The Sustainable Development Goals (SDGs) are a new, universal set of goals, targets and indicators that UN member states will be expected to use to frame their agendas and political policies over the next 15 years. The SDGs include 17 Sustainable Development Goals and 169 targets. The 17 sustainable development goals (SDGs) include

- GOAL 1: No Poverty
- GOAL 2: Zero Hunger
- GOAL 3: Good Health and Well-being
- GOAL 4: Quality Education
- GOAL 5: Gender Equality
- GOAL 6: Clean Water and Sanitation
- GOAL 7: Affordable and Clean Energy
- GOAL 8: Decent Work and Economic Growth
- GOAL 9: Industry, Innovation and Infrastructure
- GOAL 10: Reduced Inequality
- GOAL 11: Sustainable Cities and Communities
- GOAL 12: Responsible Consumption and Production
- GOAL 13: Climate Action
- GOAL 14: Life Below Water
- GOAL 15: Life on Land
- GOAL 16: Peace and Justice Strong Institutions
- GOAL 17: Partnerships to achieve the Goal

The GOALS seek to build on the Millennium Development Goals that expired in 2015. Most notably SDGs are integrated, indivisible and balance the three dimensions of sustainable development: the economic, social and environmental. This road project is expected to cut-across the three dimensions

of sustainable development hence making SDGs a key reference point. The SDGs are also linked to several Kenyan legal frameworks such as Water Act, Forestry Act, and EMCA Cap 387.

4.8. Project ESMP Implementation

4.8.1. Role of Environmental, Health and Safety and Social Experts

The ESIA process culminates with the formulation of a comprehensive Environmental and Social Management Plan. To ensure the latter is fully implemented, the Contractor should be required to hire Environmental, Health and Safety (EHS) and social experts who will continuously advise on EHS and social components of the project implementation. Elements in the environmental and social management plan are expected to be integrated in the project with appropriate consultations with KeNHA through the supervising environmental and social experts. The EHS and social staff of the contractor will also be expected to fully understand the engineering and management aspects of the project for effective coordination of relevant environmental issues listed in the Environmental and Social Management Plan.

4.8.2. Project supervision

The environment supervisor should be appointed by KeNHA (as the project client) to ensure effective implementation of the environmental management plan. It is expected that the project supervisor will engage the services of an EHS and social experts who should master all environmental recommendations and the proposed action plans, timeframes and expected targets. The experts shall be the liaison persons between the contractor and the KeNHA on the implementation of environmental, health, safety and social concerns associated with the implementation of the project.

In brief, we are recommending that the Contractor hires EHS and Social experts. The contract should also provide the role of the Supervision Engineer-EHS Supervisor and Social Supervisors. This team will be undertaking regular monitoring on the project to ensure compliance to the ESMP and WB guidelines and policies.

5. Stakeholder engagement plan and public participation

5.1. Introduction

This chapter describes the process of public consultation and participation that were followed to identify the key issues and impacts of the proposed project. Stakeholder Engagement and Public Participation Process is an integral aspect of successful decision making in the ESIA processes for major developments. Public participation is a key requirement as stipulated in Article 69 Section 1 of the Kenyan Constitution, 2010, Legal Notice 101 of the Environmental Management and Coordination Act (EMCA), 1999, Section 3 of the EIA/EA regulations, 2003 and Section 87 & 113 of the County Governments Act, 2012. Stakeholder Engagement and Public Participation is also necessary for Category 'B' projects provided under World Bank Safeguards Policies. OP/BP 4.01 Environment Assessment requires stakeholder engagement of project affected persons (PAPs) in the preparation/designing and implementation of World Bank financed projects. It is an important process through which stakeholders including beneficiaries and members of public living in project areas (both public and private), are given an opportunity to contribute to the overall project design by making recommendations and raising concerns projects before they are implemented. In addition, the process creates a sense of responsibility, commitment and local ownership for smooth implementation.

5.2. Objectives for consultation and public participation

The general objectives of the consultation and public participation were to:

- Disseminate and inform the stakeholders about the project with special reference to its key components and location.
- Create awareness among the public on the need for the ESIA for the proposed project.
- Gather comments, suggestions and concerns of the interested and affected parties.
- Incorporate the information collected in the ESIA study.

5.3. Methods used for consultation and public participation

The public consultation and participation was conducted through;

1. Household socio-economic survey
2. Key stakeholder interviews
3. Key stakeholder Meeting (Isiolo and Meru)
4. Public Meetings
5. Focused Group Discussions

The procedures used for each of the above are outlined below;

5.3.1. Household socio-economic survey

Household socio-economic surveys were conducted during the field visits. This was done using structured questionnaires (Sample Questionnaire attached in the **Appendix H**) to assess the socio-economic status of the project area.

5.3.2. Key stakeholder interviews

Key Stakeholder Interviews were conducted on 13th to 17th of November 2017. The key stakeholder engagements were conducted to foster better and mutual understanding of public concerns as well as incorporate key stakeholders' opinions to this report.

The following stakeholders were consulted:

- i. County Government Departments
 - a. Public Health Office Isiolo County

- b. Livestock Production Department- Isiolo County
 - c. Lands Department-Isiolo County
 - d. Sub-County Social Development Office- Isiolo County
- ii. KeNHA Isiolo, Ministry of roads and Infrastructure Isiolo County
- iii. County Warden- Kenya Wildlife Service(KWS) Isiolo County
- iv. County Warden- Kenya Wildlife Service(KWS) Meru County
- v. Ecosystem Conservator-Kenya Forest Service-Isiolo County
- vi. Ecosystem Conservator-Kenya Forest Service-Meru County
- vii. Water Resources Management Authority Isiolo and Meru Regional Offices
- viii. District Surveyor- Isiolo County
- ix. District Youth Officer Tigania (Meru County)
- x. Sub-County Livestock Production Office- Imenti North (Meru County)
- xi. KERRA Isiolo Region
- xii. Ewaso Ng'iro North Development Authority Isiolo
- xiii. Envirocane Builders
- xiv. Religious Leaders
- xv. Chiefs and local communities along the project road at the following centres: A2/A10 Isiolo Junction, Muriri/Isiolo Junction, Gambella, Ndumuru, Kachuru, Yaqbarsathi and Kulamawe.

5.3.3. Key stakeholders Consultation Workshop

Key Stakeholders Consultation Workshops were conducted on 15th to 16th of February 2018 at Isiolo and Meru Counties respectively. The engagements were conducted to incorporate key stakeholders' opinions to the study as well as ensure full representation of the respective County Governments.



Plate 5:1 Key stakeholders workshop at Bomen Hotel, Isiolo County

5.3.4. Focused group discussion

FGDs were conducted for specific groups of people such as youth, women and the elderly within the community. A structured guideline was used to get their specific views with regards to the project.

Views from the local community, local leaders, surrounding institutions and development partners for the proposed upgrade of the Isiolo - Kulamawe road, who in one way or another would be affected or have interest in the proposed project were sought through interviews and public meetings as stipulated in the Environment Management and Coordination Act, EMCA Cap 387.

5.3.5. Public meetings

Five public participation meetings were conducted in five urban centers of **Isiolo**, **Gambella**, **Ndumuru**, **Kachuru** and **Kulamawe**. The local chiefs were used to mobilize the public to attend the meetings, at least 150 Public Participation Notices were issued per centre; they were displayed in prominent locations like markets, mosques, churches and schools. The announcements for the meetings were also made in places of worship and chiefs barazas. A total of 620 people (489 Male and 131 Female) participated in the meetings while 162 questionnaires were administered to capture the key concerns of stakeholders along the road corridor. The minutes of the meetings are appended in the appendix of this report.

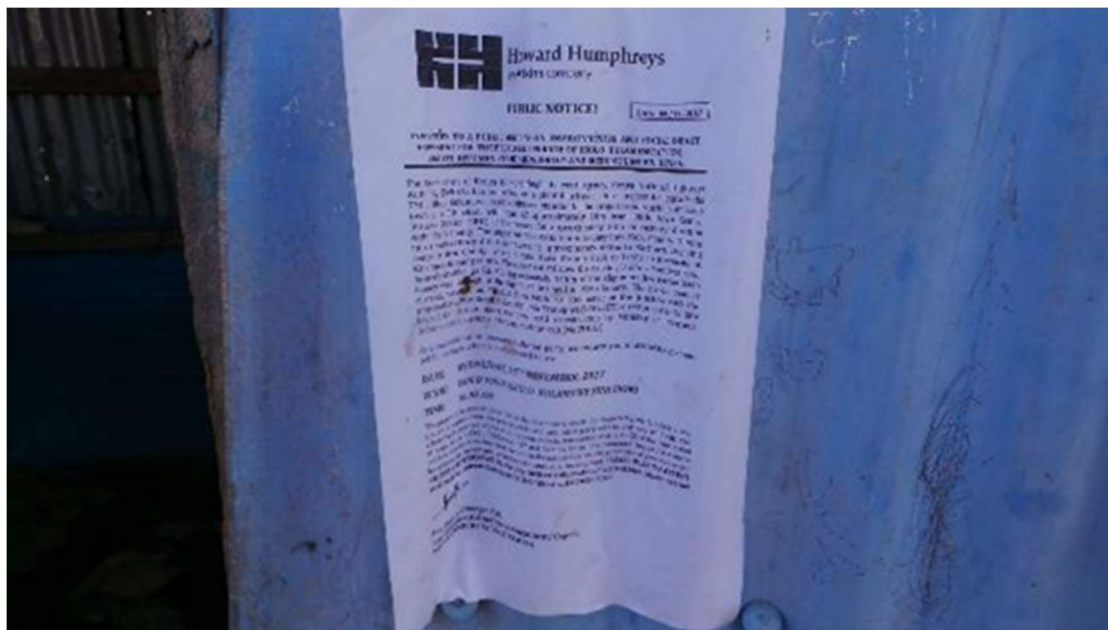


Plate 5:2: A Displayed Public Participation Notice

The table below shows the number of people who attended the Public meetings at each center.

Table 5:1: Summary of the Attendance of Public Participation Meetings

S/No.	Urban Centre	Number of Participants			Date of Meeting
		Male	Female	Total	
1.	Kulamawe	90	2	92	13 th November 2017
2.	Kachulu	118	26	144	13 th November 2017
3.	Ndumuru	64	46	110	14 th November 2017
4.	Gambella	106	27	133	14 th November 2017
5.	Isiolo	111	30	141	15 th November 2017
Total Participants		489	131	620	



Plate 5:3 ESIA Team Leader addressing a public consultative meeting at Isiolo Junction



Plate 5:4: ESIA Team Leader addressing a public consultative meeting at Gambella Centre.



Plate 5:5 A Youth giving their views during a public participation meeting at Ndumuru Centre



Plate 5:6: A lady giving their views during a public participation meeting at Ndumuru Centre



Plate 5:7 A Community Elder airing views during a public participation meeting at Kachuru Centre



Plate 5:8 An elderly person giving his views in a public participation meeting at Kulamawe Centre

5.4. Positive comments obtained during the public consultation meetings:

The following section provides a summary of the positive impacts of the proposed Isiolo –Kulamawe road project as expressed by the stakeholders who were interviewed during the meetings: Appendix C provides the public participation and stakeholder questionnaires obtained.

- **Creation of employment opportunities:** The residents expressed that the construction and operation of the road would lead to job opportunities for locals. During construction, drivers, masons, engineers, steel-fixers, carpenters will gain employment. The stakeholders expressed that priority of employment opportunities for skilled, semi-skilled and unskilled labour should, be given to the local community. Although women highly expressed interest to prepare food for the workers within the project site, a significant number indicated as having equal skills and hence should be considered for all available existing opportunities. In any of the cases, where local community do not have adequate or none of the skilled labour, the communities agreed that such can be sourced from outside the region. It was further agreed that the modalities and quotas for employment for different locations (Kulamawe, Kachuru, Ndumuru and Gambella) be agreed upon by the local community, local administration and the contractor through a local committee.
- **Increased business opportunities:** The public and stakeholders suggested that the road would open the area to investors and this will lead to growth of new and older market centers and towns. There will also be improved transportation of business goods thereby improving business in the area.
- **Improved social infrastructure:** The public explained that the road would lead to growth of water, electricity and telecommunication infrastructure in the area. They also specified that CSR activities such as drilling of boreholes, building of markets, schools will improve the area infrastructure.
- **Faster means of transport:** The public and stakeholders affirmed that the road will result in the shortening of travel time from the current 5 hours (Kulamawe to Isiolo) and reduction of the cost of transportation in the area. This will lead to an increase in the speed of transacting business hence saving money.
- **Cheap / affordable fares:** The members noted that the improved road would reduce hours spent via public means hence resulting to affordable fares.
- **Easy and fast movement of people:** The public noted that the road will result in faster and speedy movements between Isiolo and Mandera.
- **Easy and fast movement of goods:** The locals said that since the road is mainly used to transport perishable goods, they normally face a lot of losses during adverse weather condition. The tarmacking of the road will thus make the road passable in all times of the year making it easy to transport goods.
- **Interaction of people from different communities:** The residents were positive that the road will lead to an influx of people from different places in the area. The road stretch is currently inhabited by people from Meru, Borana, Turkana, Samburu and Somali ethnic communities. The communities said that the interaction of these different communities would lead to a growth of the area and will have many positives than negatives.
- **Growth of towns:** The local community suggested that the road will lead to growth of towns and centers. This will result to development of the area.
- **Potential for increased economic activities:** The residents are optimistic that upon completion of the road project, that more opportunities for business will be realised. Another additional benefit will be improved efficiency of delivery of agricultural produce, livestock to markets within and out of their areas will be more efficient and withstand all weather conditions. Improved roads condition to bitumen standards means that costs of travel from one point to the other will be lowered because of shorter time taken to travel. Break down and maintenance costs associated with roads conditions will also be reduced. This means that the returns to the residents will be higher than the current case
- **Transfer of skills:** The public was optimistic that the construction of the road will bring people of different professions and skills to the area. They noted that these skills would be transferred to local youth in the area. Suggestions were also put for scholarships and trainings to be offered for the locals by the contractor.
- **Improved security:** The community expressed that once complete, the Isiolo -Kulamawe road would enhance accessibility hence improved security surveillance within the region. They

particularly expressed that the security operators take long to respond due to poor road infrastructure.

5.5. Negative concerns of the stakeholders

- **Increased Accidents:** Since the area is inhabited by pastoralists, the public said that animals graze in many areas along the road stretch and these could lead to animal accidents. The locals suggested that to minimize this, Side paths and underpasses such as culverts should be created along the road close to livestock grazing and watering areas so as to minimize accidents, guard rails to be put along dangerous places to avoid livestock from crossing the road at these points, erect speedbumps, and rumble strips near village and town centers and livestock crossing points, signage should be provided throughout the road length and especially in the major towns and villages and construct culverts at strategic points for livestock crossing. The public also stated that public sensitization and awareness on road use and safety should be conducted. This was further affirmed by the consultant.
- **Impact on water resources:** The public had mixed reactions that the road project will lead to competition on the few available water resources that they use for their domestic needs. WRMA Isiolo County Sub-Regional manager highlighted that his office should be consulted prior to drilling of any boreholes or abstraction of any water resource.
- **Noise pollution:** The public stated that construction activities would result to noise pollution. Vibrations and noise from the construction machinery may be excessive and result into noise around and within the area.

The public were notified that the Contractor will abide by the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009 Legal Notice No. 61 and the OSHA, 2007.

- **Dust generation:** The public said that the excavation, quarrying and borrow works during construction will result to air pollution through dust generation.

The consultant assured the residents that the contractor will mitigate air pollution through the sprinkling of water on dusty roads, putting speed limits for vehicles and providing PPEs for the workers.

- **Waste disposal and spoils:** The public stated that the workers campsites, borrow pits and quarries would produce waste and spoils. They stated that the area is free from solid waste pollution and thus the contractor should ensure that they leave the environment clean.

The public were assured that the contractor will dispose all generated waste by ensuring that all waste is properly collected and disposed as per existing legal requirement to ensure a clean and healthy environment for all.

- **Loss of vegetation cover:** The public stated that the road will lead to clearance of vegetation and trees along the road reserve and in areas where borrow pits and campsites will be put. They suggested that the contractor should replant any cut trees and revegetate cleared areas.
- **Loss of pasture for livestock and wildlife:** The public stated that the excavation and construction of the road will result in removal of grass and tree pasture permanently in grazing areas for their livestock. Thus, loss of pasture for both the livestock and wildlife will take place. The excavation of various sites for collection of construction material will result in a permanent loss if the areas are not filled and the tree and grass cover re-established.
- **Displacement of local communities and loss of property:** The public stated that since the RoW for the road is going to be changed to 60m most of their property will be destroyed and many people will be displaced. There was an issue on how compensation will be done since most of them did not have title deeds for their land parcels.

The consultant assured the public that a detailed RAP will be conducted for property valuation and compensation. He further highlighted that Article 63 of the Constitution of Kenya, 2010 (the Constitution) provides for classification of land known as Community land providing for the recognition, protection and registration of community land rights. They were also told that a detailed RAP study will be conducted for property valuation and compensation.

- **Disruption and loss of businesses:** Business people along the sections of the road in Kachuru, Kulamawe, Gambella and Isiolo centers said that the construction of the road will lead to a disruption of their businesses. They said that some of their kiosks will be demolished for the construction of the road.

The consultant assured them that a detailed RAP and valuation study will be undertaken to restore their livelihoods.

- **Cultural erosion:** The public anticipated that the influx of new people and communities in the area because of the road will lead to loss of their cultural values and traditions.
- **Increase in the spread of STD, HIV and AIDS:** The residents along the proposed road corridor expressed concern that there would be an increase in incidences of sexually transmitted diseases including HIV and AIDS especially during construction of the road because of increased prostitution. The project proponent will need to work jointly with appropriate county and national government public health agencies to come up with a comprehensive STD, HIV and AIDs control programme during the construction and operational phases of the project.

5.6. Other concerns

5.6.1. Demand on water resources

This issue was discussed to know how the road will impact on water resources in the area. The WRMA Sub Regional manager suggested that they should be consulted before the drilling of boreholes or abstraction of any water. He further said that the area is water scarce and that all existing water resources along the road should be conserved. The residents said that the contractor should drill boreholes closer to their villages and centres for the water to also benefit the community. All drilled boreholes should be surrendered to the community after the completion of the project.

5.6.2. Safety of road users

The risks of vehicular traffic during construction and operational phases will increase. This is attributed to an expected increase in number of vehicles on the route, and the increased speed once the road construction is done compared to current situation. Measures such as speed bumps, road safety signage and awareness programs to the members of the public and school going children will be put in place for mitigation against risks associated with vehicular traffic. This program will include awareness on how the residents should handle domestic animals

5.6.3. Impact on cultural resources

The public noted that there are baobab trees at Yaqbarsadi area that are engraved with the names of their ancestors and these should be preserved. The locals also suggested that the Mosques within the road reserve should not be destroyed.

The consultant assured the public that no significant cultural resource will be interfered without consultations with the community elders

5.6.4. Impact/ participation of women, youth and marginalized groups

Women, Youth and people living with disabilities said that they should be given special considerations in terms of employment and tenders for the project. The locals suggested that the youth, women and Vulnerable and Marginalized Groups (VMGs) should not be discriminated for any form of work arising during construction. The women were specific that they can do all categories of work (skilled, semi-skilled or unskilled jobs). However, they suggested that food selling businesses should be left for them. The youth said that they should be given priority in training and scholarships.

The public were notified that the Kenya Constitution, 2010 gives attention to women, youth and other vulnerable groups and the contractor will factor in these groups.

5.6.5. Corporate social responsibility and social infrastructure

The public suggested that since the area is a marginalized area and social infrastructure is not developed, the contractor should consider ways of giving back to the community to enhance the development of the area.

The public were notified that the financier has a component for Corporate Social Responsibility and Social Infrastructure as a means for ensuring social development in the area. A budget will be set aside for these activities. The following projects were to be given priority as suggested by the locals:

- **Water:** Construction of boreholes, and water pans since the area is a water stressed area. Gambella farmers suggested that the construction of water pans will help them to move from rain-fed agriculture to irrigation thus shifting from seasonal farming. The Kulamawe residents suggested that boreholes should be drilled at Yaqbarsadi and another area in consultation with the community. Kachuru and Ndumuru people said that the boreholes should be drilled with consultation from the communities.
- **Education:** In many of the public meetings except for Isiolo, the residents suggested that Public Primary and Secondary Schools should be constructed due to lack of educational infrastructure in the area. In Isiolo preference was set on the construction of a Technical Training Institute and University. The public also said that scholarship opportunities should be offered to the locals.
- **Health:** Most of the public lamented that they travel for long distances to seek for medication and the construction of health centres should be prioritized at Kulamawe, Kachuru, Ndumuru and Gambella Centres.
- **Markets:** The residents suggested that markets should be constructed at all the market centres along the road
- **Rehabilitation centre:** The Youth of Isiolo town suggested that a rehabilitation centre should be built in the area due to the prevalence of drug abuse.

The issues raised are summarised in the table below. For a detailed report on the issues that were raised during the public participation and stakeholder engagement meetings, the minutes and questionnaires are appended in **Appendix B** and **C** of this report respectively.

Table 5:2 Summary of key issues raised and response from the consultant

S/N	Key issue raised	Brief explanation of issue	Consultants response
1.	Livestock and Domestic Animals/ Water and Pasture areas	The local community / inhabitants along the road project are mainly pastoralists. They noted that their livestock (cows, camels, goats, sheep and donkeys) graze along the road periphery especially at Kulamawe, Ndumuru, Gambella and Kachuru areas. Based on this, the community expressed fears that speeding vehicles might hit and kill their livestock. They also noted that the road has sharp hills along which their livestock graze hence high likelihood of speeding vehicles hitting their livestock. The community further expressed fears that there are at least six (6) key livestock crossing points between Kachuru and Kulamawe and hence livestock could be hit.	<ul style="list-style-type: none"> ▪ Side paths and underpasses such as culverts should be created along the road close to livestock grazing and watering areas to minimize accidents. (Specific sections to be agreed upon with local elders) ▪ Guard rails to be put along dangerous places to avoid livestock from crossing the road at these points ▪ Erect speedbumps, and rumble strips near Kulamawe centre and livestock crossing points ▪ Signage to be provided throughout the road length and especially in the major towns and villages

2.	Impact on Wildlife and Migratory Routes/ Accidents	<p>The community noted that the road has various wildlife species - elephants, gazelles, dik diks, ostrich, buffalos, giraffes, hyenas, lions and leopards -which could result to wildlife being knocked down by vehicles.</p> <p>The participants expressed that there is an existing elephant corridor / crossing point near Kulamawe Centre with elephants moving from Shaba National Reserve to Meru National Park and vice-versa.</p>	<ul style="list-style-type: none"> ▪ Erect speed bumps to reduce vehicle speeds ▪ Signage to be provided at wildlife corridor points. ▪ Earth embankments will be built ▪ Construction of wildlife underpasses such as culverts at strategic points
3.	Road Safety & Quality	<p>The community feared that since the proposed road will be used by vehicles on high speed, there would be high number of accidents at market centres. They also expressed fears over how their school going children would cross the roads.</p> <p>The residents were concerned that the current road is prone to flooding and hence this would affect the new road leading to its destruction by floods.</p>	<ul style="list-style-type: none"> ▪ Erect road bumps along market centres, and the primary schools along the road to mitigate accidents. ▪ Conduct public sensitization and awareness on road use and safety ▪ Erect road signage and clearly mark the crossing points near markets. ▪ The key consultant explained that the engineers have surveyed the area and have sufficient data on the flood prone areas and have factored that in the road design. Bridges and culverts will be constructed in flood prone areas.
4	Demand on Water Resources (Rivers, streams, boreholes and other water pans)	<p>The participants were concerned that the road project would bring water competition and increased demand on the few existing water sources i.e. boreholes and water pans.</p>	<ul style="list-style-type: none"> ▪ The key consultant explained that the existing water resources will be protected at all cost. He asserted that the contractor will drill boreholes for project use and after project, surrender the boreholes to the community. ▪ Boreholes can be drilled close to the centres to benefit the local community. ▪ The community emphasized that the contractor should consult elders before drilling boreholes or abstracting water for his use due to boarder conflicts and future use of the boreholes.
5.	Impact on Cultural Resources e.g. Graves, shrines, archaeological sites etc.	<p>The locals informed that there are Baobab trees at Yaqbarsadi which are engraved with the names of their ancestors and hence the trees should not be cut.</p> <p>The community feared that mosques close to the road especially at Kachuru and Kulamawe would be destroyed.</p>	<ul style="list-style-type: none"> ▪ Key consultant assured areas of key cultural significance will be assessed with consultations with the elders and not be destroyed. ▪ Any burials sites will be relocated as per consultations with elders. ▪ Road redesigning will be conducted by the engineers to avoid interfering with the mosques.

6.	People, Property and Public resources	The community expressed fears regarding the properties that are within the road reserve since the road RoW will be widened from the current 40m to 60m. The residents also feared that since they do not have title deeds, they were going to lose their land to the road project.	<p>The Team Leader explained;</p> <ul style="list-style-type: none"> Any property or person's land that will be affected by the road widening will be compensated to restore/improve their livelihoods. He further highlighted that Article 63 of the Constitution of Kenya, 2010 (the Constitution) provides for classification of land known as Community land providing for the recognition, protection and registration of community land rights. A Resettlement Action Plan (RAP) to be commissioned Property valuation and compensation Implementation of a public awareness programme Community facilities such as hospitals, schools, mosques will not be demolished before consultations with the community elders.
7	Jobs and Employment	-The public wanted to know how the available job opportunities will be issued. They suggested that locals must be considered for employment first. All ethnic communities available in the project area should be considered for employment. In addition, the local suggested that the contractor should consult with a local community made up of the chief, village elders, women and youth during recruitment.	<p>The consultant noted that;</p> <ul style="list-style-type: none"> The locals will be given priority for any type of available job first. Employment of locals should be prioritized and contractor to exhaust all available locals before hiring from other regions. All ethnic groups within the area will be considered.
8	Impact/ Participation of Women, Youth and Marginalized Groups	<p>The Women and Youth wanted to know how they will gain special consideration from the project. Women suggested that they should not be discriminated from any form of employment and food selling business should be left for them specifically.</p> <p>On the other hand, the youth suggested that they should be offered training opportunities, scholarships and rehabilitation programmes</p>	<p>The following was suggested;</p> <ul style="list-style-type: none"> Women should be considered for all kind of jobs available (skilled, semi- skilled and unskilled), Other jobs could include food selling to road workers and clearing of vegetation Youths will be given priority of employment and offered scholarships for training in technical courses.

9	Quarries and Borrow pits	The public wanted to know how the contractor will acquire land for borrow pits and quarries. They insisted that the contractor should get land that is owned by the community instead of private owned land for the gain of the whole community.	<ul style="list-style-type: none"> ▪ The consultant suggested that the locals will be consulted before excavation of any borrows and quarries. ▪ The land owner on whose land the quarries will be located to be compensated ▪ Preferably the borrow pits should be constructed on community land so as the proceeds could benefit the whole community instead of individuals.
10	Social Infrastructure/ Corporate Social Responsibility	The public expressed concerns that since the area is a marginalized area, the contractor should do programmes that will lead the development of the area. They suggested that key social infrastructure such as schools, water, electricity and hospitals are lacking in the area	<ul style="list-style-type: none"> ▪ The Public was informed that there is a component under the funding of the road that caters for uplifting the livelihoods of the community and development of the project area. <p>The following CSR activities were highlighted as needs in the community;</p> <ul style="list-style-type: none"> ▪ Dispensary – The area requires a healthcare facility that can reduce distance travelled to seek medical attention. Further the health care should offer maternity care. ▪ Security- Community need a vehicle that can be used to facilitate security operation in the region. ▪ Water – the existing (incomplete borehole in Kulamawe) should be completed to assist the local people and their livestock access water. ▪ Market Centres: All the 5 Centres suggested that market centres should be constructed for them. ▪ Rehabilitation Centre: The Isiolo youth suggested that A rehabilitation centre should be constructed due to the prevalence of drug abuse in the area. ▪ Schools: residents of Ndumuru, Kachuru Gambella said that primary and Secondary schools should be constructed in the area. ▪ University/ Technical Training institute: The public in Isiolo said that a University and TTI will result to an improvement of the area.
12	Supply of Goods and Services	The road links the area to other areas of the country such as Mandera, Nairobi Meru, Nanyuki etc. It assists in the transportation of goods and services to and from the area.	<ul style="list-style-type: none"> ▪ The community said that the road assists them to move their farm produce to Isiolo and other places. Gambella has many farmers. ▪ Livestock and livestock products are transported to other parts of the country. ▪ Miraa from Meru and retail goods from other areas in the country are brought into Kulamawe centre and region.

13	Dust Emissions/ Pollution (Noise, Air etc.)	The participants expressed concern over possibility of generation of large amounts of dust which would affect schools and markets within the project site and surrounding areas because of demolition, excavation works and transportation of building materials.	<ul style="list-style-type: none">▪ On Noise Pollution; the public were notified that the Contractor will abide by the Environmental Management and Coordination (Noise and Excessive Vibration Pollution Control) Regulations, 2009 Legal Notice No. 61. <p>The Consultant explained that dust levels at the project site will be minimized through;</p> <ul style="list-style-type: none">▪ Sprinkling of water on dry and dusty surfaces regularly including the access murram roads and diversions.▪ Spraying stock piles of earth with water.▪ Avoiding pouring dust materials from elevated areas to ground.▪ Covering all trucks hauling soil, sand and other loose materials.▪ Providing dust screen where necessary.
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6. Potential environmental and social impacts

6.1. Introduction

The proposed Isiolo - Kulamawe road will have both positive and negative environmental and social impacts. Through an intensive and extensive field survey, key stakeholder consultation and public participation forums conducted on the proposed project area, the impacts were identified. Additionally, literature review of published reports, scientific papers and other approved EIAs on road projects was conducted by the consultant to provide a complete list of expected impacts on the road project. The impacts were categorised according to different phases of the project i.e. construction, operation and decommissioning phases. The magnitude and the extent of the impacts was also quantified by this study. The magnitude of each impact is described in terms of being significant, minor or negligible, temporary or permanent, long-term or short-term, specific (localised) or widespread, reversible or irreversible. Generally, temporary impacts having no obvious long-term consequences are regarded as being minor. But those with long-term repercussions are classified as significant. Significant positive impacts are usually associated with improved access, which is the prime objective of the upgrading project.

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

- I. Biophysical Environment:
 - Biodiversity: Flora and Fauna.
 - Water: hydrology of the area.
 - Land and Soil.
 - Climate and Weather
- II. Social Environment:
 - Population characteristics.
 - Settlement trends.
 - Land use patterns.
 - Health and Safety.
 - Culture.
- III. Economic Issues:
 - Trade and industries.
 - Transportation and communication.
 - Income generation activities.

6.2. Quantification of the magnitude of impacts

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

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

To make the following observation, expert knowledge based on the magnitude of the predicted impacts was relied upon. The scale that was applied in the analysis of impacts is shown in the table below.

Table 6:1; Levels of Scale used in the Analysis of Impacts

Value	Description	Scale Description
0	No impact	This means that to the best knowledge of the expert, the activity/action will not have any known impact on the environment. Such an impact will not in any way affect the normal functioning of either the human or the natural systems and does not therefore warrant any mitigation.
1	Minimal impact	Any activity with little impact on the environment calls for preventive measures, which are usually inexpensive and manageable. Such activities have minimum impacts on either natural or human environment or both.
2	Moderate impact	A moderate impact will have localized effect on the environment. If the effect is negative and cumulative, action in form of mitigation measures needs to be put in place to ensure that it doesn't become permanent and /or irreversible.
3	High impact	An impact is high if it affects a relatively high area (spatial), several biological resources (severity) and/or the effect is felt for a relatively long period (temporal) e.g. more than one year. In case the effect is negative, such an impact needs to be given timely consideration and proper mitigation measures put in place to prevent further direct, indirect or cumulative adverse effects.
4	Very high impacts	Such an activity rates highly in all aspects used in the scale i.e., temporal, spatial and severity. If negative, it is expected to affect a huge population of plants and animals, biodiversity in general and a large area of the geophysical environment, usually having trans-boundary consequences. Urgent and specialized mitigation measures are needed. It is the experts' opinion that any project with very high negative impacts MUST be suspended until sufficient effective mitigation measures are put in place.
5	Not known	There are activities for which impacts are not yet known e.g. some chemicals are suspected to produce carcinogenic effects, but this has not yet been confirmed.

6.3. Positive environmental and social impacts during construction phase

The following are the expected positive environmental and social impacts for the proposed Isiolo-Kulamawe road project during the construction phase:

6.3.1. Creation of employment opportunities

The construction phase of the road, will offer job opportunities for both skilled and unskilled locals in the area. The locals will be employed as casuals, and other permanent consultancy and technical staff during the construction of the road. Civil and structural engineers, masons, carpenters, welders and other casuals will all gain employment during the construction phase of this road. These jobs are expected to improve the economy of the area and improve the livelihoods of the local people. This impact will be very high hence given a value of 4.

6.3.2. Gains in the local and national economy

Through the provision of employment to the locals, income from the salaries and wages will improve the economy of the town centres and the county at large. The contractor is also expected to purchase most of his materials from the project area and as such contribute positively to the local and national economy. The materials for construction will also be sourced from other areas within the nation hence positively affecting the national economy. This impact will be very high hence given a value of 4.

6.3.3. Transfer of skills

During construction of the road, many people from within and without the area will be employed to provide different services. As such, the local people will learn new skills from the civil engineers, welders, masons and other employees that come from outside. This impact will be moderate hence a value of 2.

6.3.4. Provision of market and supply for building materials

The contractor will purchase building materials such as sand, cement etc. from suppliers within or without the area. This impact will be moderate hence a value of 2.

6.3.5. Improvement of local and regional trade and business opportunities

The road will lead to the growth of local and regional trade. In the construction phase, building materials for road construction will be purchased both locally and regionally. Other small-scale business people such as food vendors, kiosk owners will also benefit during the construction of the road. Livestock products will be transported efficiently from the project area to local and regional markets. This impact will be moderate hence value of 2.

6.3.6. Improved security

In the wake of insecurity incidences in the project area, the proposed road project will lead to an improvement of security. There will be a high deployment of police along the project area during the construction. Road patrols will be conducted frequently thereby improving the security of the area. This impact will be very high hence a value of 4.

6.3.7. Corporate social responsibility

The contractor will identify the needful areas in the project area and participate in CSR activities. Some of the noted problems in the area are: unavailability of water, poor education and health infrastructure, among others. Therefore, the contractor is expected to assist in any of these areas as part of CSR. Further, material sites such as borrow pits may serve as water collection points. As part of corporate social responsibility, the contractor will construct additional water points such as earth pans, boreholes amongst others. These water points will also ecologically benefit the wildlife in the locality. This impact will be high hence a value of 4.

6.4. Negative environmental and social impacts during construction phase

The likely negative environmental and social impacts during the construction phase of the project are:

6.4.1. Noise pollution and excessive vibrations

Because of excavation, construction and demolition works, there will be high noise and vibration levels in the project area. Noise and vibrations will emanate from transportation vehicles, construction machinery, metal grinding and cutting equipment, and among others. Excavation works will also cause vibration and noise. Quarries and borrow pits that will be used for sourcing of road construction material will also result to noise emissions. However, the proponent is expected to take appropriate steps to minimize noise pollution through provision of appropriate personal protective equipment to construction workers, minimizing the frequency of transport of construction materials and ensuring that all construction machinery is well maintained, all quarries and borrow pits will be subjected to independent Environmental Impact Assessment (EIA) studies. This impact will be moderate hence value of 2.

6.4.2. Air pollution due to dust and exhaust emissions

In the construction phase, the excavations, demolitions, and transportation of building materials will result in the emissions of large amounts of dust within the project site and surrounding areas. Asphalt, concrete and batching plants are also possible sources of dust and air pollution within the project area. The diversion of traffic in the construction phase will also contribute to dust emissions. The contractor is expected to conduct separate EIAs for the batching plants and monitor the dust levels periodically as stipulated in the Environmental Monitoring Plan, he will also minimise this through sprinkling water on daily basis on the areas that transport trucks use, excavated areas and the diversion routes. This impact will be moderate hence value of 2.

6.4.3. Increased generation of solid waste

Volumes of solid wastes will be produced during the different phases of the project development. Solid waste materials will be generated during demolition works as well as from various packaging materials. Milling of the first few kilometres from Isiolo T-Junction is expected to produce asphalt waste. Significant quantities of rock and soil materials will be generated from earth moving during construction activities. Solid waste generation during operation and maintenance activities will include road resurfacing waste (e.g. removal of the old road surface material), road litter, illegally dumped waste, or general solid waste from campsites; vegetation waste from the clearance of road reserves; and sediment and sludge from storm-water drainage system. Paint waste may also be generated from road and bridge maintenance (e.g. due to removal of old paint from road stripping and bridges prior to re-painting). The contractor would need to ensure that all solid wastes are collected and disposed appropriately to promote a clean and healthy environment along the transport corridor, a storm-water management plan that has been provided in this report should be adhered to. The contractor shall comply with recommendations of solid waste management provided in the ESMP. This impact will be moderate hence a value of 2.

6.4.4. Increased energy consumption

The construction of the proposed Isiolo- Kulamawe road is expected to lead to an increase in traffic between Isiolo and Meru. Also, most of the traffic will be flowing faster. It is thus expected that this will lead to increased consumption of fossil fuel particularly petrol and diesel. It is also expected that there will be high consumption of fossil fuels due to the high number of construction machinery and trucks that will be deployed in the project. At construction, wood may be consumed in the melting of bituminous products. Substantial quantities of bitumen will be utilised, the quantities of wood required are therefore likely to be significant. Subsequently, workers at campsites might also do tree logging to produce charcoal for their cooking and heating needs at the campsite. This impact will be moderate (value of 2) in view of the measures that will be put in place to reduce consumption of fossil fuels.

6.4.5. Discharge of wastewater, sewage and degradation of water quality

There will be an increase in the generation of wastewater and sewage during the construction phase of the project. The increases will take place at construction camp sites and in various towns located along

the road. This is attributed to increased activities in these towns. There will be impact due to oil spillage, disposal practices of used oil, oil filters during the construction of the project. This impact will be moderate hence a value of 2.

6.4.6. Water abstraction and consumption

During the construction of the road, there will be increased abstraction of water from several seasonal streams and from groundwater resources. This may reduce the flow of the few available streams in an area which is generally arid and semi-arid. This may further reduce availability of water to the local communities including possibility of degrading aquatic ecosystems due to reduction in base flows. This impact will be moderate hence a value of 2.

6.4.7. Modification of hydrology

The increased water abstraction from rivers and wetlands may modify the hydrological characteristics of these water bodies. Also, quarries and pits for extraction of road construction materials (ballast, soil, etc.) may provide localized areas for surface water infiltration with the possibility of recharging groundwater aquifers. However, water collecting in such open pits may also provide a large surface for the evaporation of water. Surface runoff may also accumulate along the sides of the highway preventing direct flow to river channels. This impact will be low hence a value of 1.

6.4.8. Generation of storm water and impact on drainage

Construction or widening of sealed roads increases the amount of impermeable surface area, which increases the rate of surface water runoff. The project will also impact on the drainage during the construction phase of the road. There will be increased generation of surface runoff on the road. The increased or excess runoff could overwhelm local drainage system including streams with potential for increasing downstream flooding, damage to property and crops. Flooding downstream can also become a health hazard (e.g. breeding ground for mosquitos, etc.). Good drainage design and construction in the development of roads is critical to the success of road construction. Also, storm water generated on the road may be contaminated with oil and grease, metals (e.g. lead, zinc, copper, cadmium, chromium, and nickel), particulate matter and other pollutants released by vehicles on the highway. Storm water may also contain nutrients and herbicides used for management of vegetation in the rights-of-way. This impact will be moderate hence a value of 2.

6.4.9. Increased soil erosion risk and soil quality degradation

Construction of the road will involve creation of a large impervious surface that restricts the infiltration of rainwater. This leads to high generation of surface runoff that flows on the sides of the road in drainage ditches. Where the surface runoff is channeled directly to bare steep slopes with loose soil, it can lead to serious soil erosion problems. This can undermine the stability of the road including associated facilities such as bridges. Sediment and erosion from construction activities and storm water runoff may also increase turbidity of surface waters. This impact will be moderate (value of 2) in view of the gentle nature of the landscape through which the road will pass.

6.4.10. Loss of vegetation cover and biodiversity

During the construction phase of the project, there will be clearance of vegetation along the corridor to pave way for the proposed road. The project area has scarce vegetation and therefore there will be minimal clearance of vegetation. It is expected that the project will require huge quantities of materials such as ballast, murram, stones, conglomerates / aggregate, sand, gravel, and soil, among others. In addition, the contractors will install several material camp sites as well as a batching plant that will impact on the environment, especially smothering vegetation around the camp sites. The proponent is going to ensure that campsites and quarries are constructed in areas that are not high in vegetation density. Due to the need to clear vegetation existing for quarries and building of campsites. All borrow pits and quarries will need to undergo a separate Environmental and Impact Assessment Study to ensure there will be no major negative impacts from them. This impact will be moderate hence a value of 2.

6.4.11. Disruption and loss of businesses

During the field survey, it was noted that few squatters have established small-scale businesses and temporary structures on the road reserves in towns and market centres. These squatters will be

displaced from the road reserve to pave way for construction of the proposed road project. Some hotel owners and food vendors who depend on squatters operating businesses on the road reserves expressed concern that there would be loss of livelihood. However due to the anticipated resettlement action plan (RAP), this impact will be low hence a value of 1.

6.4.12. Spread of STD, HIV and AIDS

The residents along the proposed road corridor expressed concern that there would be an increase in incidences of sexually transmitted diseases including HIV and AIDS especially during construction of the road because of increased prostitution. The project proponent will need to work jointly with appropriate county and national government health agencies to come with a comprehensive STD, HIV and AIDs control programme during the construction and operational phases of the project. This impact will be moderate hence a value of 2.

6.4.13. Gender Based Violence

Due to inequalities between genders as a result of employment from the road works, it is anticipated that cases of gender based violence might occur. This will be compounded by issues such as compensation for land acquisition, regular source of income, growth of businesses and among others. Though men are victims of gender based violence, women are more prone and vulnerable to experience it. This impact will be moderate hence a value of 2.

6.4.14. Interference of existing development infrastructure

During the field survey, it was noted that the proposed project would interfere with other infrastructural public utilities already existing along the proposed road corridor such as power lines. These lines may have to be relocated during the construction of the road. This impact will be moderate hence a value of 2.

6.4.15. Insecurity

There were concerns that due to an influx of people as construction workers at the project, insecurity is likely to increase. There will be increased risk of poaching of wild animals especially giraffes, dikdiks and gazelles. Also, construction workers may be attacked by wild animals like hyenas and foxes which are prone in areas where the proposed road passes. This impact will however be low hence a value of 1.

6.4.16. Cultural changes

The road traverses land inhabited by Merus, Boranas, Turkanas and Somalis who are mainly Muslims. The Muslims have conserved their culture from time immemorial. The Muslims have established social organization systems. The upgrading of the road is likely to increase the attractiveness of the area, which may result in the following.

- Degradation of the cultural values and norms in the area;
- Increase in the levels of crime in the area;
- Increase in undesirable sexual and social interaction in the area.

6.4.17. Delays in transportation

During construction phase, the road traffic will be controlled and, in some cases, complete road closure will be necessary especially at river crossings. This will entail disruption to traffic flows resulting in delay to transport of people and goods. There will be also delays caused by diversion during construction. This impact will however be low hence a value of 1 due to the current low traffic in the region and mitigation measures to be put in place.

6.4.18. Gender and equality biases

Gender and equality biases in road projects may be the basis of differential treatment of persons based on their sex roles, ethnicity, status, religion, race, age, beliefs and disability among other attributes. The proponent should put measures in place to address issues of gender equality and freedom from discrimination among all Kenyans that will be involved in the project with a focus on Special Interest Groups, namely; women youth, children, persons with disabilities (PWDs), the elderly and minority and

marginalized groups and communities. The proponent is expected to roll out programs and activities in various sectors including health, education, housing, employment and social support and justice among others. The overall goal will be the reduction of gender inequalities and the discrimination against all interest groups during the project cycle. Therefore, this impact will be low hence a value of 1.

6.4.19. Occupational safety and health

The Occupational safety and health issues associated with the construction and operation of the proposed road will include; physical hazards, chemical hazards and noise hazards. Chemical hazards in road construction, operations, and maintenance activities will principally be associated with exposures to road construction materials, dust during construction; exhaust emissions from heavy equipment and motor vehicles during all construction activities. Road construction and maintenance personnel can be exposed to a variety of physical hazards from operating machinery and moving vehicles but also working at elevation on bridges and overpasses. Other physical hazards include exposure to weather elements, noise, work in confined spaces, trenching, contact with overhead power lines, falls from machinery or structures, and risk of falling objects. There is also a possibility of accidents when transporting workers to the construction sites. This impact will however be low hence a value of 2.

6.4.20. Community health and safety

Community health and safety issues will emerge during construction of the road. The impacts will include dust, noise, and vibration from construction vehicle movements and communicable diseases associated with the influx of temporary construction labor. Significant community health and safety issues associated with the proposed road project will include pedestrian safety, traffic safety, and emergency preparedness.

Pedestrians and motor cyclists are at the greatest risk of serious injury from collisions with moving vehicles. Children will generally be the most vulnerable due to lack of experience and knowledge of traffic related hazards, their behavior while at play, and their small size making them less visible to motorists. Collisions and accidents can involve a single or multiple vehicles, pedestrians or motor cyclists and animals. Many factors contribute to traffic accidents. Some are associated with the behavior of the driver or the quality of the vehicle, while others are linked to the road design, or construction and maintenance issues. Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and/or the release of oil or hazardous materials.

The night glare from vehicles will cause disturbances to local communities at night and interfere with their sleep. This problem is likely to be greater in the future as vehicular traffic is set to increase several folds. Mitigation measures will however be put in place to prevent further direct, indirect or cumulative adverse effects. The impact scale is considered high hence a value of 3.

6.4.21. Disturbance to Wildlife

The project area has giraffes, dikdiks, gazelles, elephants, hyenas, ostriches and among other wildlife that roam freely. The public raised a concern that the wildlife will be disturbed considering they will not have freedom of movement from one side to the other side of the road since they will only be forced to use the culverts. The influx of many people working at the project may also cause change in animal behavior. Reduced movement of wild animals may lead to concentration in certain areas leading to overgrazing, damage to natural vegetation and general loss of ecological integrity of the ASAL ecosystem along the road. There would also be visual and auditory disturbance due to the presence of machinery, construction workers, and associated equipment. The contractor is however expected to conduct respective EIAs for borrow pits and boreholes to mitigate associated impacts. In this respect, disturbance to wildlife will be low hence a value of 1.

6.4.22. Increased loss of human and animal life due to road accidents

Since the area is inhabited by pastoralists, livestock grazing along the proposed road stretch could lead to accidents. Further the new road is likely to lead to over-speeding of vehicles hence a likelihood of people being knocked down and mostly at major town centers

6.4.23. Reduced accessibility of neighborhood areas

During construction, there is a likelihood is reduced accessibility of neighborhood areas, grazing points or villages because of construction trenches and soil stalking.

6.4.24. Community conflicts

Due to the multiethnic relations in the region, there is a likelihood of community conflicts attributed to cultural issues and historical relations. The community are likely to raise grievances based on geographical boundaries, location of social amenities and employment opportunities.

6.4.25. Sexual Exploitation/Child Abuse

As a result of influx of workers into the area due to the road construction, it is anticipated that there will be a lot of money in circulation and this may lead to the sexual abuse of young children by the workers for exchange of money, food or other basics of life. Other forms of child abuse might be the employment of minors for labor at the construction site.

6.4.26. Cumulative Impacts

Cumulative impacts are impacts which result from the incremental impact of a proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Isiolo-Kulamawe road will be developed contemporaneously with other roads in the NETIP. As such, cumulative impacts such as impacts on resources such as water, energy and road construction materials within the region might arise due to the needs for the simultaneous construction of the roads, impacts on vegetation due to an increase of vehicular traffic and people within the region. Furthermore, the project can also contribute to potential community impacts identified for the project, such as changes in community character, traffic patterns, housing availability, and employment.

6.5. Positive environmental and social impacts during operation phase

The following were the positive environmental and social impacts for the proposed Isiolo - Kulamawe road project during the operation phase:

6.5.1. Creation of employment opportunities

Both direct and indirect employment opportunities will emerge during the operation phase. For the direct employment, people will be employed for the normal and continuous road maintenance whereas for the indirect employment, vehicular traffic will increase hence providing employment to the drivers and turn boys. Road side businesses will also grow ranging from small shops to big petroleum filling stations and garages along the road. This will in turn create indirect employment opportunities to the locals.

6.5.2. Improved local socio-economy

Respondents who were interviewed acknowledged that the proposed road will contribute immensely to the development of business at the trading centers along the road and the following socio-economic benefits:

- Increased business opportunities at the market centres due to the presence of the increased vehicular traffic along the route for instance petrol filling station, garages, shops etc.,
- Employment of local workers during the operation phase of the project;
- Strengthening of local economy through the establishment of micro-enterprises such as foodstuff sale points.

The implementation of the project will result in the improvement of the living conditions of population living along the road thus contributing to poverty reduction.

6.5.3. Increased security

The area where the road traverses has over the years been known for insecurity and cattle rustling. The road will make it easier for road patrols and security operations to be conducted in the area. Additionally, the road will lead to an improvement in the communication infrastructure as such making it easy for the relaying of intelligence reports.

6.5.4. Provision of a cheaper and faster means of transport

During the field survey, the respondents were positive that the proposed road project will provide a faster and cheaper means of transport for cargo trucks, passengers and personal cars, between Isiolo and Meru counties. This will considerably reduce additional travelling and transportation costs being incurred currently and improve the current transport situation along the road. During rainy seasons the road is rendered impassable hence tarmacking will solve this problem. Coming with the project are bridges and associated road infrastructure which shall be constructed to enhance transportation.

6.5.5. Gain to the county and national economy through transportation

The main mode of transportation in the area is road transport. There are no other affordable options for transport in the project area. Generally, the project road plays an important role in the area by transportation of passengers to the various town centers along the project road.

With improved road conditions, it is expected that there will be improved transport within the region. This is likely to benefit the local and regional economy in the short term and the national economy in the long term. There will also be easier access to the essential services offered in the neighboring Counties.

6.5.6. Revitalization of large scale agriculture in the area

The project area is rangeland occupied by pastoralist communities. The farmers are largely livestock keepers and are the leads in the supply of livestock products in the country. However, the up-scaling and growth of this farming has been hindered by the poor transportation network in the region. Therefore, construction of the proposed road project in the area will offer numerous opportunities for farmers to upgrade their business and hence lead to the improvement of agriculture. There also exists an export business for gums and resins.

6.5.7. Reduction in particulate matter emissions (dust)

The current carriage way is made of earthen material. Dust is a major concern as vehicles plying the route makes the area along the road quite dusty. Considering the locality is in an arid area, the received rainfall is low, meaning that hot, dry and dusty conditions prevail. Paving of the road surface with bitumen will eliminate dusty conditions experienced by users and villages located along the proposed road project.

6.5.8. Improved road safety

Road projects can lead to reduction in accidents when they involve significant improvements in vertical and horizontal alignments, improved carriageway width, junction layout or greater separation of pedestrians, non-motorized traffic and motor vehicles. The improvement of the project road may lead to significantly increased running speeds; the standard speed of the road will be 80 Km/hr - 100 Km/hr and is likely to induce significant generation of fast-moving traffic. This will shorten the travelling time and transportation cost.

The proposed project design will contribute to improving road safety and the comfort of road users in several ways such as:

- Sight distance and visibility especially at approaches to bridges will be improved;
- Road signs (both warning and directional) and road markings will be included in the design;
- Adequate shoulders will be designed throughout its road corridor.

6.6. Negative environmental and social impacts during operation phase

6.6.1. Noise pollution and excessive vibrations

The public also feared that there would be noise during operation stage of the project due to high speed and revving of motor vehicles along the road since its design speed is 80-100km/hr. However, this impact will be moderate hence a value of 2.

6.6.2. Air pollution due to dust generation and air emissions

Traffic movement between Isiolo and Meru counties and beyond will lead to the release of dust and smoke from the moving vehicles. Exhaust emissions are likely emitted pollutants which can cause significant air quality impact. Such emissions can be enormous and may affect a wider geographical area depending on increase in traffic. This impact is however moderate for proposed road project hence a value of 2.

6.6.3. Impacts on livestock and wildlife breeding points

Livestock and wildlife crossing the road in search of pasture may be hindered once the road becomes operational making access to pasture, water and breeding grounds difficult. Further both livestock and wildlife are likely to become prone to accidents from moving vehicles. This impact will be moderate in view of the measures that will be put in place, hence a value of 2.

6.6.4. Increased consumption of fossil fuel

The construction of the proposed Isiolo- Kulamawe road project is expected to lead to an increase in traffic movement between Isiolo and Meru counties and beyond. Also, most of the traffic will be flowing faster. It is thus expected that this will lead to increased consumption of fossil fuel particularly petrol and diesel. It is also expected that there will be high consumption of fossil fuels due to high number of construction machinery and trucks that will be deployed in the project. This impact will be moderate in view of the measures that will be put in place to reduce consumption of fossil fuels, hence a value of 2.

6.6.5. Storm water and impact on drainage

Construction of sealed roads (tarmacked road) increases the amount of impermeable surface area, which increases the rate of surface water runoff flow. The project will also impact on the drainage during the operational phase of the road. There will be increased generation of surface runoff on the road. The increased or excess runoff could overwhelm local drainage system including streams with potential for increasing downstream flooding, and damage to properties. Good drainage design and construction in the development of roads is critical to the success of road construction. Also, storm water generated on the road may be contaminated with oil and grease, metals (e.g. lead, zinc, copper, cadmium, chromium, and nickel), particulate matter and other pollutants released by vehicles on the road. The storm-water management plan specified in this report should be observed. This impact will be high hence a value of 3.

6.6.6. Loss of human life and livestock due to road accidents

With the tarmacking of the road, vehicles will be travelling at a design speed of 80-100km/h. Being a pastoralists zone, livestock cross the road for pasture and water. The availability of wildlife like elephants, giraffes, dikdiks, ostriches, gazelles and hyenas along the project road may lead to increased accidents. Considering the above-mentioned speed, there is a likelihood of possible human accidents along the road, and especially near villages. Road bumps, rumble strips and signage need to be provided throughout the road length and especially in towns and villages such as Gambella, Ndumuru, Haidaven, Kachuru, Yaqbarsathi and Kulamawe to reduce these incidences. This impact will be moderate hence a value of 2.

6.6.7. Increased risk to community health and safety

Community health and safety issues will emerge during the operation of the road. The impacts will include dust, noise, and vibration from vehicles in transit. Significant community health and safety issues associated with the proposed road project will include pedestrian safety, traffic safety, and emergency preparedness.

Pedestrians and motor cyclists are at greatest risk of serious injury from collisions with moving vehicles. Collisions and accidents can involve a single or multiple vehicles, pedestrians or motor cyclists and animals. Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and/or the release of oil or hazardous materials. The night glare from vehicles will cause disturbances to local communities at night and interfere with their sleep. This problem is likely to be greater in the future as vehicular traffic is set to increase several folds. The impact scale is however considered to be moderate hence a value of 2.

6.6.8. Generation of solid waste

Solid waste generation during operation and maintenance activities will include earthen materials, road litter, illegally dumped waste, or general solid waste from villages; vegetation waste from the clearance of road reserves; and sediment and sludge from storm water drainage system. The proponent would need to ensure that all solid wastes are collected and disposed appropriately to promote a clean and healthy environment along the transport corridor. This impact will be minimal hence value of 1.

6.6.9. Soil quality degradation due to oil spills

The increase in the fuel stations due to the increase in the traffic, oil residuals from fuel service stations, motor garage yards, solid waste dumping and roadside truck parking are anticipated to impact the soil quality. The impact on soil quality from these activities will be cumulative as per the IFC PS 1. The impacts will be significant in towns along the road. This impact will be moderate hence a value of 2.

6.6.10. Sexual Exploitation/Child Abuse

Many cases of child abuse and sexual exploitation have been reported at areas along roads where commercial transit vehicles operate. With the completion of the Isiolo-Kulamawe road, it is expected that the traffic of heavy commercial vehicles will increase along the route. As a result, it is anticipated that the impact of sexual exploitation and child abuse will occur

6.6.11. Cumulative Impacts

In the operational phase of the project, some of the cumulative impacts that might arise include disturbance of vegetation and soil as a result of growth in transport and tourism activities it is expected motorists stop indiscriminately hence roadside vegetation is damaged by vehicle and foot traffic, and the soil is left unprotected, influx of people due to the opening up of the entire region, proliferation of terrorism activities since the Isiolo-Mandera road connects the horn of Kenya to Somalia which has been a war torn nation.

6.7. Positive impacts during decommissioning phase

Due to the national and international significance of this project, the likelihood of decommissioning is minimal, therefore impacts discussed below are almost unlikely.

6.7.1. Rehabilitation and restoration of the site to its original status

During the decommissioning of the project the area will be rehabilitated to its original status by revegetating areas where vegetation is cleared, making sure that water ways are cleared to facilitate drainage etc.

6.7.2. Employment opportunities

In the event of decommissioning locals will gain employment from the various jobs that will arise.

6.7.3. Reduced environmental pollution

Motor vehicles emit air, soil and water polluting substances. In the event of road decommissioning, the traffic in the area will reduce and hence considerably reducing environmental pollution

6.7.4. Reduced negative environmental impacts of operation

At the operation phase of the project many negative environmental impacts will arise. Such impacts include; disturbance of wildlife, noise pollution, water pollution, road accidents etc. All these impacts will subsequently reduce when the project is decommissioned.

6.8. Negative impacts during decommissioning phase

6.8.1. Solid waste generation

A lot of solid waste such as tarmac waste, cement waste, and among other wastes will be generated during decommissioning of the project.

6.8.2. Noise and vibration

There will be noise and vibration from vehicles and machines that will be used during the decommissioning phase.

6.8.3. Dust emission

Dust will be emitted by moving vehicles and from the decommissioning works through digging and excavating of the tarmac surface.

6.8.4. Reduced/ loss of positive impacts to the project

During decommissioning people will lose employment. Drivers, conductors and turn-boys and other bus operators will be affected because of the decommissioning. Other positive impacts that will be accrued during the operation phase like fast movement of goods and services, cheaper transportation etc. will also be reduced.

7. Mitigation measures and monitoring programmes

7.1. Introduction

The construction of the proposed Isiolo- Kulamawe road will have a wide range of impacts on the biophysical environment, health and safety of employees and members of the public, and socio-economic well-being of the local communities and households. It is usually impossible to mitigate all the expected negative environmental and social impacts. Thus, in this chapter, an attempt was made to formulate mitigation measures for the most significant negative environmental and socio-economic impacts. The aim is to ensure that the most significant negative impacts are minimized as much as possible while maximizing on the positive benefits of the project. The mitigation measures will be presented in the environmental management and monitoring plan that is intended to assist the proponent in the management of the adverse environmental impacts associated with the life cycle of the project.

7.2. Mitigation measures during the construction phase of the proposed Isiolo - Kulamawe road project

The following section provides a discussion on the mitigation measures that will be undertaken during construction of the project. It is important to note that a special focus has been given to the negative impacts that are considered significant and that warrant intervention to reduce the level of impact to the local communities and the environment.

7.2.1. Mitigating noise pollution and excessive vibrations

Noise pollution and excessive vibrations should be mitigated as follows:

- Sensitize drivers of construction vehicles and machinery operators to switch off engines or machinery that are not being used.
- Ensure that all vehicles and construction machinery are kept in good condition all the time to avoid excessive noise generation.
- Ensure that all workers wear ear muffs and other personal protective gear/equipment when working in noisy sections.
- Undertake loud noise and vibration level activities during off-peak hours during the day (i.e. between 8.00 am and 5.00 pm).
- Acquire Noise and Excessive Vibrations Pollution Control Permit and comply with conditions provided by the Environment Management and Coordination, Noise and Excessive Vibrations Pollution Control Regulations 2009.
- Support facilities such as hard rock quarries should adopt controlled blasting techniques, preventing flying rock debris and high intensity vibrations. The management should equally observe relevant explosives use and blasting permits provided by the Inspector of Mines and Geology.
- Blasting activities along the road corridor and associated quarries should be done during the day and the public should be properly informed of the activity in time.

7.2.2. Mitigating air pollution due to dust generation and air emissions

This negative impact of dust should be mitigated as follows:

- Sprinkling of water on dry and dusty surfaces regularly including the access roads and diversion tracks.
- Add suitable soil stabilizers on access roads or pave access roads to control dust.
- Erection of dust screens around buildings under construction especially at the workers' camps. Dust control measures should be adopted at concrete batching plants, providing adequate PPE to staffs, canopying loading points and erecting dust screens around the plant.
- Collecting storm water and use to de-dust the construction site and the all-weather access roads if volumes stored are sufficient.
- Comply with personal protective clothing requirement for dusty areas such as dust masks and protective glasses.
- Enforce onsite speed limit regulations.
- Re-vegetating exposed areas during the operation phase of the project.
- Sprinkling water along the diversion routes or earth along the road section.
- Slowing the speed of traffic by using bumps and/ or clearly marked road signs may contribute to reducing dust levels.
- Haulage routes will need to be identified and maintained by watering to minimize the impact of dust.
- Dust control mechanisms at the gravel borrow sites through extraction in wet conditions and transport in covered trucks.
- Implement dust control measures at the quarry sites and aggregate crushing sites.
- Covering heaps and berms of soil.
- Adhere to the Environmental Management and Co-ordination (Air Quality) Regulations, 2014.

To mitigate exhaust emissions, it will be mandatory to:

- Procure machines, equipment and vehicles which are environmental friendly.
- Ensure machines and vehicles are properly and regularly maintained.
- Discourage plant operators and drivers of construction vehicles from unnecessary revving and idling.
- Limit construction traffic movement and operations to the most necessary activities through adequate planning.
- Sensitize construction drivers and machinery operators to switch off engines when not being used.
- Ensuring that the construction machines, equipment and vehicles have the requisite inspection certificate.
- Control the speed of the traffic movement by through adequate policing and monitoring.
- Adhere to the Environmental Management and Co-ordination, Fossil Fuel Emission Control Regulations 2006.

7.2.3. Minimizing generation of solid waste

All storage and construction sites are to be kept clean, neat and always tidy. No burying or dumping of any waste materials, metallic waste, litter or refuse shall be permitted. The Contractor must adhere to Environmental Management and Co- ordination (Waste Management) Regulations 2006. The

Contractor shall implement measures to minimize waste and develop a waste management plan to include the following: -

- Maximizing the rate of recycling of road resurfacing waste either in the aggregate (e.g. reclaimed asphalt pavement or reclaimed concrete material) or as a base;
- Incorporating recyclable materials (e.g. glass, scrap tires, certain types of slag and ashes) to reduce the volume and cost of new asphalt and concrete mixes.
- Collecting road litter or illegally dumped waste and managing it according to the recommendations in the General EHS Guidelines and Waste Management Regulations, 2006.
- Provision of bottle and can trash disposal receptacles at parking lots to avoid littering along the road.
- Obsolete products should be managed as a hazardous waste as described in the General EHS Guidelines.
- Collecting animal carcasses in a timely manner and disposing them through prompt burial or other environmentally safe methods.
- Composting of vegetation waste for reuse as a landscaping fertilizer.
- Managing sediment and sludge removed from storm drainage systems maintenance activities as a hazardous or non-hazardous waste based on an assessment of its characteristics.
- Management of all removed paint materials suspected or confirmed of containing lead as a hazardous waste.
- Grinding of removed, old road surface material and re-use in paving, or stockpiling the reclaim for road bed or other uses. Old, removed asphalt may contain tar and polycyclic aromatic hydrocarbons and may require management as a hazardous waste.
- Develop and implement a Construction Waste Management Plan before start of the project.
- Sub-contract a licensed waste handling firm to collect solid wastes on regular basis and dispose off in approved dumping sites.
- Drainage outfalls should be properly constructed to reduce the erosion from surface runoff and storm water.
- Comply with provisions of the Environmental Management and Co-ordination, Waste Management Regulations 2006.

7.2.4. Minimizing energy consumption

This should be mitigated as follows:

- Promote the use of solar energy and energy efficient bulbs in workers base camps and for street lights in towns and villages situated along the road.
- Install automatic control street lights with Light Dependent Resistor (LDR) sensors.
- Switch off lights when not in use.
- Install electricity meters to monitor the consumption of electricity in workers camps.
- Ensure construction machinery and trucks are well maintained.
- Use energy-efficient construction machinery and trucks during construction phase of the project.
- Carry out Energy Audits for evaluation and improvement of energy consumption and saving practices adopted by all parties involved.
- Ensure compliance with Energy Management Regulations of 2012.

7.2.5. Mitigating discharge of wastewater, sewage and degradation of water quality

The contractor should develop appropriate measures to ensure all waste water is treated, handled and disposed appropriately to avoid contamination of water bodies (both open and underground), soils and farm lands. Measures like development of garages for repairs, management of waste oil, development of car washing facilities, oil spills management among others should be incorporated in the project.

No grey water runoff or uncontrolled discharges from any site or working areas (including wash-down areas) to adjacent watercourses and/or water bodies shall be permitted. This should be mitigated as follows

- Water containing pollutants such as cements, concrete, lime, chemicals and fuels shall be discharged into a conservancy tank for removal from site. This particularly applies to water emanating from concrete batching plants and concrete swills;
- The Contractor shall also prevent runoff loaded with sediment and other suspended materials from the site/working areas from discharging to adjacent watercourses and/or water bodies; This can be done by use of sediment traps and use of drainage to control the flow and velocity of the runoff
- Potential pollutants of any kind and in any form, shall be kept, stored and used in such a manner that any escape can be contained and the water table not endangered;
- Construct a standard septic tank/bio-digester linked to a constructed wetland system.
- Promote recycling of wastewater and storm water.
- Install meters in workers' camps to control and monitor consumption rates of water.
- Ensure regular maintenance of plumbing systems and septic tanks to avoid spillage of raw sewage.
- Comply with the Environment Management and Coordination, Waste Management and Water Quality Regulations 2006.

7.2.6. Minimizing water abstraction and consumption

This should be mitigated as follows:

- Install water conserving automatic taps and toilets in the various workers' camps.
- Install gutters on the roof of the workers' camps to harvest rain water.
- Construct underground reservoir for storage of harvested rain water.
- Drilling of boreholes along the road corridor for use to reduce over reliance on water from existing streams. The boreholes will also support the locals after the road construction.
- Harvest surface runoff in check dams and borrow pits for use to suppress dust.
- The Contractor must adhere to water quality regulations described in Legal Notice No. 120 of the Kenya Gazette Supplement No. 68 of September 2006 and Water Act 2016.

7.2.7. Modification of hydrology of ASALs

This could be mitigated as follows:

- Control excessive abstraction of water from wetlands, water pans and boreholes.
- Provide diversion channels for rivers to avoid complete blockage during construction of bridges and culverts.
- Re-open all blocked river channels after construction of bridges/culverts.

- Quarries and pits for extraction of road construction materials to be used as water harvesting sites after reclamation.
- Surface runoff on the sides of the road should be channelled to areas with gentle slopes to avoid excessive erosion of the road slopes.
- Construct over passes and bridges in areas occupied by rivers and wetlands.

7.2.8. Minimizing generation and movement of storm water and impact on drainage

This should be mitigated through the following:

- Use of storm water management practices that slow peak runoff flow, reduce sediment load, and increase infiltration.
- Use of vegetated swales (planted with salt-resistant vegetation); filter strips; terracing; check dams; detention ponds or basins; infiltration trenches; and infiltration basins.
- Regular inspection and maintenance of permanent erosion and runoff control features.
- Paving in dry weather to minimize runoff of asphalt or cement materials.

7.2.9. Minimizing increased soil erosion risk and soil quality degradation

There are several activities that would bring about soil loss and erosion as mentioned above. To address soil conservation during construction and operation, phases, mitigation measures have been addressed as follows: -

- *Cut and fill areas:* Road design activities should aim at balancing and fill activities to reduce the net quantities of soil either for disposal or borrowing. All cut, and fill sites will be replanted with sod grass to complete cover while the edge of the road reserve will be marked with a row of locally adapted tree species.
- *Project will avoid opening new materials borrow sites:* In as much as possible, hard rock will be sourced from existing quarries. However, there may be need to open up new quarries in some areas. Such opening will be followed by rehabilitation of the quarry site prior to closure of the contract. An Environmental Management and social Plan is expected to be developed and cleared for each of the material site opened under the project.
- *Rehabilitation of borrow areas:* During quarrying and other works involving removal of top soil, each layer not required should be stockpiled separately for re-use to reinstate quarries and other material sources after exhaustion. Towards mitigation of craters left behind after material extraction, all land acquired for material extraction will be backfilled and re-instated. Where the top soil does not fill the pit, water draining tunnels will be constructed to prevent /minimize stagnation of water. Further, in consultation with the residents, such quarries could be converted into pans for purposes of storing runoff for livestock watering. This will greatly improve access to water more so, during dry seasons.

More specifically:

Rehabilitation of all quarry spoils and efficient sourcing and use of raw materials must be reached. The proponent will source building materials such as gravel, sand, ballast and hard core at the project locality. Consultation should be held with the community members and their representatives on the best sites to source materials and rehabilitation measures should be agreed. Sites to be selected should have minimum negative impacts on access to water points.

It is recommended that environmental impact monitoring should be conducted for such activities or in consultation with County Director to ensure environmental conservation and rehabilitation after use. The contractor should ensure application of acceptable environmental performance standards and that the negative impacts of their activities at the extraction sites are considerably well mitigated.

To reduce the negative impacts on availability and to ensure sustainability of the materials, the proponent should only extract what will be required through accurate budgeting and estimation of actual construction requirements. This shall ensure that materials are not extracted or purchased in excessive

quantities. Moreover, the proponent will ensure that wastage, damage or loss (through run-off, wind, etc.) of materials at the construction site is minimal, as these would lead to additional demand for and extraction or purchase of the materials.

In addition to the above measures, the proponent should consider reuse of excavated materials and use of recycled materials. This will lead to reduction in the amount of raw materials extracted from natural resources as well as reducing impacts at the extraction sites. All exhausted quarries and borrow pits should be isolated, protected and rehabilitated to usable state before the contract closure.

7.2.10. Minimizing loss of vegetation cover and biodiversity

This should be mitigated as follows:

- Separate EIAs should be conducted for camps, borrow pits, quarries, boreholes and sand-pans.
- Design and construction of wildlife access such as culverts to avoid or minimize habitat fragmentation.
- Minimize clearing and disruption of riparian vegetation.
- Provide adequate protection against scour and erosion; and consider the onset of the rainy season with respect to construction schedules.
- Minimize clearing of indigenous plant species and replanting of indigenous plant species in disturbed areas.
- Explore opportunities for habitat enhancement through such practices as placement of nesting boxes in rights-of-way, bat boxes underneath bridges, and reduced clearance to conserve or restore native species.
- Employ vegetation rehabilitation techniques to recover lost plant cover such as Reforestation and Afforestation.
- The contractor is expected to comply with the National Sand Harvesting Guidelines provided by NEMA and the County Governments.

7.2.11. Mitigating disruption and loss of businesses in the town centres traversed by the road

This should be mitigated as follows:

- Provide support to squatters to establish small-scale businesses in other suitable locations in affected town.
- Educate squatters on the need to maintain free road reserve.
- Provide comprehensive health and safety education to squatters in affected town.
- Promote other sources of livelihood among the local communities.
- Provision of subsistence or transitional allowance to squatters.
- Provision of employment in the project for the squatters where possible.
- Put in place a grievance redress mechanism as discussed in chapter eight (8) of this report.

7.2.12. Minimizing the spread of STD, HIV and AIDS

This should be mitigated as follows:

- Develop a comprehensive STDS, HIV and AIDs awareness and control programmes such as provision of condoms to workers both male and female.
- Provision of STDs, HIV and AIDS prevention measures to workers.
- Creation of awareness of STDs, HIV/AIDS in workers camps through trainings and installation of posters.

- Adhere to and implement the Sexual Offences Act, 2006 and its amendment 2012.

7.2.13. Minimizing Gender Based Violence

This should be mitigated as follows:

- Financial management training should be conducted to the PAPs and the employees
- Have separate latrines for different genders
- Provide a communication line to report such cases

7.2.14. Minimizing interference of existing development infrastructure

This should be mitigated as follows;

- Relocate all facilities affected in consultations with various parties affected with respect to water, sewerage, pipelines, and electricity.
- Involvement and continuous consultation of key stakeholders and community members with respect to water, pipelines, and electricity at all stages of the project cycle.
- Compensation and re-locations.
- Use of an integrated approach in planning public utilities by sharing most transport corridors for roads, water, sewerage, electricity lines, etc.

7.2.15. Minimizing security risk

This should be mitigated as follows:

- Thoroughly screen workers, suppliers and distributors.
- Ensure 24-hour surveillance by engaging the Administration Police services during the day and night.
- Install CCTV cameras in strategic locations in workers' camps.
- Ensure close liaison with the local Police Department.
- Avoid the disposition of meat waste and animal carcasses near the campsites and villages.

7.2.16. Minimizing cultural changes

The following measures will be implemented by the proponent to reduce cultural erosion / changes;

- Provide community awareness programmes.
- Develop programmes to enhance cohesion between project employees and the local community.
- Comply with defined national or local cultural heritage regulations and provisions of World Bank Physical Cultural Resources: OP/BP 4.11.
- Consult with the affected Communities to identify cultural heritage of importance, and to incorporate into the client's decision-making process the views of the affected Communities on such cultural heritage.

7.2.17. Minimizing delays in transportation

To reduce delays in transportation, the following will be adapted;

- Long traffic diversion roads shall be avoided.
- In any case all diversions shall be kept damp and dust free to ensure dust is minimized hence easier visibility for drivers.

- Ensure Installation and maintenance of all construction signs, signals, markings, and other devices used to regulate traffic, including posted speed limits, warnings of sharp turns, or other special road conditions.
- Advance information on communication systems will be an advantage to users.
- Traffic circulation changes will be made as per the Traffic Act Cap 403.
- Traffic personnel will be stationed on strategic points to help during the diversions.

7.2.18. Gender equality

To ensure gender equality, the proponent should apply the following approaches: -

- Apply all Kenyan Constitutional requirements on gender throughout the project.
- Apply all guidelines under the National Gender and Equality Commission Act, 2011.
- Undertake gender mainstreaming at project design, implementation/ construction, operation and decommissioning stages.
- Incorporate best practices in gender mainstreaming from project partners.
- Developing the project sustainably by transforming the distribution of opportunities, resources and choices for males and females so that they have equal power to shape their own lives and contribute to their families, communities, and countries.

7.2.19. Minimizing occupational safety and health impacts

This should be mitigated as follows:

- Develop and enforce a fleet management plan for road construction that includes measures to ensure work zone safety for construction workers and the travelling public.
- Establishment of work zones to separate pedestrians and livestock travelling by foot from vehicular traffic and equipment by routing of traffic to alternative roads where possible.
- Use protective barriers to shield livestock and pedestrians from vehicular traffic, regulation of traffic flow by warning lights, avoiding the use of flaggers if possible, design of the work space to eliminate or decrease blind spots, and ensure reduction of vehicle speeds in work zones. Training of workers in safety issues related to their activities, such as the hazards of working on foot around equipment and vehicles.
- Ensure safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination for the work space (while controlling glare so as not to blind workers and passing motorists).
- Barricade the area around which elevated work is taking place to prevent unauthorized access. Working under personnel on elevated structures should be avoided.
- Hoisting and lifting equipment should be rated and properly maintained, and operators trained in their use.
- Elevating platforms should be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings).
- Use of the correct asphalt product for each specific application and ensuring application at the correct temperature to reduce the fuming of bitumen during normal handling.
- Maintenance of work vehicles and machinery to minimize air emissions.
- Reduction of engine idling time in construction sites; Use of extenders or other means to direct diesel exhaust away from the operator; Ventilation of indoor areas where vehicles or engines are operated or use of exhaust extractor hose attachments to divert exhaust outside.

7.2.20. Minimizing negative community health and safety impacts

Community health and safety issues during the construction of the proposed road can be mitigated as follows:

- Implement pedestrian safety management strategies such as provision of safe corridors/ side road along the road alignment and construction areas, including tunnels and bridges (e.g. paths separated from the roadway which can be used by both pedestrians and livestock), and safe crossings (preferably over or under the roadway) both during construction and operation.
- Installation of barriers (e.g. guardrails, fencing, plantings) to deter pedestrian and livestock access to the roadway except at designated crossing points.
- Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas.
- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways.
- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, including posted speed limits, warnings of sharp turns, or other special road conditions.
- Construction of roadside rest areas and bus stops at strategic locations to minimize driver fatigue. Installation of measures to reduce collisions between animals and vehicles (e.g. use of signs to alert drivers on road segments where animals frequently cross; construction of animal crossing structures; installation of fencing along the roadway to direct animals toward crossing structures; and use of reflectors along the roadside to deter animal crossings at night when vehicles are approaching).
- Targeting elimination of accidents rail crossings by use of a real-time warning system with signage to warn drivers of congestion, accidents, adverse weather or road conditions, and other potential hazards ahead.
- Prepare an emergency preparedness and response plan in coordination with the local community and local emergency responders to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.
- Ensure there is adequate wastewater disposal system to avoid breeding of malaria parasite transmitting mosquitos. Proper disposal of wastewater to minimize contamination of water supplies with typhoid causing organisms.
- Ensure health and safety measures as proposed in the ESMP apply to the letter for quarrying and earth borrowing activities.

7.2.21. Minimizing disturbance to wildlife

This will be mitigated as follows:

- Review existing information on species and habitats in the project area. Contact appropriate agencies early in the planning process to identify potentially sensitive ecological resources that may be present in the project area.
- Conduct pre-disturbance surveys in order to locate site facilities away from important ecological resources (e.g., wetlands, important upland habitats, sensitive species populations).
- Ensure activities pose minimal impacts to downstream flora and fauna.
- Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance.
- Use existing facilities and disturbed areas (e.g., access roads, graded areas) to the extent possible to minimize the amount of new disturbance. Configure new access roads and rights-of-way (ROWS) to avoid high-quality habitats and minimize habitat fragmentation.
- Bury electrical supply lines in a manner that minimizes additional surface disturbance. Use overhead lines in cases where the burial of lines would result in further habitat disturbance.

- Develop a site and ROW reclamation plan that addresses both interim and final reclamation requirements and that identifies vegetation, soil stabilization, and erosion reduction measures.
- Ensure that interim reclamation of disturbed areas is conducted as soon as possible following facility construction.
- Explore opportunities for habitat enhancement through such practices as the placement of nesting boxes in rights-of-way, bat boxes underneath bridges, and reduced clearance to conserve or restore native species.
- Develop a plan for control of noxious weeds and invasive plants that could occur because of new surface-disturbing activities at the site. The plan should address monitoring, weed identification, the way weeds spread, and methods for treating infestations. Require the use of certified weed-free mulch. Prohibit the use of fill materials from areas with known invasive vegetation problems.
- Develop a spill management plan.
- Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices.
- Minimize the number of stream crossings when locating access roads. When stream crossings cannot be avoided, use fill ramps rather than stream bank cutting. Design stream crossings to provide in-stream conditions that allow for and maintain movement and safe passage of fish.
- Develop site fencing in conjunction with appropriate natural resource agencies to either allow or prevent site access by wildlife species.
- Minimizing clearing and disruption of riparian vegetation.
- Minimize removal of indigenous plant species and replanting of indigenous plant species in disturbed areas.
- Comply with the provisions of the Wildlife Conservation and Management Act 2015.

7.2.22. Minimizing increased loss of human and animal life due to road accidents

This should be mitigated as follows:

- ***Lowering of speed limits:***

Installation and use of relevant road safety signs, construction of road bumps, and road safety awareness program (information and awareness of road users).

- ***Optical reflective dissuaders:***

Dissuaders serve to discourage the crossing of the road by the wildlife in the case of higher risk.

The light from the vehicle approaching illuminates the reflecting device and is reflected in the adjacent areas with reflection angles that are not visible and disturbing to drivers.

Creating a protective light curtain for the fauna near the road. The coloration of these devices can be red, white or blue.

- ***Road signs and information panels.***

The goal is to inform drivers to prevent accidents with the fauna and reduce the speed. The information boards can be made more evident when combined with two flash LED powered by a small solar panel.

- ***Acoustic slowdown bars and slow systems in optical effect.***

The acoustic slowdown bars are made of bands posed on the roadway that emit noise to the passage of vehicles prompting the driver to reduce speed.

- ***Maintenance of the road edge.***

The goal is to increase the visibility of the roadside (visibility at the roadside) and discourage access to the roadway

7.2.23. Mitigating reduced accessibility of neighborhood areas

This should be mitigated as follows:

- Provide opening or crossing points in road barriers to allow crossing of pedestrians and livestock.
- Provide access roads linking key villages in affected areas.

7.2.24. Minimizing community conflicts

This should be mitigated as follows:

- Ensure all stakeholders and the public are involved in the planning process.
- Ensure proper identification and compensation of all persons who will lose businesses and land.
- Obtain necessary permissions and approvals from the County Governments.
- Ensure EIAs are conducted for specific project activities such as sand harvesting, borrow pit and quarrying sites.
- Largely involve the community in the project through their leaders, take keen in timely addressing their grievances and ensure a good percentage of the local community members are employees in the project.

7.2.25. Mitigating sexual exploitation and child abuse

This should be mitigated as follows:

- Conduct awareness and educational programmes to workers and minors on the issue of sexual exploitation and child abuse
- Provide hotlines for the reporting of such cases
- Ensure that stern action is taken for offenders found to have committed sexual exploitation
- Employ adults(18 and over) provided with a national identity card

7.2.26. Mitigating Cumulative Impacts

Specific actions that may be needed to effectively manage cumulative impacts include the following:

- Project design changes to avoid cumulative impacts (location, timing, technology).
- Adaptive management approaches to project mitigation
- Mitigation of project impacts by other projects (not under control of the proponent to further minimize impacts).
- Collaborative engagement in other regional cumulative impact management strategies.
- Participation in regional monitoring programs to assess the realized cumulative impacts and efficacy of management efforts.
- Effect monitoring needed to assess the realized cumulative impacts is clearly defined and implemented.
- Ensure multiparty regional mitigation and/or management (e.g., additional mitigation of other developments, offsets, management programs) that may be needed to effectively manage cumulative impacts is also identified
- Support from other stakeholders (County Governments, developers and communities) is sought to implement it

7.3. Mitigation measures during the operation phase of the proposed Isiolo- Kulamawe road project

The following mitigation measures are applicable during the operation phase of the proposed project to mitigate the negative project impacts.

7.3.1. Mitigating noise pollution and excessive vibrations

- Enforcement of Traffic Act regulations to ensure that all vehicles using the road are in good condition all the time to avoid excessive noise generation.
- Install speed control measures such as bumps and rumble strips in the villages and towns where the road traverses.
- Install no hooting signs in sensitive areas such as near hospitals, schools, mosques etc.

7.3.2. Mitigating air pollution due to dust generation and air emissions

The recommended mitigation measures are similar as those presented in section 7.2.2 above.

7.3.3. Mitigation of impacts on livestock and wildlife

The Supervising Road Engineer and Environmental Social Officer will liaise with the Kenya Wildlife Service to identify the exact known wildlife crossing areas and ensure that appropriate safety signage is placed alongside the road warning motorists of “dangers a head”. At important crossing points, animal tunnels or culverts may be used to reduce collision rates, especially for protected or endangered species. This measure is expensive and will be used only at a few locations where it is both justified (by the importance of the animal population and the crossing route as recommended by KWS) and affordable (relative to the cost of the project and the funds available). It will also be important that the Supervising Engineer in liaison with the local administration take care of areas with high population of livestock so that appropriate measures such as culverts or signage is placed along the road warning motorists.

7.3.4. Minimizing fossil fuel consumption

- Design an energy efficient road in terms of terrain, avoiding steep slopes and sharp bends which cumulatively influence fuel consumption levels per journey.
- Use of automatic sensor solar lighting along the road corridor.
- Regular road maintenance will also ensure that movement of vehicles is not interfered with. This as a result will minimize consumption of fossil fuels due to unnecessary stopping along the road.

7.3.5. Minimizing storm water run-off

The proposed mitigation measures include:

- Use of storm water management practices that slow peak runoff flow, reduce sediment load and increase infiltration.
- Regular inspection and maintenance of permanent erosion and runoff control features.

7.3.6. Minimizing increased loss of human life and livestock due to road accidents

- Provide a side road parallel to the proposed tarmacked road for use by locals during transportation of livestock.
- Maintain pedestrian and livestock crossing points with foot bridges in certain key areas for instance near the villages and towns.
- Maintain under passes for livestock and wild animals at strategic locations along the road.
- Maintain parking areas and bus stops for trucks.

7.3.7. Minimizing negative community health and safety impacts

The proposed mitigation measures include:

- Implement pedestrian and livestock safety management strategies such as provision of safe corridors (side roads) along the road alignment and construction areas, including tunnels and bridges and safe crossings for pedestrians and livestock,

- Installation of barriers (e.g. guardrails, fencing, plantings) to deter pedestrian and animals access to the tarmacked roadway except at designated crossing points,
- Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas such as bumps, rumble strips in all the villages along Isiolo - Kulamawe road,
- Installation and maintenance of all road signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian, wildlife or livestock,
- Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, including posted speed limits, warnings of sharp turns, or other special road conditions,
- Installation of measures to reduce collisions between animals and vehicles (e.g. use of signs to alert drivers on road segments where animals frequently cross).

7.3.8. Minimizing generation of solid waste

The recommended mitigation measures are similar as those presented in section 7.2.3 above.

7.3.9. Minimizing soil quality degradation attributed to oil spills

The recommended mitigation measures are similar as those presented in section 7.2.9 above.

7.3.10. Minimizing sexual exploitation and child abuse

This should be mitigated as recommended in section 7.2.24

7.4. Mitigation measures during the decommissioning phase of the proposed Isiolo - Kulamawe road project

7.4.1. Minimizing solid waste generation

The recommended mitigation measures are similar as those presented in section 7.2.3 above.

7.4.2. Minimizing noise and vibration

The recommended mitigation measures are similar as those presented in section 7.2.1 above.

7.4.3. Minimizing dust emission

The recommended mitigation measures are similar as those presented in section 7.2.2 above.

7.4.4. Minimizing loss of positive impacts to the project

The recommended mitigation measures are similar as those presented in section 7.2.11 above.

7.5. Environmental risks to the project

In any project, there are risks associated with it during the project cycle. For the proposed Isiolo - Kulamawe road project, the following environmental risks were identified and some recommendations to reduce their occurrence are outlined.

7.5.1. Flush floods along the road corridor

The project area is characterised by seasonal streams and being a low-lying area, most parts of the road are prone to flooding during rainy seasons. Parts of the road are usually impassable during heavy downpour especially from upstream. The project area is also flat and low lying which makes it prone to flooding. The floods could be a risk to the project especially during construction and operation phases as they could lead to loss of properties, roads and even lives.

It will be prudent for the proponent to consider the highest recorded flood levels of the area and include the data in the design of the various stream crossings. During construction, it will also be prudent for the contractor to ensure measures have been put in place to provide adequate warning before flooding.

This will ensure adequate evacuation is done prior to the floods. A Storm Water Management Plan will also be requisite to state the measures to be taken during the flooding periods.

7.5.2. Transport of dangerous goods

Dangerous goods are frequently transported in bulk presenting a potential risk of release to the environment in the event of accidents. Additionally, there is a potential for the release of diesel during fuelling operations. The recommended measures to prevent minimize, and control releases of hazardous materials during road transportation and use include the following:

- Use of tank cars and other rolling stock that meet national and international standards (e.g. thermal protection and puncture resistance) appropriate for the cargo being carried, and implementing a preventive maintenance program; and
- Preparation of spill prevention and control, and emergency preparedness and response plans, based on an analysis of hazards, including the nature, consequence, and probability of accidents.

Based on result of the hazard analysis, implementation of prevention and control measures which may include:-

- Routing and timing of hazardous materials transport to minimize risk to the community (e.g. restricting transport of hazardous materials in certain hours);
- Limiting the general speed of vehicles in developed areas;
- Construction of protective barriers and other technical measures (e.g. guardrails) at sensitive locations (e.g. water resources and settlements);
- Dissemination of emergency preparedness and response information to the potentially affected communities (e.g. emergency notification systems and evacuation procedures);
- Implementation of a hazardous material security plan and security awareness training, including provisions for personnel security, prevention of unauthorized access, and measures to reduce risks during storage and transport of hazardous materials; and
- Use of standardized fuel spill prevention systems.

7.5.3. Fire

If vegetation growth is left unchecked or slash from routine maintenance is left to accumulate within the right-of-way, sufficient fuel can accumulate that may promote bush fires. Recommended measures to prevent and control risk of bush fire include:

- Monitoring of right-of-way vegetation according to fire risk;
- Removal of blow down and other high-hazard fuel accumulations;
- Trimming, slashing, and other maintenance activities to avoid seasons when the risk of bush fires is high;
- Removal of maintenance slash or management by controlled burning. Controlled burning should adhere to applicable burning regulations, fire suppression equipment requirements, and typically should be monitored; and
- Planting and management of fire-resistant species (e.g. hardwoods) within, and adjacent to, rights-of-way.

7.5.4. Terrorism

The issue of terrorism cannot be completely ruled out of the project, because the proposed project is located near the Somali border. Several cases of terrorism have been reported in the past of terrorism where lives have been lost.

It will be prudent for both the County and National Governments to provide adequate security both during construction and operation phase of the proposed project. This will ensure that terrorism activities have been minimized.

7.5.5. Wildlife attacks

Due to the project passing periphery of key wildlife zone, and the anticipated influx of people as construction workers at the project site; there will be increased risk of wildlife attacks like hyenas and foxes on people. This risk will however be mitigated hence low. Some of the measures include

- Construction camps to be located away from wildlife corridors.
- Develop construction camps site fencing in conjunction with appropriate natural resource agencies to prevent site access by wildlife species.
- Ensure 24-hour surveillance by engaging the services of day and night guards
- Install CCTV cameras in strategic locations of the workers camps.
- Provision of adequate security by County and National Governments

7.5.6. Inter-ethnic Conflicts

The project area is inhabited by several ethnic groups: Borana, Meru, Turkana, Somali and occasionally the Samburu make forays. As earlier discussed, there is continuous and sporadic conflict between all the ethnic groups, (Safer World, 2015). These conflicts are therefore likely pose a risk to the project development.

It will be prudent for both the County and National Governments to provide adequate security both during construction and operation phase of the proposed project. This will ensure that inter-ethnic activities do not interfere with the project.

7.5.7. Cattle rustling

The inhabitants of the area; Borana, Meru, Turkana, and Somali tend to keep livestock. As earlier noted, the Borana occasionally conflict over livestock with the Meru. The Meru and Turkana also conflict over livestock and pasture. On other hand, the Borana and Somali also conflict over livestock and pasture. Based on this, there exists cattle rustling within the project area which is likely to pose risk to the project.

It is important for both the County and National Governments to provide adequate security both during construction and operation phase of the proposed project. This will ensure that cattle rustling activities have been minimized.

7.5.8. Spread of Invasive species

Prosopis juliflora is one of the invasive species recorded along the proposed road alignment. It is a gap colonizer widely associated with ecosystem disturbances. Spread of such invasive species will mitigated by:

- Reducing open gaps in road reserves by planting appropriate tree species suitable for highway or road side tree planting.
- Monitoring composition of species regenerating along road reserves and taking prompt actions in case of emergence of invasive species.
- Carrying out routine road reserves maintenance mainly to clear bushes that may harbour invasive species

7.6. Environmental risk management

The failure of environmental mitigation can result in serious impacts such as erosion, increased road accidents and disruption of the community lifestyles. Construction of a road also involves occupational health and safety risks to road workers, primarily in the areas of storage and handling of dangerous materials, and operation of heavy machinery close to traffic, slopes and watercourses. The anticipated risks in this project include:

- Exposure to excessive dust particles or toxic fumes from bitumen and other chemicals used in road works;
- Potential for collapse of trenches;
- Risk of accidents involving passing traffic;
- Risk of bush fires during dry seasons;
- Risk of rock falls during blasting; and
- Risk of fuel spills and therefore contaminating soil and groundwater.

The above risks can be mitigated to some extent through:

- Strengthening staff skills and training in environmental management;
- Monitoring environmental actions and responsibilities and making provision for remedial actions;
- Planning for remedial measures in case initial planned actions are not successful;
- Limiting time of exposure to dust particles, chemicals and noise;
- Provision of Personal Protective Equipment (PPE);
- Establishing safety and inspection procedures in materials handling, operating heavy equipment and construction of trenches;
- Safe handling of toxic materials, explosives and other hazardous substances.

7.7. Environmental monitoring plan

Environmental monitoring is an essential component of project implementation. An Environmental Monitoring Plan (EMP) provides mechanism of monitoring environmental impacts of a project during its execution to reduce their negative effects and to introduce standards of good practice to be adopted for all project works. The EMP facilitates and ensures the follow-up of the implementation of the proposed mitigation measures proposed in the ESMP. The parameters of the proposed Isiolo- Kulamawe road project that were identified for monitoring include: water quality, air quality, solid waste generation, Occupational Health and Safety risks, wildlife/livestock/human accidents, HIV/AIDS incidences, soil erosion, storm water drainage, livelihood and environmental risks. This is represented in the Table 7.1 overleaf.

Table 7.1: Environmental monitoring plan for the proposed project

Environmental Component	Parameters to be monitored	Points to be monitored	Frequency of monitoring	Sampling Points	Total samples	Cost per sample	Total Cost	Lab Materials and Equipment/Other Requirements	Responsibility
Water Quality	pH, Total Suspended Solids (TSS) and Total Dissolved Solids(TDS), heavy metals, oils and grease	Ewaso Nyiro flood plain, River Isiolo, Kima, Bisanadi boreholes	Quarterly	5	12	12,000.00	720,000.00	Sampling bottles, cooler box, Access to a NEMA accredited laboratory	Contractor and KeNHA
Air Quality	TSP, NO _x , SO ₂ , CO, Dust particles, particulate matter etc.	Construction, Quarrying and Earth Borrowing sites, campsites, towns and villages	Continuous, with quarterly air quality measurements	5	12	50,000.00	3,000,000.00	Air sampling equipment	Contractor and KeNHA
Solid Waste Generation	Slag, domestic refuse, metallic scraps, sludge, waste composition, treatment methods	Construction sites, campsites	Monthly	N/A					Contractor and KeNHA
Occupational Health and Safety risks	Safety training for workers, accident reports and records, number and types of accidents, hazards	Construction sites, campsites	Continuous	N/A				Incidents log-book	Contractor and KeNHA
Human Accidents	Total number of human accidents, categories of humans knocked, accident locations	Towns centres, market centres, water points	Continuous	N/A				Accident recording book, camera, field patrol vehicle, GPS device.	Contractor and KeNHA
Wildlife Accidents	Total number of wildlife accidents, types of animals knocked, accident locations	Along the road especially between water points and townships	Continuous	N/A				Accident recording book, camera, field patrol vehicle, GPS device.	Contractor and KeNHA
Livestock Accidents	Total number of livestock accidents, types of animals knocked, accident locations	Along the road, and water points, livestock crossing points	Continuous	N/A				Accident recording book, camera, field patrol vehicle, GIS machine	Contractor and KeNHA
HIV/AIDS Incidences	Training programmes, number of incidences, number of condoms distributed, seminars, and participants trained etc.	Campsites, construction sites, towns, villages,	Quarterly	N/A				Office Supplies	Contractor and KeNHA
Soil Erosion	Soils eroded, Turbidity in storm water and other water sources, sources and causes	Excavated areas, sloppy areas along the road	Continuous	N/A				Camera, field vehicle	Contractor and KeNHA
Storm Water Drainage	Rainfall volume, topography	Flood prone areas, culverts, water ways, low lying areas	Continuous	N/A				Rain-gauge, field survey maps	Contractor and KeNHA
Environmental Risks	Fire outbreak, floods etc.	Possible hazardous areas only	Continuous during operation stage	N/A				Field inspections and information from lead agencies	KeNHA

8. Grievance redress mechanism

8.1. Introduction

A grievance mechanism provides a way to reduce risk for the proposed project, offers communities an effective avenue for expressing concerns and achieving remedies, and promotes a mutually constructive relationship. A well-functioning grievance mechanism:

- Provides a predictable, transparent, and credible process to all parties, resulting in outcomes that are fair, effective, and lasting;
- Builds trust as an integral component of broader community relations activities; and
- Enables more systematic identification of emerging issues and trends, facilitating corrective action and pre-emptive engagement.

Within the proposed Isiolo - Kulamawe road project, the following principles need to be established to ensure the effectiveness of the GM:

- Commitment to fairness in both process and outcomes.
- Dedication to building broad internal support across project lines.
- Mainstreaming responsibility for addressing grievances throughout the project, rather than isolating it within a single department.
- Willingness by KeNHA to visibly and sincerely champion the grievance system.

The design of this Grievance Mechanism is aligned to international best practice and guidelines and has taken the following factors into consideration:

- Proportionality: Scaled to risk and adverse impacts on affected communities
- Cultural appropriateness: Considering culturally appropriate ways of handling community concerns.
- Accessibility: Clear and understandable mechanism that is accessible to all segments of the affected communities at no cost.
- Transparency and accountability: To project affected stakeholders at field level.
- Appropriate protection: Prevents retribution and does not impede access to other remedies.

According to the proposed project, a grievance or complaint includes any communication that expresses dissatisfaction, in respect of the conduct or any act of omission or commission or deficiency of service and seeking a remedial action but do not include the following:

- Complaints that are incomplete or not specific in nature;
- Communications offering suggestions; and
- Communications seeking guidance or explanation.

Anticipated grievances in the proposed project area are especially in relation to disagreements on the relocation assistance values.

8.2. Process of registering and addressing grievances

Dissatisfactions may arise during the process of compensation for a variety of reasons, including disagreements on the compensation values during valuation of assets, controversial issues on property ownership etc. To address the problem of PAPs during implementation of compensation, a Grievance Redress Committee (GRC) will be established in project affected area.

The composition of the Grievance Redress Committee is as shown below:

- Representative of local Administration (Chairperson);
- Representative of Land Administration (Secretary) and
- Representatives of local Elders (Members) in the respective affected areas.

The main function of the committee would be arbitration and negotiation based on transparent and fair hearing of the cases of the parties in dispute between PAPs and the implementing agencies. The committee gives solution to grievances related to compensation amounts, delays in payment of compensation or provision of different type of resettlement assistance.

Timely redress of grievances is important in ensuring satisfactory implementation of resettlement and completion of the project on schedule. The means of grievance redress must be accessible and credible to reduce project resistance. This section proposes a Grievance Management Mechanism (GMM) to ensure that all complaints are addressed fairly and respectfully. A checklist of issues considered in the design of grievance procedures for the project corridor included the following:

- An inventory of any reliable conflict mediation organizations or procedures in the project area and an assessment to determine if any can be used instead of having to create new ones.
- Inclusion in the list of affected people. Dispute of the disclosed list of affected persons.
- A review of grievance redresses mechanisms for simplicity, accessibility, affordability, and accountability. Mechanisms such as use of oral means and in the local and national languages were prioritized and proposals on ways to impose explicit time limits for addressing grievances. Appeal procedures were specified, and suggestions made on how information needs were to be made available to the Project Affected Persons (PAPs).
- Any new committee to be created to address grievances would need to be given the authority to resolve complaints. It was proposed that such a committee include representatives of PAPs, as well as project officials and staff from other agencies with a substantial role in road construction resettlement activities.
- A Complaints Form, a Grievance Acknowledgement Form and Grievance Resolution Form should be introduced and dully filled by the involved parties.

8.3. Receiving grievances

The channels of receiving grievances will include:

- At KeNHA Level
 - Project Coordinating Team Level
 - Project Implementation Team Level
- County government

8.4. Steps in dealing with grievances

- a. Formal complaint received in writing (letter/email) or at the grievance desk within the project area.
- b. Recording of complaint in standard form and grievance register and log.
- c. Project supervisor receives the complaint and assigns to respective grievance committee at community level (PAP Committee).
- d. Grievance committee reviews the complaint, verifies, investigates and acts (if complaint is valid, resolves or passes it on to the Project Implementation Committee).
- e. Project Implementation Committee resolves and closes the complaint.
- f. Feedback to complainant within the stipulated timeframe.

8.5. Mechanism for appeal

Disputes not resolved by the GRC may be referred by KeNHA to a registered and licenced Arbitrator practising in Kenya and the arbitration shall be governed by the Kenya Constitution 2010, the Arbitration Act (Chapter 49 of the Laws of Kenya). Arbitration agreements shall be enforced by the courts, which have the power to refer a dispute to arbitration.

If the PAP is still not satisfied with the settlement after formal arbitration, other legal redress mechanisms may be sort such as appealing in court through litigation. This should however be a last resort mechanism to avoid dragging the project, since project implementation will not commence until all major public grievances are addressed satisfactorily.

8.6. Closure of grievance

Every grievance shall be disposed off within a period of thirty (30) days of its receipt and a final reply shall be sent to the complainant, containing details of resolution or rejection of the complaint, with reasons thereof recorded in writing.

A grievance shall be considered as disposed off and closed in any of the following instances, namely:

- When the intermediary or entity regulated by KeNHA or Isiolo and Meru Counties has acceded to the request of the complainant fully.
- Where the complainant has indicated in writing, its acceptance of the response of the intermediary or entity regulated by KeNHA or Isiolo and Meru Counties.
- Where the complainant has not responded within forty-five (45) days of the receipt of the written response of the intermediary or entity regulated by KeNHA or Isiolo and Meru Counties.
- Where the grievance redress committee has certified under indication to the subscriber that the intermediary or entity regulated by KENHA or Isiolo and Meru Counties has discharged its contractual, statutory and regulatory obligations and therefore closes the complaint.
- Where the complainant has not preferred any appeal within fourteen (14) days from the date of receipt of resolution or rejection of the grievance communicated by the intermediary or entity regulated by KeNHA or Isiolo and Meru Counties.
- Where the decision of KeNHA or Isiolo and Meru Counties in appeal has been communicated to such complainant.

8.7. Taking further steps if the grievance remains open

If however the grievance still stands then the community liaison officer (CLO) will initiate further investigation and determine the steps for future action. This will be referred to the Resident Engineer who will constitute a team to determine a team to address the grievance and determine if the client must be notified.

8.8. Record Keeping

All comment responses and, grievances are to be logged using the Comment Response, and Grievance logging forms and registers. This includes details of the comments/grievance, the commenter/aggrieved, and ultimately the steps taken to resolve the grievance. Hard copies of the form are to be kept at the project sites, whilst soft copies will be saved on the Contractor server. Any accompanying documentation e.g. written statements, photographic evidence, or investigation reports are to be filed along with the grievance log both in hard and soft copies.

A master database will be maintained by the CLO to record and track management of all comments and grievances. This will serve to help monitor and improve performance of the Comment Response and, Grievance Mechanism.

8.9. Comment Response and, Grievance Mechanism Log

A sample format for logging summary details of each comment response and, grievance must be provided. As noted above hard and soft copies should be kept on file.

Note:

- If it is a comment, the commented will receive a copy if he/she requests one
- If it is a Grievance, the aggrieved shall always receive a copy once complete for their own records.

8.10. Initial Response Template

The template is necessary for providing the initial response to the aggrieved only in the case of Grievances. This should be written on headed paper. This response must be sent within 3 days of the grievance being entered into the logbook.

It is vitally important to monitor the effectiveness of the comment response and, grievance mechanism. Appropriate measures/KPIs for this include monthly reporting on the number of grievances received, resolved and outstanding. This will be undertaken by the sociologist and reported to the resident engineer. As part of the annual review/report, analysing the trends and time taken for grievance resolution will help to evaluate the efficacy of the comment response and, grievance mechanism.

8.11. Monitoring and Review

As part of stakeholder engagement and consultation, involving the views of the stakeholders for whom the Comment Response and, Grievance Mechanism is designed in this monitoring and review will help to improve effectiveness and stakeholder buy-in.

Figure 8.1 below gives a flow chart of the main steps to be followed in recording and resolving received grievances.

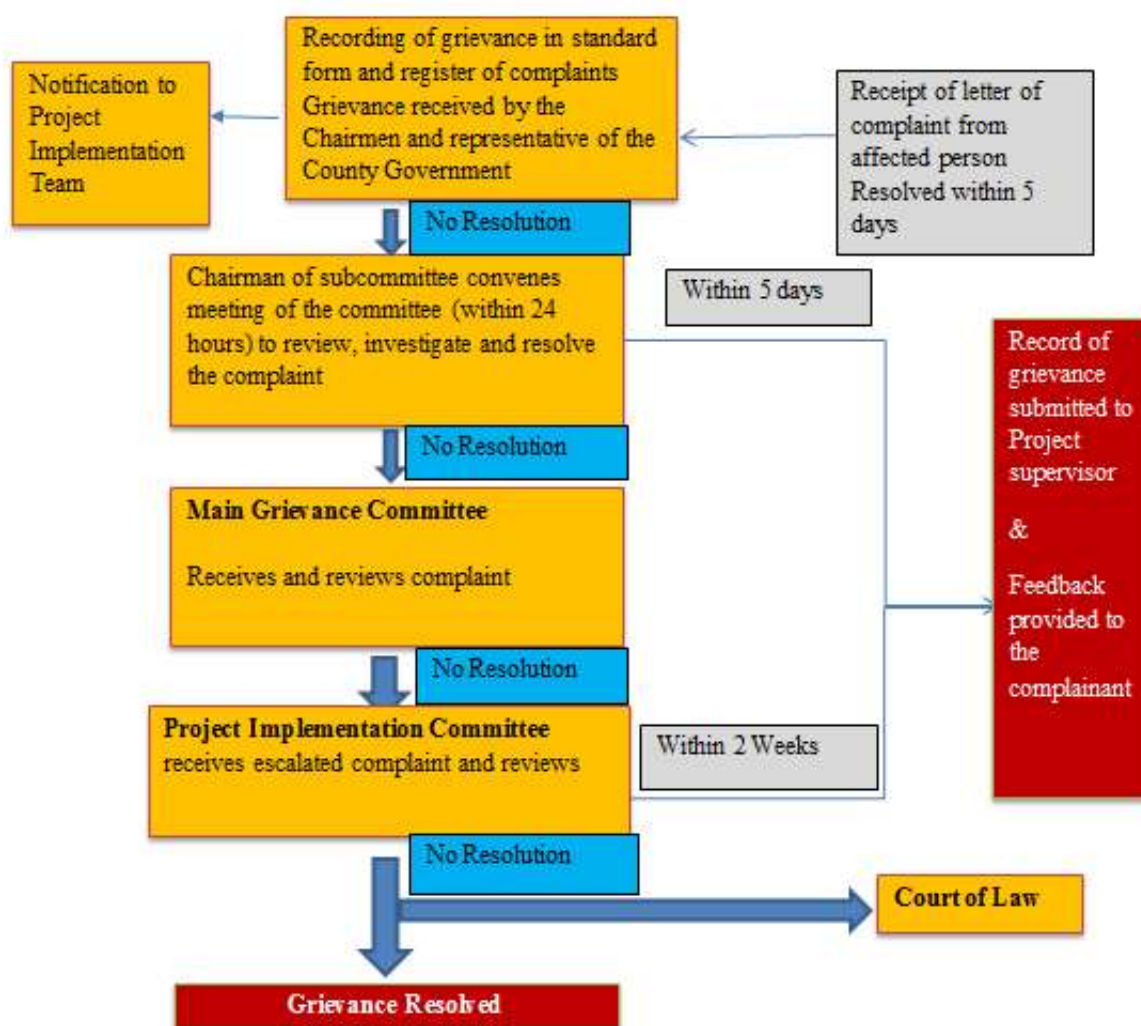


Figure 8.1 Grievance Escalation Matrix

8.12. World Bank's Grievance Redress Service

The Grievance Redress Service (GRS) ensures that complaints are promptly reviewed and addressed by the responsible units in the World Bank.

The objective is to make the Bank more accessible for project affected communities and to help ensure faster and better resolution of project-related complaints. The GRS is open to all those who believe they have been affected by a Bank-financed project.

8.13. World Bank's independent Inspection Panel

The Inspection Panel is an independent complaints mechanism for people and communities who believe that they have been, or are likely to be, adversely affected by a World Bank-funded project.

The Panel assesses allegations of harm to people or the environment and reviews whether the Bank followed its operational policies and procedures.

This often includes issues such as:

- Adverse effects on people and livelihoods as a consequence of displacement and resettlement related to infrastructure projects
- Risks to indigenous peoples, their culture, traditions, lands tenure and development rights;
- Adverse effects on physical cultural heritage, including sacred places;
- Adverse effects on natural habitats, including protected areas, such as wetlands, forests, and water bodies.

The project affected persons have this avenue to Report Complaints and Grievances if they feel like they are dissatisfied with available GRM.

9. Analysis of project alternatives

9.1. Introduction

This Chapter looks at the project alternatives in terms of site, transport alternatives, materials and technology scale, solid waste and wastewater management options and shall involve studying design alternatives and analysing them based on the environmental costs and benefits. This shall involve studying the technology, design, capital investments, operation and maintenance requirements among others.

9.2. “Without the project” scenario

In the analysis of “without the project” scenario, the following criteria is used; past, current and future effect/ impacts of the road as currently existing, anticipated benefits of proposed upgrading plus any other considerations are analysed.

The selection of “without the project” alternative would mean the discontinuation of project proposal and result in the road being retained in its existing form. As such, this alternative is likely to have the greatest implications on the socioeconomic environment of the area and surrounding communities. Due to the proposed size of the NETIP development it is anticipated that it will open up the North Eastern part of Kenya, improve connectivity to these areas, provide opportunities for employment, benefits associated with the construction industry and potentially significant business opportunities to spring up as a result of upgrading of the Isiolo - Kulamawe, Kulamawe-Modogashe, Modogashe-Samatar, Wajir-Rhamu and Rhamu-Mandera road sections. These benefits would be foregone if the proposed project is not undertaken.

9.3. Analysis of alternative construction materials and technology

The proposed road project will be constructed using modern, locally and internationally accepted materials to achieve public health, safety, security and environmental aesthetic requirements. Equipment that saves energy and water will be given priority without compromising on cost or availability factors. The road surfaces sub-structure and road infrastructure will be made using locally sourced materials that meet the Kenya Bureau of Standards requirements.

On the alternative construction materials and technology; rainwater should be harvested and be used in construction activities and supply to labour camps for flushing toilets and other non-domestic activities. Community members should also be encouraged to harvest rain water not only to supplement the water supplied but also to help reduce pressure on the drainage structures. Heavy use of timber and wood during construction should be discouraged to minimize destruction of natural resources. The exotic tree species should be preferred to indigenous species in the construction of the project components where need will arise as they can be replanted with ease.

Asphalt mixers, crushers and other construction equipment and machinery should be incorporated with pollution control devices like dust arrestors/precipitators, emission control, noise abatement devices and desulfurization devices. The equipment and vehicles should have highest levels of combustion efficiency, capability to use cleaner fuels like biofuels and should have enhanced safety features.

9.4. Solid waste management alternatives

A lot of solid waste will be generated from the proposed development. An integrated solid waste management system is recommendable. First, the proponent will give priority to reduction at source of

the waste materials. This option will demand a solid waste management awareness programme in the management and the workers. Notices for proper waste management/handling may be posted at strategic places for the sake of visitors in the workers' camps. Secondly, Recycling, Reuse and compositing of the waste will be the second alternative in priority. This will call for a source separation programme to be put in place especially in the kitchen section. The recyclables will be sold to waste buyers within County. The third priority in the hierarchy of options is combustion of the waste that is not recyclable. Finally, sanitary land filling will be the last option for the proponent to consider.

9.5. Alternative mode of transportation

There are no viable alternatives to this road that fulfil the functions of providing relatively fast, cheap land transportation. Air, rail, and water transport are unlikely to either complement or to substitute for roads or highways in this region. There is no railway transport system close to the project area connecting the two towns and no water body that can be used as a mode of transportation in the project area. The only possible means is air transport but, this is a rather expensive alternative and cannot be used as an alternative to the road.

The road is the most important link between Nairobi, Isiolo, Meru and it serves the entire North-Eastern region.

10. Environmental and social management plan

10.1. Introduction

This chapter presents the Environmental and Social Management Plan (ESMP) that will need to be implemented by the proponent/contractor to prevent or reduce significant negative impacts to acceptable levels. All the project components support infrastructure were considered when this ESMP was developed. Environmental management and social plans for all project phases have been outlined to cover:

- Design and Construction Phase.
- Operation Phase.
- Decommissioning Phase.

The following ESMP table forms the core of this ESMP for the construction, operational and decommissioning phases of the proposed road project. The following table details all necessary mitigation measures as well as the person responsible for implementing and monitoring such measures. The table should be used as checklist on site. Due to the magnitude of the project, compliance with the ESMP must be monitored periodically and reports prepared and provided at monthly site meetings during the construction phase and quarterly during the operations and maintenance period as required in EMCA, Cap 387. Annual audits will be conducted during both the construction, operation and maintenance phases.

10.2. Cost of implementation the ESMPs

For effective implementation of the ESMPs, the project must establish an Environment, Health and Safety (EHS) unit that will be responsible for *Project environmental Monitoring and Evaluation to ensure compliance to NEMA and World Bank Safeguards Policies and Procedures*. The project proponent will be required to produce periodic reports on project environment monitoring to be sent to the concerned agencies for information and supervision. The project proponent will be responsible for all costs of implementing the project's EIA licence conditions, including the ESMPs and the actual costs of public involvement in the ESIA process. Hence all costs proposed in the ESMPs below will be incurred by the project proponent who may transfer all to the contractor/ concessionaire except those of land acquisition and resettlement (Resettlement Action Plan Implementation budget). The costs outlined are current costs mainly for project environmental monitoring and evaluation to ensure compliance to NEMA and World Bank Safeguards Policies and Procedures. To estimate future costs, an increase to cover annual inflation should be applied. The costs for actual activities should be included in the main bill of quantities of the project.

Table 10:1: Environmental and Social Management Plan – Design, Construction, Operation and Decommissioning Phases

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
Design and construction phase				
Noise Pollution and Excessive Vibrations	<ul style="list-style-type: none"> Sensitize drivers of construction vehicles and machinery operators to switch off engines or machinery that are not being used. Ensure that all vehicles and construction machinery are kept in good condition all the time to avoid excessive noise generation. Ensure that all workers wear ear muffs and other personal protective gear/equipment when working in noisy sections. Ensure machines are switched off when not in use. Undertake loud noise and vibration level activities during off-peak hours during the day (i.e. between 8.00 am and 5.00 pm). 	Contractor/KeNHA	Monthly	- - - - -
Air Pollution due to Dust Generation and Air Emissions	<ul style="list-style-type: none"> Sprinkling of water on dry and dusty surfaces regularly including the access roads. Use of waste water to sprinkle at the construction site to reduce excessive dust. Adherence to personal protective clothing such as dust masks. Enforce onsite speed limit regulations. Ensure machines and vehicles are properly and regularly maintained. 	Contractor/KeNHA	Monthly	9,000,000 - - - -
Solid Waste Generation	<ul style="list-style-type: none"> Maximizing the rate of recycling of road resurfacing waste either in the aggregate (e.g. reclaimed asphalt pavement or reclaimed concrete material) or as a base; Incorporating recyclable materials to reduce the volume and cost of new asphalt and concrete mixes. contracting of an ordinary waste and hazardous waste handler to collect and appropriately dispose wastes from camp sites Collecting road litter or illegally dumped waste and managing it according to the recommendations in the General EHS Guidelines. Provision of bottle and can recycling and trash disposal receptacles at parking lots to avoid littering along the road. Collecting animal carcasses in a timely manner and disposing them through prompt burial or other environmentally safe methods. Managing sediment and sludge removed from storm drainage systems maintenance activities as a hazardous or non-hazardous waste based on an assessment of its characteristics. Management of all removed paint materials suspected or confirmed of containing lead as a hazardous waste. Grinding of removed, old road surface material and re-use in paving, or stockpiling the reclaim for road bed or other uses. 	Contractor/KeNHA	Monthly	- - 1,800,000 - 100,000 - - - -
Energy Consumption	<ul style="list-style-type: none"> Promote the use of solar energy and energy efficient bulbs in workers base camps and for street lights in towns situated along the proposed road. Switch off lights when not in use. Install energy meters to monitor the consumption of power in workers camps. 	Contractor/KeNHA	Monthly	- - -

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Ensure construction machinery and trucks are well maintained. Use energy-efficient construction machinery and trucks during construction phase of the project. 			- -
Discharge of Wastewater, Sewage and Degradation of Water Quality	<ul style="list-style-type: none"> Construct communal septic tank linked to a constructed wetland system. Promote recycling of wastewater in construction activities. Install meters in premises to control consumption of water. Ensure wastewater is channelled and treated in sewerage plants or disposed in septic tanks Ensure regular maintenance of plumbing system to avoid spillage of wastewater. Discharge of partially treated sewage into septic tanks Ensure regular maintenance of plumbing system and septic tanks to avoid spillage of raw sewage. 	Contractor/KeNHA	Monthly	500,000 - - - - - -
Water Abstraction and Consumption	<ul style="list-style-type: none"> Install water conserving taps and toilets. Install gutters on the roof of houses in workers camps to harvest rain water. Construct underground reservoir for storage of harvested rain water. Drilling of boreholes in towns such as Kulamawe and Ndumuru to supplement existing water resources. Harvest surface runoff and use it for landscaping purposes or sprinkling on roads during construction. 	Contractor/KeNHA	Monthly	- - 500,000 4,000,000 -
Modification of Hydrology of ASALs	<ul style="list-style-type: none"> Control excessive abstraction of water from rivers and wetlands. Avoid complete blockage of river channels during construction of bridges and culverts. Re-open all blocked river channels after construction of bridges. Quarries and pits for extraction of road construction materials to be used as water harvesting sites. Surface runoff on the sides of the road should be channelled in areas with gentle slopes to avoid erosion of the road sides. Construct over passes and bridges in areas occupied by rivers and wetlands. 	Contractor/KeNHA	Monthly	- - - - - -
Storm water generation and impact on drainage	<ul style="list-style-type: none"> Use of storm water management practices that slow peak runoff flow, reduce sediment load and increase infiltration. Use of vegetated swales, filter strips, terracing, check dams / water pans, detention ponds or basins, infiltration trenches and infiltration basins. Regular inspection and maintenance of permanent erosion and runoff control features. Paving in dry weather to prevent runoff of asphalt or cement materials. 	Contractor/KeNHA	Monthly	- 500,000 - -
Soil Erosion Risk	<ul style="list-style-type: none"> Ensure surface runoff generated on impervious surface is not channelled directly to steep slopes. 	Contractor/KeNHA	Monthly	-

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Provide grassed water ways along the access roads. Construct flow breaks on roadside drainage channels. Promote harvesting of surface runoff for landscaping purposes. 			- - -
Loss of Vegetation Cover and Biodiversity	<ul style="list-style-type: none"> Siting roads and support facilities to avoid critical terrestrial habitat by utilizing existing transport corridors. Design and construct wildlife access to avoid or minimize habitat fragmentation. Minimize clearing and disruption of riparian vegetation. Provide adequate protection against scour and erosion and consider the onset of the rainy season with respect to construction schedules. Minimize removal of indigenous plant species and replant indigenous plant species in disturbed areas. Explore opportunities for habitat enhancement 	Contractor/KeNHA/KFS	Monthly	- - - - 2,000,000 -
Disruption and Loss of Businesses	<ul style="list-style-type: none"> Provide miscellaneous support/assistance to community members as part of corporate social responsibility during construction Educate squatters on the need to maintain free road reserve. Provide comprehensive health and safety education to squatters in affected towns. Promote other sources of livelihood among the local communities. 	Contractor/KeNHA	Monthly	3,000,000 - 100,000 -
Spread of STD, HIV and AIDS	<ul style="list-style-type: none"> Develop a comprehensive STDS, HIV and AIDs control programme. Control of prostitution in main towns situated along the highway in collaboration with the Police and County Governments. Provision of STDs, HIV and AIDS prevention measures to workers. Creation of awareness of STDs, HIV/AIDS in workers camps. 	Contractor/KeNHA/County Governments	Monthly	2,000,000 - 200,000 -
Interference of Existing Development Infrastructure	<ul style="list-style-type: none"> Compensate for the relocation of other infrastructural public utilities already existing along the proposed road corridor such as Power poles near Isiolo –Kulamawe Junction (Point Zero). Undertake an integrated system of planning for infrastructure development along the corridor for future developments. Ensure effective stakeholder participation in the design of the road. 	Contractor/KeNHA/NLC	Monthly	Part of project cost (PPC) - -
Cultural Changes	<ul style="list-style-type: none"> Provide community awareness programmes. Develop programmes to enhance cohesion between project employees and the local community. Comply with defined national or local cultural heritage regulations and provisions of World Bank Physical Cultural Resources: OP/BP 4.11. Consult with the affected Communities to identify cultural heritage of importance, and to incorporate into the client's decision-making process the views of the affected Communities on such cultural heritage. 	Contractor/KeNHA	Continuous	- - - -
Security Risk and Wildlife-Human Conflicts	<ul style="list-style-type: none"> Thoroughly screen workers, suppliers and distributors. 	Contractor/KeNHA/KWS	Monthly	-

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Ensure 24-hour surveillance by engaging the services of day and night guards. Install CCTV cameras in strategic locations of the workers camps. Accord the local people the priority in employment. Ensure close liaison with the local Police Department. 			- PPC - -
Interference to road use activities due to diversions and closures	<ul style="list-style-type: none"> Avoid long traffic diversion roads. Water diversions to ensure dust is minimized hence easier visibility for drivers. Ensure Installation and maintenance of all construction signs, signals, markings, and other devices used to regulate traffic, including posted speed limits, warnings of sharp turns, or other special road conditions. Advance information on communication systems will be an advantage to users. Make Traffic circulation changes as per the Traffic Act Cap 403. Station Traffic personnel on strategic points to help during the diversions. 	Contractor/KeNHA	Periodically	- PPC PPC - - -
Gender Discrimination	<ul style="list-style-type: none"> Apply gender Kenya constitutional requirements throughout the project. Apply all guidelines under the National Gender and Equality Commission Act, 2011. Undertake gender mainstreaming at project design, implementation/ construction, operation and decommissioning stages. Incorporate best practices in gender mainstreaming from project partners. 	Contractor/KeNHA	Monthly	- - - -
Occupational Health and Safety	<ul style="list-style-type: none"> Development of a transportation management plan for road construction that includes measures to ensure work zone safety. Establishment of work zones to separate workers on foot from traffic and equipment by routing of traffic to alternative roads. Use protective barriers to shield workers from traffic vehicles, regulation of traffic flow by warning lights, design of the work space to eliminate or decrease blind spots, and ensure reduction of maximum vehicle speeds in work zones. Training of workers in safety issues related to their activities. Ensure safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination for the work space. Barricade the area around which elevated work is taking place to prevent unauthorized access. Hoisting and lifting equipment should be rated and properly maintained, and operators trained in their use. Elevating platforms should be maintained and operated according to established safety procedures including use of fall protection measures (e.g. railings). 	Contractor/KeNHA	Monthly	- - - - - 2,000,000 - -

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Use of the correct asphalt product for each specific application and ensuring application at the correct temperature to reduce the fuming of bitumen during normal handling. Maintenance of work vehicles and machinery to minimize air emissions. Reduction of engine idling time in construction sites; Use of extenders or other means to direct diesel exhaust away from the operator. Ventilation of indoor areas where vehicles or engines are operated or use of exhaust extractor hose attachments to divert exhaust outside. 			- - - -
Community Health and Safety	<ul style="list-style-type: none"> Implement pedestrian safety management strategies such as provision of safe corridors along the road alignment and construction areas, including tunnels and safe crossings for pedestrians and cyclists. Installation of barriers (e.g. fencing, plantings) to deter pedestrian access to the roadway except at designated crossing points. Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas. Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways, speed limits, warnings of sharp turns, or other special road conditions. Construction of roadside rest areas at strategic locations to minimize driver fatigue. Installation of measures to reduce collisions between animals and vehicles (e.g. use of signs to alert drivers on road segments where animals frequently cross). Prepare an emergency preparedness and response plan in coordination with the local community and local emergency responders. 	Contractor/KeNHA	Monthly	- PPC PPC 500,000 - -
Disturbance to Wildlife	<ul style="list-style-type: none"> Siting roads and support facilities to avoid critical terrestrial and aquatic habitat by utilizing existing transport corridors. Design and construction of wildlife access to avoid or minimize habitat fragmentation. Avoidance or modification of construction activities during the breeding season and other sensitive seasons or times of day to account for potentially negative effects. Minimize clearance and disruption of riparian vegetation. Minimize removal of indigenous plant species, and replant indigenous plant species in disturbed areas. Explore opportunities for habitat enhancement through reduced clearance to conserve or restore native species. 	Contractor/KeNHA/KWS/KFS	Monthly	- - - - -
Road Accidents	<ul style="list-style-type: none"> Construct pedestrian crossing points in certain key areas. Create parking areas for trucks. Create bunks in towns. Design road bumps and rumble strips along key towns such as Kulamawe, Kachuru, Ndumuru and Gambella. 	Contractor/KeNHA/KWS	Monthly	- PPC PPC -
Reduced Accessibility of Neighbourhood Areas	<ul style="list-style-type: none"> Construct overpasses, underpasses or culverts in densely populated areas to facilitate safe crossing of the road. 	Contractor/KeNHA	Monthly	-

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Provide opening or crossing points in road barriers to allow crossing of pedestrians. 			-
Possible Displacement of Local Communities, Loss of Properties and Businesses	<ul style="list-style-type: none"> The affected communities along the Isiolo –Kulamawe road route will be compensated appropriately according to existing best practices. The proponent will need to ensure that the final designs of the highway will be realigned to ensure that displacements are minimized as much as possible. Ensure that the Resettlement Action Plan is done appropriately and professionally (implementation monitoring) 	Contractor/KeNHA	Continuous	500,000,000 - 4,000,000
Degradation of borrow and quarry areas	<ul style="list-style-type: none"> All borrow /quarry areas will be refilled, re-vegetated and landscaped. In case it is not done, then such areas will be cordoned with barbed wire fence, with warning signs or be harnessed to form water pans or earth dams for the local community and wildlife Haphazard borrowing and quarrying should be avoided Prior investigation /assessments on the drainage and other environmental aspects should be conducted according to the specifications of the authorities. Borrow pits and quarries should be located far from the settlements Ensure maximum use of existing quarries, already in operations. Degraded and barren areas, riverbeds, and wastelands to be used for borrowing materials. Use of productive lands will be prohibited. Lands could be selected through Community consultation, and sites subsequently developed into water pans or other productive purposes. In case of new borrow areas, all measures will be taken so that there will be no loss of productive soil, and all environmental considerations are to be met with. While turning borrow pits into artificial water pools for human and wildlife, always consider the risk of changing the natural behaviour of avian life in the project area. Such pools should be reduced in number 	KeNHA/Contractor	Quarterly	5,000,000 - - - - - - -
Community conflicts	<ul style="list-style-type: none"> Ensure all stakeholders and the public are involved in the planning process. Ensure proper identification and compensation of all persons who will lose businesses and land. Obtain necessary permissions and approvals from the County Governments. Ensure EIAs are conducted for specific project activities such as sand harvesting, borrow pit and quarrying sites. Largely involve the community in the project through their leaders, take keen in timely addressing their grievances and ensure a good percentage of the local community members are employees in the project 	KeNHA/Contractor	Continuous	4,000, 000
Sexual Exploitation/Child Abuse	<ul style="list-style-type: none"> Conduct awareness and educational programmes to workers and minors on the issue of sexual exploitation and child abuse 	KeNHA/Contractor	Continuous	2,000, 000

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Provide hotlines for the reporting of such cases Ensure that stern action is taken for offenders found to have committed sexual exploitation Employ adults(18 and over) provided with a national identity card 			
Gender Based Violence	<ul style="list-style-type: none"> This should be mitigated as follows: Financial management training should be conducted to the PAPs and the employees Have separate latrines for different genders Provide a communication line to report such cases 	KeNHA/Contractor	Continuous	2,000, 000
Cumulative Impacts	<ul style="list-style-type: none"> Specific actions that may be needed to effectively manage cumulative impacts include the following: Project design changes to avoid cumulative impacts (location, timing, technology). Adaptive management approaches to project mitigation Mitigation of project impacts by other projects (not under control of the proponent to further minimize impacts). Collaborative engagement in other regional cumulative impact management strategies. Participation in regional monitoring programs to assess the realized cumulative impacts and efficacy of management efforts. Effect monitoring needed to assess the realized cumulative impacts is clearly defined and implemented. Ensure multiparty regional mitigation and/or management (e.g., additional mitigation of other developments, offsets, management programs) that may be needed to effectively manage cumulative impacts is also identified Support from other stakeholders (County Governments, developers and communities) is sought to implement it 	KeNHA/Contractor	Continuous	2,000, 000
Operational phase				
<i>Noise Pollution and Excessive Vibrations</i>	<ul style="list-style-type: none"> Enforcement of Traffic Act regulations to ensure that all vehicles using the road are in good condition all the time to avoid excessive noise generation. Install speed control measures in town areas (Kulamawe, Kachuru, Ndumuru and Gambella) such as bumps and ramble strips. Install no hooting signs in sensitive areas such as near schools, etc. 	Contractor/KeNHA	Monthly	- PPC PPC
<i>Air Pollution due to Dust Generation and Air Emissions</i>	<ul style="list-style-type: none"> Reduction of traffic congestion in town areas. Enforcement of Traffic Act regulations to ensure that all vehicles using the road are kept in good condition all the time to avoid excessive emissions. 	Contractor/KeNHA	Monthly	- -
<i>Impacts on livestock and wildlife</i>	<ul style="list-style-type: none"> Liase with KWS to ensure that important wildlife crossing corridors at Ndumuru, Yaqbarsathi and Kachuru area have developed underpasses such as culverts. Maintenance of road signs at appropriate areas to warn drivers on wildlife and livestock crossing paths. 	Contractor/ KeNHA	Continuous	- PPC

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Maintenance of bumps and pedestrian crossing areas close to livestock pasture and watering areas. 			-
Increased consumption of fossil fuels	<ul style="list-style-type: none"> Design an energy efficient road in terms of terrain, avoiding steep slopes and sharp bends which cumulatively influence fuel consumption levels per journey. Use of automatic sensor solar lighting along the road corridor. Regular road maintenance will also ensure that movement of vehicles is not interfered with. This as a result will minimize consumption of fossil fuels due to unnecessary stopping along the road. 	Contractor/KeNHA	Continuous	- PPC -
Increased Generation of Storm Water	<ul style="list-style-type: none"> Use of storm water management practices that slow peak runoff flow, reduce sediment load and increase infiltration. Regular inspection and maintenance of permanent erosion and runoff control features. Use of vegetated swales, filter strips, terracing, check dams / water pans, detention ponds or basins, infiltration trenches and infiltration basins. Repair works to be carried out in dry weather to prevent runoff of asphalt or cement materials. 	Contractor/KeNHA	Continuous	- - - -
Loss of human and animal Life due to increased road accidents	<ul style="list-style-type: none"> Provide a side road parallel to the proposed tarmacked road for use by locals during transportation of livestock. Maintain pedestrian and livestock crossing points with foot bridges in certain key areas for instance near the villages and towns. Maintain culverts for livestock and wild animals at strategic locations along the road. Maintain parking areas and bus stops for trucks. Conduct road safety sensitization programmes. Carry out Risk Assessment to identify risk areas and provide appropriate prevention measures. 	Contractor/KeNHA	Continuous	- - - - 10,000,000.00 -
Community Health and Safety	<ul style="list-style-type: none"> Implement pedestrian safety management strategies such as provision of safe corridors along the road alignment and construction areas, including tunnels and bridges and safe crossings for pedestrians and cyclists. maintenance of barriers (e.g. fencing, plantings) to deter pedestrian access to the roadway except at designated crossing points. Installation and maintenance of speed control and traffic calming devices at pedestrian crossing areas. Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, specifically those related to pedestrian facilities or bikeways. Installation and maintenance of all signs, signals, markings, and other devices used to regulate traffic, including posted speed limits, warnings of sharp turns, or other special road conditions. Maintenance of roadside rest areas at strategic locations to minimize driver fatigue. Installation of measures to reduce collisions between animals and vehicles (e.g. use of signs to alert drivers on road segments where animals frequently cross). 	Contractor/KeNHA	Continuous	- - - - - -

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Prepare an emergency preparedness and response plan in coordination with the local community and local emergency responders. Comply with OSHA 2007 requirements, they include; <ul style="list-style-type: none"> ✓ Carrying out Safety Audits. ✓ Implementing DOSHS improvement orders. ✓ Carrying out EHS Risk Assessments. Involve all the relevant stakeholders during the audit so as to incorporate suggested EHS measures into the report. 			- - - - -
Increased Generation of Solid Waste	<ul style="list-style-type: none"> Maximizing the rate of recycling of road resurfacing waste either in the aggregate (e.g. reclaimed asphalt pavement or reclaimed concrete material) or as a base. Incorporating recyclable materials to reduce the volume and cost of new asphalt and concrete mixes. Collecting road litter or illegally dumped waste and managing it according to the recommendations in the General EHS Guidelines. Provision of bottle and can recycling and trash disposal receptacles at parking lots, bus stops and bus stations to avoid littering along the road. Collecting animal carcasses in a timely manner and disposing them through prompt burial or other environmentally safe methods. Managing sediment and sludge removed from storm drainage systems maintenance activities as a hazardous or non-hazardous waste based on an assessment of its characteristics. Management of all removed paint materials suspected or confirmed of containing lead as hazardous waste. Grinding of removed, old road surface material and re-use in paving, or stockpiling the reclaim for road bed or other uses. Ensure implementation of the project's operation phase Waste Management Plan. Comply with EMCA Cap 387 Waste Management Regulations, 2006. 	Contractor/KeNHA	Continuous	- - - 2,000,000.00 - - - -
Occupational Health and Safety	<ul style="list-style-type: none"> When undertaking road repairs, use protective barriers to shield workers from traffic vehicles, regulation of traffic flow by warning lights, design of the work space to eliminate or decrease blind spots, and ensure reduction of maximum vehicle speeds in work zones. Training of workers in safety issues related to road maintenance activities. When undertaking road repairs, ensure safe practices for work at night and in other low-visibility conditions, including use of high-visibility safety apparel and proper illumination. When repairing the highway, use asphalt product of appropriate specification and ensure application at the correct temperature to reduce the fuming of bitumen during normal handling. Maintenance of work vehicles and machinery to minimize air emissions. 	Contractor/KeNHA	Continuous	- - - - -

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Reduction of engine idling time in construction sites; Use of extenders or other means to direct diesel exhaust away from the operator. Ventilation of indoor areas where vehicles or engines are operated or use of exhaust extractor hose attachments to divert exhaust outside. Carry out Safety Audits. Implement DOSHS improvement orders. 			- - - -
Soil Quality Degradation	<ul style="list-style-type: none"> Rehabilitate borrow areas. Revegetate cleared areas. Ensure proper drainage infrastructure along the road. Used Oil and spills should be disposed in an environmental friendly manner. 	Contractor/KeNHA/Public	Continuous	5,000,000.00 2,000,000.00 - -
Risk of spread of invasive species	<ul style="list-style-type: none"> Reduce open gaps in road reserves by planting appropriate tree species suitable for highway or road side tree planting Monitor composition of species regenerating along road reserves and take prompt actions in case of emergence of invasive species Carry out routine road reserves maintenance mainly to clear bushes that may harbour invasive species. 	Contractor/KeNHA/Public	Continuous	4,000,000.00
DECOMMISSIONING PHASE				
Demolition waste	<ul style="list-style-type: none"> Use of an integrated solid waste management system i.e. through a hierarchy of options: <ul style="list-style-type: none"> ✓ Source reduction ✓ Recycling ✓ Composting and reuse ✓ Combustion ✓ Sanitary land filling. All buildings, machinery, equipment, and others that will not be used for other purposes must be removed and recycled/reused as far as possible. All foundations must be removed and recycled, reused or disposed of at a licensed disposal site. Where recycling/reuse of the machinery, equipment, implements, structures, partitions and other demolition waste is not possible, the materials should be taken to a licensed waste disposal site. Donate reusable demolition waste to charitable organizations, individuals and institutions. 	Contractor/KeNHA	at the time of decommissioning	- - - - - - - -
Noise and Vibration	<ul style="list-style-type: none"> Sensitize workforce including drivers of construction vehicles. Install sound barriers for pile driving activity. Install portable barriers to shield compressors and other small stationary equipment where necessary. 	Contractor/KeNHA	at the time of decommissioning	150,000 200,000 -

Possible impacts	Mitigation measures	Responsible party	Frequency/Timing	Budget (Kshs)
	<ul style="list-style-type: none"> Proper maintenance of all equipment. Workers near high level noise to wear safety and protective gear. 			-
<i>Dust Emission</i>	<ul style="list-style-type: none"> Spray demolished piles of earth with water. Avoid pouring dust materials from elevated areas to ground. Cover all trucks hauling soil, sand and other loose materials. Provide dust screen where necessary. 	Contractor/KeNHA	at the time of decommissioning	1,000,000 - - 200,000
<i>Site degradation</i>	<ul style="list-style-type: none"> Implement an appropriate re-vegetation programme to restore the site to its original status. Consider use of indigenous plant species in revegetation. 	Contractor/KeNHA	at the time of decommissioning	3,000,000 -

11. Conclusion and recommendations

The ESIA study has established that the proposed development project by KeNHA is a worthy investment by the proponent and without a doubt will contribute significantly to the economic development of the country. This will be achieved through the prior discussed positive impacts namely; growth of the economy, boosting of the informal sector during the construction phase, provision of market for supply of building materials, employment opportunities, increase in government revenue and optimal use of land among others. The studies conducted on the proposed upgrading of Isiolo- Kulamawe (77Km) shows that indeed the project will pioneer development in North Eastern Kenya.

However, the ESIA study has established that the proposed project will also have some negative impacts. The negative environmental impacts that will result from establishment of the proposed project which include possible livestock-vehicular accidents, hydrology and water quality degradation, noise pollution, dust emissions, solid waste generation, increased water demand, increased energy consumption, generation of exhaust emissions, workers accidents and hazards during construction, possible exposure of workers to diseases, increased storm water among others can however be sufficiently mitigated.

The proponent of the proposed project shall be committed to putting in place several measures to mitigate the negative environmental, safety, health and social impacts associated with the life cycle of the project. It is recommended that in addition to this commitment, the proponent shall focus on implementing the measures outlined in the Environmental Management and Monitoring Plan as well as adhering to all relevant national and international environmental, health and safety standards, policies and regulations that govern establishment and operation of such projects in Kenya. More emphasis should also be put on complying with the World Bank Safeguards Policies and Procedures discussed in the report. It is expected that the positive impacts that emanate from such project shall be maximized as much as possible as exhaustively outlined within the report.

Considering the positive socio-economic and environmental benefits which will accrue because of the proposed development and the ESIA study having found no major impacts to arise from the development, it is our recommendation that the project be allowed to proceed on the understanding that the proponent will adhere to the mitigation measures recommended herein and will further still implement the proposed Environmental Management and Monitoring Plan to the letter. Kenya as a country has a big shortage of such road project developments especially in the Northern side. Therefore, the construction of the proposed project goes a long way in solving part of the existing challenges experienced on road transportation sector.

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