South Sudan – Eastern Africa Regional Transport, Trade and Development Facilitation Program

Original

Draft Revised ESIA Study Report

December 2014

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PROJECT SUMMARY

Project Title:	**Proposed Upgrading of the Lodwar-Lokichogio-Nakodok 240Km (A1) Road.**
Consulting Services for:	**Review and Update the Environmental and Social Impact Assessment (ESIA) for the Proposed Rehabilitation of the Lodwar-Lokichogio-Nakodok 240Km (A1) Road**
Objectives:	**Objective of the Rehabilitation of the Lodwar-Lokichogio-Nakodok 240Km (A1) Road:** The objective of the Proposed Rehabilitation of the Lodwar-Lokichogio-Nakodok 240Km (A1) Road include the following: • Enhance connectivity between Kenya and South Sudan • Enhance the economic profile of the East African region as a strategic investment and export hub; • Facilitate the movement of people, goods and services along the Northern Corridor and its spurs especially considering the current economic activities in Turkana relate to oil and other resources.. • Facilitate cross border trade between Kenya and South Sudan; • Create employment opportunities; • Develop a sustainable economy in the County of Turkana while contributing to poverty reduction **Project Scope** The Road Upgrading Project will include the following: • Identify project affected persons; • Carry out resettlement of project affected persons; • Demolition of affected structures; • Clearing of vegetation along road route; • Preparation and use of road deviation to be used during road upgrading construction; • Road excavation and grading works; • Development of road construction material sources (borrow pits) and transportation of the materials to the construction site; • Road and bridge construction activities. **Objective of Reviewing and Updating of Lodwar-Nakodok Road ESIA Study are:** • Review and update the ESIA Study Report compiled in 2013; • Ensure all environmental consequences of construction and operation of the road are evaluated and addressed as part of the mitigation measures in the final road design; • Review and update the Draft ESIA Report to conform with World Bank Operational Policies and Kenya National Highways Authority (KeNHA) requirements;; • To identify gaps in the Draft ESIA Report and address them in the revised version; • To conduct second Public Consultation Meetings to sensitise all the stakeholders about the project, seek their inputs into the project design and disclose the positive and negative impacts of the project.
Project Location	The project is located in Turkana County. It commences in Lodwar Town, at the roundabout on the road from Kitale, and ends at Nakodok at the border with South Sudan covering total distance of 240km.
Client:	**Kenya National Highways Authority (KeNHA)**
Consultant:	**Joshua P. Oyieko (Panafcon Ltd)**
Report Title:	**Environmental and Social Impact Assessment (ESIA) for the Proposed Rehabilitation of the Lodwar-Lokichogio-Nakodok 240Km (A1) Road**
Submission Date:	**December 2014**

CERTIFICATION

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LIST OF ACRONYMS

ACC	Assistant County Commissioner
ACK	Anglican Church of Kenya
ALCS	Axle Load Control Station
BCM	Billion Cubic Metres
BD	Biological Diversity
BP	Bank Procedure
CBO	Community Based Organisation
°C	Degrees Celsius
CC	County Commissioner
CSR	Cooperate Social Responsibility
DC	District Commissioner
DCC	Deputy County Commissioner
DDO	District Development Officer
DDP	District Development Plan
DEO	District Environment Officer
DO	District Officer
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act (1999)
EMF	Electromagnetic Field
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
FM	Frequency Modulation
FNU	Formazin Nephelometric Units
GE	Gastroenteritis
GoK	Government of Kenya
HH	Household Head
HTN	Hypertension
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEC	Information, Education and Information
ILO	International Labour Organisation
ISS	Immune Suppression Syndrome
KCAA	Kenya Civil Aviation Authority
KES	Kenya Shillings
Km	Kilometres
Km^2	Square Kilometres
KNBS	Kenya National Bureau of Statistics
kV	Kilo Volts
KWS	Kenya Wildlife Service
m	Meters
M	Million
Mm	millimeters
ND	Non Detect
NEMA	National Environment Management Authority
NIB	National Irrigation Board
NNS	Neonatal Sepsis
NTU	Nephelometric Turbidity Units
NRPB	National Radiological Protection Board
OOP	Office Of the President
OP	Operational Procedure
OPD	Out Patient Department
OPP	Organo-Phosphate Poisoning
OSHA	Occupational Safety and Health Act

PAPs	Project Affected Persons
PCM	Public Consultation Meeting
PDP	Part Development Plan
ppb	Parts Per Billion
POP	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PTB	Pulmonary Tuberculosis
Q&A	Questions and Answers
RAP	Resettlement Action Plan
RIU	Resettlement Implementation Unit
ROW	Right of Way
RTA	Road Traffic Accident
STI	Sexually Transmitted Infection
TB	Tuberculosis
TLV	Threshold Limit Value
TOR	Terms of Reference
UNEP	United Nations Environment Programme
UTI	Urinary Tract Infection
URTI	Upper Respiratory Tract Infection
UTM	Universal Transverse Mercator
WHO	World Health Organisation
µg/m³	Micro-gram per cubic metre
WRMA	Water Resources Management Authority
µS/cm	Microsiemens per Centimetre

EXECUTIVE SUMMARY

INTRODUCTION

The Government of Kenya through Kenya National Highways Authority (KeNHA) is planning to upgrade the road from Lodwar Town to Nakodok covering a total distance of 240km. The project has the potential to generate environmental and social impacts as listed in the Environmental and Social Impact Assessment (ESIA) Study Report for the proposed upgrading of the Lodwar-Lokichogio-Nakodok 240Km (A1) Road that was compiled in 2013.

The present study is being carried out to review and update the earlier ESIA Study carried in 2013. This ESIA Study has been carried out according to the requirements of the Environmental Management and Co-ordination Act (EMCA), 1999, part II of the Environmental Impact Assessment and Audit Regulations (2003) and subsequent NEMA Regulations and World Bank Safeguard Policies for any triggers.

PROJECT BACKGROUND

The Government of Kenya, through the Kenya National Highways Authority (KeNHA) has proposed to improve and upgrade the Lodwar – Lokichogio – Nakodok (A1) Road. The road is part of the Northern Corridor Transport Improvement Project (NCTIP) whose aim is to enhance connectivity between Kenya's coastal ports of Mombasa and Lamu with neighbouring countries in East and Central Africa with a view to enhancing the economic profile of the East African region as a strategic investment and export hub. Improving the road and upgrading it to international standard is considered an important investment that will enhance regional connectivity and integrate South Sudan and northern Uganda with East African neighbouring countries by increasing transport efficiency, facilitating cross border trade and improve access to export markets through Kenya's coastal ports. In addition, Turkana County, which has remained under-developed for a long time, will be the important link in the envisaged international integration and is, therefore, expected to attract tremendous investment opportunities and economic development. The purpose of this study is to evaluate the environmental consequences of construction and operation phases of the proposed road project and identify measures to mitigate adverse environmental and social impacts of the project.

DESCRIPTION OF THE PROJECT

The project road commences at Lodwar, at the roundabout on the road from Kitale, and ends at Nadapal at the border with South Sudan. The Lodwar – Lokichogio – Nakodok road has a total length of 240km. From Lodwar the road runs in a north westerly direction generally traversing flat to rolling terrain. It passes through Nasiger, Makutano Gold, Nakalale and Songot market centres and the towns of Kakuma and Lokichogio. In essence the route can be divided into three major sections:

1) The 69 km section between Lodwar and Lokitaung turnoff at Makutano Gold, which was constructed in the late eighties. This section is completely worn-out;
2) The 146 km section between Lokitaung turnoff and Lokichogio, which was constructed in the early nineties. This section is in fair to poor condition;
3) The 30 km section between Lokichogio and Nakodok (Sudan Border) is essentially an earth track widened at many locations with a grader. This section is a very poor earth road with very sharp boulders.

The section from Lodwar up to Lokichogio consists of a two lane bituminous carriageway with narrow shoulders of about 0.5 to 1m wide. From Lokichogio to the end at Nadapal, only a gravel / earth track of approximately 2 lane width exists.

The condition of the thin bituminous pavement is generally fair to poor and extensive patch works and potholes are observed throughout the road stretch. Low embankment of 1m to 1.5m is generally available and the condition of side slope is stable in most of the sections. The condition of the gravel track in the Nadapal section is very poor and with many large pot holes.

DESCRIPTION OF ENVIRONMENTAL AND SOCIAL BASELINE

Topography

The main topographical features in the County are low-lying open plains interspersed with isolated mountain ranges and hills, Lake Turkana and the river drainage patterns. Most of the Turkana region consists of low-lying plains. The altitude rises from about 900 m at the foot of the escarpment marking the Uganda border to the West and then falls to 369 m to the shores of Lake Turkana in the East. The isolated mountains are mainly found in the central area with plains around Lodwar and more specifically the Lotikipi plains in the north. In the southeast, the Suguta valley follows a tectonic trough bordering the Samburu uplands.

Climate

Turkana County is classified as an arid area where the climatic conditions are characterized as warm to hot, with temperatures ranging between 24 to 38 degrees Celsius. Rainfall is erratic and unpredictable both in timing and distribution. The western border with Uganda and Sudan receive more than 500 mm per year. The highlands in the north-eastern parts bordering Ethiopia and the hills in the south and southwest bordering Pokot also register higher rainfall. The lowest rainfall occurs along the shore of Lake Turkana and in the central plains around Lodwar with an annual average 150 mm per year).

Geology and Soils

The region is characterized by four dominant geological formations which include: Cenozoic sediments, tertiary volcanic rocks; Quaternary volcanic rocks and Quaternary to Recent sediments. The Mozambique Belt rocks underlie the entire region except for the western parts of Turkana, which are completely covered by volcanic formations.

Vegetation

A quarter of the county is devoid of trees and two thirds support only scattered trees while reliable sources of grass with high productivity are small and widely scattered. The presence of plant biomass is related to altitude except for riverine areas. The two main types of woody vegetation found in Turkana are riparian and non-riparian. Forests with a canopy cover of over 12% are limited to the mountain ranges, especially the Loima Hills, which are relatively humid, and also along the main rivers (Turkwel and Kerio), which have significant areas of riverine forest. The shores of Lake Turkana are dominated by *Acacia spp* and Doum palm (*Hyphene compressa)* and more recently invaded by *Prosopis* spp on some sites along the rivers, especially the Kalokol to Turkwel stretch.

Prosopis juliflora is an introduced tree species that is rapidly gaining the status of an invasive weed in a large swathe of the project area.

Fauna
Being arid and semi arid environment coupled by years of hunting, Turkana in general has relatively low diversity of fauna outside the existing protected areas. Notable are dikdiks, monkeys, guinea fowls and a wide variety of birds.

Water resources
In Turkana, only about 15 per cent of people have adequate access to water, compared to the national average of 57 per cent. For many of the communities, the main source of water is open 'scoop wells' dug in dry riverbeds

SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

Human population size and density
Turkana County has a population of 855,399 of which 53% are male and 47% female (KNBS, 2009). The population density in this vast county is low and varies from 1 person per Km^2 in Kibish Division to 29 persons per Km^2 in Kakuma Division, with a county average of 6.9 persons km^2, with a with a sex ratio of male/female 92:100. There are 123,191 households. The total population almost doubled changing from 450,860 in 1999 to 855,399 in 2009 this population change is almost double (89.7%) when compared with the National population change of 34.6% from 1999 to 2009.

The Turkana are some of the most mobile people in the world. Traditionally, there were no permanent settlements occupied by them. Permanently and semi-permanently settled areas in the Turkana are found along Turkwel and Kerio rivers where irrigated farming is practiced and water is accessible and near Lodwar town. Along these areas, there exist peri-urban market centres with the necessary social and economic infrastructures like schools, health facilities and shopping centres.

Land tenure
Since independence to date land tenure in Turkana County has been only as Trust Land and all land in the County is administered under the Trust land Act. The existing land tenure in the trust lands can be described as a quasi-customary/communal in that land rights are held in trust by the county councils. Because there have been no formal surveys or land adjudication in the whole County, land is still held communally by various communities under customary tenure, and is managed by the County Government on behalf of the communities.

Land use
Nomadic pastoralism is the dominant land use in Turkana County. Other land use activities include small scale agriculture along river banks and flood plains, scattered settlements, urban centres etc.

Livelihoods
The Turkana County is subdivided into four main livelihood zones based on their sources of income – pastoralism (64%), agro-pastoralism (16%), fishing based (12%), and peri-urban and urban (8%). Pastoralism is the main subsistence and economic activity in the county. It is estimated that about 60% of the population derive their livelihood from livestock-based activities. Fishing is an important activity along the lakeshore. The Turkana who live along the major water courses engage in small-scale agriculture. Indigenous fruits/foods are important sources of food particularly during dry spells.

Charcoal production
Charcoal is primarily produced along the Turkwel and Kerio Rivers and is sold along the main highway between Kainuk and Lokichogio. Unfortunately, whilst charcoal production offers small returns to those that produce it, due to the destructive nature of current practices, the production and sale of charcoal is illegal in Turkana. A study by KFS indicates that a significant quantity of charcoal (approx. 25,000 bags) leave the County every month.

Mining
Gold mining has been prevalent in Turkana for many years. Whilst most gold mining operations in the contemporary period are labour intensive one man operations, gold mining in the recent past has been the domain of large businesses backed by significant political support. Currently, gold mining occurs primarily in Nakoriyek (on the road to Kanakurdio), Kimagur (on the main road before Lokichar), Lokiriama, Namorupus and Nadunga (west of Nakoriyek). Small-scale gold mining is also found in the southern part of the district at Nakwamoru and central parts at Makutano ('*Gold*') between Kakuma and Lodwar, where mining is not of a large-scale commercial nature, though an alluvial type of it is being exploited Turkana has abundant building sand and quarry materials.

Casual, waged labour and trade
The demand for casual labour in Turkana is in the form of agricultural or building jobs. However, in the case of agriculture, most casual jobs are available in the wet season with some herding opportunities becoming available in the dry season. The other job opportunities becoming available include grocery shops and supermarkets, service stations, restaurants/hotels and bookshops. These are concentrated in major towns like Lodwar, Kakuma and Lokichogio. Devolution which has brought development funds to the County headquarters is also bringing about increased development activities such as road maintenance etc. This is creating more job opportunities

Honey production
Honey production is a commercially viable enterprise, especially along the riverine ecosystems (Turkwel and Kerio Rivers) and higher altitude locations close to the Ugandan border. The principal areas of honey production include Turkwel, Kalemunyang and Toyarabon (Turkwel Division); Lokapel and Kanaodon (Katilu Division); Kainuk, Loyapat (Kainuk Division), Lokwar, Ekwar, Kaptir, Nakwamuru, Kapelibok and Oropio.

Basket-making and handicrafts
Commercial basket-making (and associated activities) supports a network of producers, traders and transporters in Turkana and is especially important for the livelihoods of households located near urban centres and along dry-river valleys close to Lake Turkana.

Public Health
Water Borne Diseases
The lack of water in the area is a major cause of the poor standard of health endured by the Turkana population. The health services in the area estimate that approximately 50% of the population are suffering from water borne diseases due to lack of clean water.

The major diseases that have regularly been reported in the Turkana are malaria, skin diseases, respiratory tract infections, and diarrhea (Republic of Kenya 2007) (Figure 20). Malaria can be prevented by the use of bed nets, but not everybody has the financial means to acquire nets. Most of these diseases are associated with poverty.

Communicable diseases including HIV and Aids
The HIV and Aids pandemic is currently a major development problem in Turkana County. In 2014 HIV prevalence stands at 7.6% which is above the national prevalence rate of 6.04 %. Considering the truck traffic generated by LAPSSET and those diverted onto the road, new truck stops may encourage prostitution and other social ills in a community that is still very conservative and proud of their culture.

Education
The Turkana County has 175 pre-primary schools, 136 primary schools, eight secondary schools, two youth polytechnics and one medical training college.

Enrolment in primary school is 122,883, with a teacher to pupil ratio of 1: 51 while secondary school enrolment is 48,004 with a teacher to pupil ratio of 1: 27.7. There are 2 tertiary institutions. Adult Literacy Classes have an enrolment of 562.

Along the project road, schools are concentrated in Towns/major centres namely:
- Lodwar Town (Radius of 5km) - 12 Primary and 6 Secondary Schools;
- Lokoyo area – 1 Primary School
- Makutano – 1 Primary School
- Kakuma – 31 Primary and 4 Secondary Schools
- Kalobeyei – 1 Primary School;
- Songot – 1 Primary School
- Lokichogio – 7 Primary Schools

Many people in Turkana have not accepted formal education as a social value leave alone as a human right. Many parents still deny their children their right to study and to be educated. In spite Free Primary Education, Turkana Districts register one of the lowest gross enrolment, retention, and completion rates in the country:

Poverty Levels
The people of Turkana fundamentally depend on the natural systems and natural resources for existence and development. However, due to the harsh environmental conditions prevalent in the area, poverty levels are high, with 71% of the Turkana population living below poverty line.

Gender dynamics
Among the Turkana, division of labour exists along gender lines, dictating general social roles and distinct daily activities performed by members of the society. As with most societies in Kenya, women's roles among the Turkana continue to be centred on the house. Within the household, it is the general responsibility of the women to provide food and comfort for the household.

History and culture of the Turkana Community
The main tribe in the study area is the Turkana. They are divided into two broad groups; the forest people (*Nimonia*) and the people of the plains (*Nocuro*) which are divided into roughly twenty clans (*ategerin*).

Conflicts and cattle rustling
Cattle raids and resource-based conflicts are the main types and manifestations of conflicts in Turkana. The district's proximity to Ethiopia, Sudan, Uganda and neighbouring districts in Kenya makes it one of the most affected areas by insecurity incidences.

Physical infrastructure
The problem of poor roads and public transportation has negatively affected the livelihoods of Turkana people. It is hard to get supplies into rural areas, and this limits trade with other regions. The Turkana people have no tradition of using carts and animal power to transport commodities and goods, and rely on carrying everything themselves.

Relief operations
Kenya has over the years hosted a large number of refugees fleeing conflicts in their countries. Most of the refugees are hosted in camps located in Kakuma and Dadaab in the arid Northern parts of the country. The Kakuma Refugee Camp is located within Kakuma town in Turkana District, in the north western region of Kenya.

Oil exploration
Oil has been discovered in Turkana North District by British company Tullow Oil. Turkana County is one of seven basins mapped in Tullow's 100,000 square kilometre exploration areas in Kenya and Ethiopia.

Trade, tourism and industry

Trade and Industry
The Project County and districts connects the rest of Kenya and is a transit area from port of Mombasa with the emerging markets of Southern Sudan. Internally, the major sectors that enable trade to thrive are the food sector where Turkana is a net importer of food stuffs such as maize and beans. The district is a major producer of animal products which includes live animals that are transported to other parts of the country. Beside these, the district produces a huge supply of fish which forms the bulk of trade with other parts of Kenya. Fish production is mostly practised in Kalokol and Kerio divisions where over 70% of the households earn their livelihood. The huge traffic generated, especially of HGV from the current 12 to a total of 122 AADT will imply improved investments and trade occasioned by rest stops by truckers.

Tourism
Turkana County has tourism potential due to the presence of a rich cultural heritage of the Turkana people, Lake Turkana, Fishing and various wild animals. In addition, there is great potential for producing tourist goods such as mats and hats produced from the large quantity of palm leaves available. The County has 52 hotels but only two are classified.

Financial Institutions
The Lodwar-Nakodok Road is served by two major Banks (KCB and Equity) who have branches in Lodwar and Lokichogio Towns. M-Pesa Financial Services are available at major centres and towns along the project route. Towns like Lodwar, Kakuma and Lokichogio have more than five M-Pesa service providers.

PUBLIC PARTICIPATION AND CONSULTATIONS

Stakeholder Consultations and Public Consultation Meeting
Key stakeholders and the project area community have been consulted during field visits where oral interviews and the filling in of questionnaires were done.

Public Consultation Meetings (PCMs) were convened from Tuesday December 2, 2014 to Friday December 5, 2014 as elaborated in the table.

Public Consultation Meetings (PCMs)

#	PCM Venue	Day	Date	Time	No. of Participants
1.	Mikeka Grounds	Tuesday	02/12/2014	10.30am	30
2.	Nasiger	Tuesday	02/12/2014	02.00pm	213
3.	Makutano Gold	Wednesday	03/12/2014	09.30am	105
4.	Kakuma Town – Baraza Park	Wednesday	03/12/2014	02.30pm	75
5.	Kalobeiyei	Thursday	04/12/2014	09.30am	177
6.	Songot Chiefs Office	Thursday	04/12/2014	02.00pm	125
7.	Anglican Church Grounds - Lokichogio	Friday	05/12/2014	10.00am	142

SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIONS

#	Environmental parameter	Potential impact	Proposed mitigation measures
1.	Project area community in the road right of way	• Potential displacement of persons with homesteads along road project route	• Resettlement Action Plan Study has been done and review is underway to establish a list of Project Affected Persons (PAPS); • Determination of Size of Land, Structures, Vegetation (Trees and Crops) and Livelihood that will be affected by the project; • Sensitisation of PAPs on compensation and resettlement; • Identification of land for resettlement; • Determination of cost of affected land and property for compensation; • Payment of compensation to the satisfaction of the PAPs ahead of project civil works;; • Resettlement of PAPs • Offering of Resettlement Assistance to PAPs to ensure they settle well in new homes and that they are equal to or better than they were before the project.
2.	Soil excavation activities during road construction loosen soil exposing to wind and water erosion.	• Soil erosion is expected to occur during March-May in the East, between Lodwar and Kakuma and during March - June in the sections north-west of Lokichogio. In general the sections north-west of Lokichogio are more prone to erosion due to the mountainous terrain and higher quantities of rainfall. • Soil may erode along the road alignment, particularly during the wet season (March through May) in the initial years after decommissioning. • Eroded soil will have the potential to cause the following impact: – Damage to the quality of water courses, – Erosion sediment in rivers damages the spawning	• Do not leave excavated soil exposed for too long; • Do not deposit excavated soil long trenches or surface runoff causeways; • Carry out road excavation works during dry period; • Optimize new drainage structures and improve capacities of the structures used in combination with specific erosion protection works; • Culvert outfall should be lined for an appropriate distance, especially after Lokichogio towards Nakodok • Scour checks should be constructed alongside drains on steep slopes • Road shoulders should be appropriately lined and tapered off to avoid scouring by runoff water.

#	Environmental parameter	Potential impact	Proposed mitigation measures
		grounds of fish; – Deposition of sediment from erosion may cause changes in river courses and create flood hazard downstream.	
3.	Air quality	• The project site is dominated by a hot, dry and windy environment which exacerbates generation and blowing away of dust beyond the project site. Dust pollution could be significant within Lodwar, Kakuma and Lokichogio Towns and adjoining settlements. • Health facilities in the project are recording significant number of patients having Upper Respiratory Tract Infections (URTI). Dust contributes to this ailment	• Regularly water excavated areas and road deviations to ensure minimal dust generation. • Road construction plan should ensure that excavated areas remain open for the shortest time period to reduce dust emission especially within the towns. • All workers should be provided with dust masks and the contractor is to sensitise workers and ensure they wear the dust masks at all times when at the sites of elevated dust generation • Issue timely warning to the neighbourhood of the project about possible generation of dust beyond normal levels
4.	Project area soil quality	Pollution of soil could occur at the contractors camp or construction site in the event of: • Accidental oil spills from construction vehicles and machines (excavators, graders, rollers, road pavers etc. • Recovered oil after service of construction vehicles, trucks and machinery • Petroleum products (petrol and diesel) stored at contractor camp, • Bitumen (amongst other liquid waste) The released petroleum products may infiltrate into the soil and impact groundwater resources.	• Contractor should construct a paved and bunded area for the storage or transfer of fuels or oils. • All vehicles, trucks and machines used at the construction site should be well maintained to avoid oil leaks occurring. • The Contractor should have paved and well bunded service area for the servicing and maintenance of machinery and trucks. • The contractor should have containers (drums) for the storage of all used oils recovered from trucks and machinery during regular service. • The used oil should be collected by a NEMA approved firm for appropriate disposal.
5.	Water Sources for Construction activities	Water is scarce and precious in the project area. Impacts on water sources could arise from: • Over exploitation of a water source; • Pollution of the available water source; • Conflicts between communities; • Livestock-wildlife-human conflict; • Salinity and poor water quality.	• Apply for WRMA permit for any required water abstractions; • Water sources are subject to separate ESIA to be prepared independent of this report. • A set of factors to consider when identifying water sources to be handed over to the community have been presented. These are to avoid future conflicts. • Assess and determine the available quantity of water from every water source: • Develop an independent water source (boreholes) that can be used for construction and later handed over to the community as a CSR activity
6.	Flora	• Potential over-exploitation of vegetation resources for cooking energy by construction workers.	• KeNHA and Contractor are to carry out sensitisation and awareness creation on use of firewood and why it

#	Environmental parameter	Potential impact	Proposed mitigation measures
		• The critical impact relates to the inability of the area to naturally regenerate after harvesting of the mature trees. • The locals may see an opportunity for income generation by selling firewood and/or charcoal to workers. • Increased invasion of *Prosopis juliflora* following soil disturbance and the road acting as water catchment that improves soil moisture at the edges of the road.	is important to control its use (Health Benefits and Preservation of Biodiversity). • Use of alternative source for cooking energy is to be encouraged. Locals should be encouraged to preserve Biodiversity • Construction workers may be allowed to use cleared vegetation materials for firewood. • Management of *Prosopis juliflora*, an invasive weed that colonizes the road edges following soil disturbance could be managed by incorporating labour based clearance of the weed on a regular basis.
7.	Fauna	• Possible poaching of wildlife by workers • Possibility of poisoning of animals from empty containers of bitumen and other materials	Carry out sensitisation and awareness creation amongst the local people and the construction workers on: • Laws that relate to wildlife hunting and consumption and the related penalties; • The importance of wildlife as a natural resource and heritage • Prudent management of domestic waste from the contractor's camp and construction waste. • Contractor to make available waste receptors/bins at the contractors camp and construction site • All waste is to be gathered together for collection and appropriate disposal by a NEMA and local Authority approved waste disposal firm.
8.	Noise and ground vibration	• Potential generation of elevated noise levels from construction trucks and machinery near urban centres, schools and health facilities. • Elevated noise levels from explosives used at quarries and compressors used to level rocky areas where the road is designed to pass. • Potential generation of elevated noise levels in the remote where only wildlife is found causing disturbance to wildlife	• Use construction equipment with low noise levels; • Restrict construction activities with elevated noise generation to specific times when appropriate especially when passing through major towns like Lodwar, Kakuma and Lokichogio • Special care should be taken when construction is taking place near sensitive receptors such as schools and hospitals (Most sensitive sites – Lodwar, Kakuma, Lokichogio). • Drivers and machine operators should be sensitised and instructed to avoid raving the engines of trucks and machines to avoid air pollution from exhausts and elevated noise levels. • To the extent possible, heavy vehicles should not be used at night across populated areas (Lodwar and Lokichogio); • Construction activities to be restricted to daylight working hours in wildlife areas to avoid disturbance and disorientation of wildlife. • Use appropriate energy source.

#	Environmental parameter	Potential impact	Proposed mitigation measures
			Generators should have low noise or fitted with mufflers. • Provide construction workers with earmuffs and ensure they are used when working at noisy areas.
9.	Bright light in wildlife areas	• Unnecessary attraction and disturbance of wildlife	• Carry out construction activities during daylight. • Where construction has to continue into the night to complete what cannot be postponed, appropriate lighting has to be used to avoid disturbance of wildlife
10.	Visual intrusion	On the whole, there are few scenic sites, but the following features may cause visual intrusion: • Opened up quarries and borrow pits Excavated areas of the road • Vegetation (Trees and shrubs) cut down along the proposed road and also the deviation road. • Heaps of excavated soil from the proposed road and the deviation routes	• Progressively rehabilitate quarries and borrow pits as work progresses or convert them to usable water pans for use by the community. • Gather all the cut down vegetation and heap them appropriately in designated areas. The community and workers may be allowed to harvest the cut vegetation for use. • Soil excavated from the proposed road and deviation routes should be heaped in an organised fashion to avoid giving the project area a clattered appearance
11.	Domestic and Construction Wastes	• Potential pollution of soil and ground water resources by sanitary waste from contractors camp • Potential impact of the environment by domestic wastes including plastics, paper, glass and waste foods and wrappings for domestic appliances and foodstuff. • Potential impact of the environment by waste plastics and wrappings for construction materials like cement bags etc. • Potential impact of soil and groundwater of the Construction waste could be a health hazard in the area	• Contractors camp should have toilet facilities and mobile toilet facilities for use at the construction site • Provide the contractor's camp with appropriate solid waste bins for collection of generated solid waste • Provide appropriate waste bins for use by construction workers to keep solid waste generated at the construction site • Sensitise workers on proper waste management practices at the site and use of toilet facilities and waste bins. There should be no littering. No matter how small the waste is, it should be appropriately disposed of through use of designated waste bins. • Develop a waste management plan for use during the entire construction period. The generated domestic and construction waste should be regularly collected by an appointed firm and disposed of appropriately. • Sensitise workers on use
12.	Urbanization	• The road could trigger rapid development of new urban centres along the road. • The current urban areas could grow as a result of transit traffic. • Potential emergence of unplanned developments along the roadside	• Local Authority to ensure proactive physical planning of any developments where the following infrastructure is provided: • Proper sanitation facilities. • Maintenance of appropriate distance away from the road for safety reasons • Planning for appropriate ways of waste collection, temporary storage and disposal • Planning and design of appropriate

#	Environmental parameter	Potential impact	Proposed mitigation measures
			housing structures to be used for various commercial activities (shops, restaurants, supermarkets, hotels etc.)
13.	Public health	Potential occurrence of diseases arising from the following: • Water borne diseases from presence of stagnant water causing spread of malaria and consumption or use of contaminated water • Respiratory diseases from air pollution (excess dust and smoke emission) • Spread of sexually transmitted diseases like HIV/AIDS and other STI's from socialisation and unprotected sex • Occurrence of injury from accidents at the construction site	Carry out sensitisation of workers and local community on: • Use of potable water for consumption to avoid getting diseases like diarrhoea, cholera, dysentery etc.) • Consistent use of mosquito nets and removal of any stagnant water near homesteads to avoid contracting malaria • Suppress generation of excess dust by regular spraying of water at construction areas and road deviations. • Minimise smoke emission by carrying out proper maintenance of trucks, equipment and machines; • Sensitise workers and local community on use of clean energy (gas and approved energy saving stoves) for cooking to avoid getting Upper Respiratory Tract Infection URTI). Firewood generates a lot of smoke and depletes forest resources. • Carry out sensitisation of workers and local community on the potential contraction of HIV/AIDS and STIs from unprotected sex and encourage workers and local community to visit VCT Centres. • Provide workers and make them available for community members.
14.	Road safety	Potential occurrence of road accidents during construction and operation of the road. This may be due to the fact that project area community have lived for long without good roads hence have become lax on the dangers of the roadways and fast moving vehicles.	To avoid occurrence of unnecessary accidents the following measures are required. • Carry out sensitisation campaigns and road safety awareness amongst the workers and local community • KeNHA and Contractor to Install elaborate road safety signs along the entire road; • Ensure that there are appropriate safety barriers around excavated areas (along the road under construction and the material borrow pits) to avoid accidents occurring.
15.	Conflicts	Potential conflicts related to water sources, material sites and job opportunities are likely to arise amongst project area communities and also between community and the contractor	• Ensure project information is disseminated to the community in a timely fashion through the local administration. • Identify water sources that will not be depleted when used by the project; • KeNHA to consider sinking and equipping boreholes to be used for construction and later handed over to the community under CSR programme. This will enhance good relationship between community and

#	Environmental parameter	Potential impact	Proposed mitigation measures
			project developer. It will also bring in a sense of ownership of the project and therefore minimise acts of vandalism of road signs etc. • Involve the local communities when selecting sites for getting road construction materials. • Purchase road construction materials locally where available to provide an opportunity of the locals gaining from the project. • Provide casual and semi skilled job opportunities to the local community to promote their economic status and enhance good relationship and support for the project and reduce occurrence of any conflict

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There are some important potential environmental impacts that will accompany the project, both in the short and long term. During construction potential negative impacts that are considered significantly high relate to impacts on vegetation, fauna public health, water resources and soil degradation. These potential impacts are relatively easy to mitigate and their impacts are reversible. Potential serious post construction impacts are indirect and long term. Woodland resources will be put under immense pressure from charcoal burning due to improved accessibility into the area. *Prosopis* invasion could be enhanced on the roadside due to better soil moisture occasioned by pavement surface run-off and ease of seed establishment following construction soil disturbance. Other operation phase impacts include increased urbanization and immigration into the area, road safety issues and cultural conflicts.

The latter two impacts could be addressed by involving all the stakeholders in the road safety and social sectors. Similarly, the other negative socio-economic impacts such as increased urbanization and immigration can be effectively handled through proactive urban centre and regional planning.

The project area administration and community showed that that there has been adequate sensitisation on the project during stakeholder consultations and during the PMCs and they are just waiting for project implementation to begin.

Recommendation

The proposed upgrading of Lodwar-Nakodok Road is considered important, strategic and beneficial in improving connectivity between Kenya and South Sudan and promoting trade in the area. The upgraded road will also enhance economic growth of the area especially considering the recent oil finds and other potential developments that can take place with improved transport. There will be creation of job opportunities; uplifting the socio-economic status of the project area people. The significant support by the community that the project is enjoying indicates how important this project is to the project area community. The Consultant highly recommends that the project should be allowed to proceed taking into account the Mitigation Measures and Environment and Social Management Plan (EMP) proposed in this ESIA Report.

1 PROJECT INTRODUCTION AND BACKGROUND

1.1 Introduction and Background

This Environmental and Social Impact Assessment (ESIA) study report has been prepared in fulfillment of the consultancy services for the Environmental and Social Impact Assessment for Reviewing and Updating the Environmental and Social Impact Assessment for the Proposed Rehabilitation of the Lodwar – Lokichogio – Nakodok 240 km (A1) Road.

The Government of Kenya, through the Kenya National Highways Authority (KeNHA) has proposed to improve and upgrade the Lodwar – Lokichogio – Nakodok (A1) Road. The proposed upgrading will entail widening the road, constructing bridges, road shoulders and auxiliary lanes (such as acceleration lanes, deceleration lanes, truck bays and lay-bys) with a view to elevating the existing road to international road status. The road is part of the Northern Corridor Transport Improvement Project (NCTIP) whose aim is to enhance connectivity between Kenya's coastal ports of Mombasa and Lamu with neighbouring countries in East and Central Africa with a view to enhancing the economic profile of the East African region as a strategic investment and export hub. Improving the road and upgrading it to international standard is considered an important investment that will enhance regional connectivity and integrate South Sudan and northern Uganda with East African neighbouring countries by increasing transport efficiency, facilitating cross border trade and improve access to export markets through Kenya's coastal ports. In addition, Turkana County, which has remained under-developed for a long time, will be the important link in the envisaged international integration and is, therefore, expected to attract tremendous investment opportunities and economic development.

Presently, the road section between Lodwar and Lokichogio is in a very poor condition, while the section between Lokichogio and Nadapal/Nakodok is an earth road. It is, therefore, not only expensive to carry out trade and commercial activities along the transport corridor currently, but the poor state of infrastructure is also a major barrier to market access for goods from north western Kenya and South Sudan. Thus, the expected outcome of the proposed road project include: (a) increase in outbound traffic from the project's area of influence; (b) reduction in average turnaround time of vehicles between Juba and the ports of Lamu and Mombasa, as well as between Turkana County and other parts of Kenya; (c) increase in economic opportunities in regard to trade, employment and economic growth; and (d) reduction in transport costs along the Northern Transport corridor. The improved road will particularly be important in promoting trade in agriculture, livestock, tourism and mining sectors of the economy. In addition, it has great potential to promote economic growth and investment in the oil sector. Moreover, the proposed road has the potential to expand economic investments in the delivery of goods and services among small and medium size entrepreneurs.

Potential beneficiaries of the proposed road project include road users, traders, freight companies, communities living along the road corridor, investors in the agriculture, fisheries, tourism and mining sectors of the economy and consumers of goods and services from these sectors. The project has the potential to improve market access and strengthen economic ties not only between Kenya and South Sudan, but also across the COMESA region. At the national level, this project is expected to contribute significantly towards the attainment of Kenya's Vision 2030, economic growth, employment creation and poverty reduction.

This Environmental and Social Impact Assessment (ESIA) has been prepared to address the potential environmental and social impacts that could arise from the road upgrading activities. The proposed upgrading of Lodwar-Nakodok Road is in the category listed in the Second Schedule of the Environmental Management and Co-ordination Act (EMCA), 1999

under item **1 General** – (a) an activity out of character with its surrounding; (b) any structure of a scale not in keeping with its surrounding; (c) major changes in land use and item **3 (a) all major roads** and are therefore required to undergo Environmental and Social Impact Assessment (ESIA). This section of the project road is only likely to trigger World Bank **OP 4.01 -Environmental Assessment**, **OP 4.11 - Physical Cultural Resources, OP 4.10 – Indigenous People and OP 4.12 - Involuntary Resettlement.** KeNHA has prepared a standalone Resettlement Action Plan and a Social Assessment to cover social risks management and mitigation of impacts, including description of any compensation required for this road section.

1.2 Project Justification

For several decades, Kenya's main transport artery has been the Northern Corridor highway running from the port city of Mombasa through Nairobi to the border with Uganda at Malaba. Substantial investment has gone into improving this transport corridor with the aim of linking it to her land-locked neighbours, such as Uganda, Rwanda, Burundi and eastern Congo. The transport corridor has not only opened economic opportunities for Kenya, it has also provided access to investment opportunities for her neighbours. In recent times, Kenya has broadened its trade links within the COMESA block with a focus on connecting with neighbouring countries, such South Sudan and Ethiopia, where transport network has previously been a barrier to economic ties.

The proposed Lodwar – Lokichogio – Nakodok (A1) Road, is expected to provide significant support to the LAPSSET project. Apart from positioning Kenya as a regional economic hub, the road will also substantially open Turkana and the larger north western Kenya region to opportunities to access commodity markets and achieve rapid economic growth. This road project will also provide the much needed infrastructure for activities associated with recent developments such as the discovery of oil and water in Turkana County to connect to the national economy.

Thus, the improvement and upgrading of the Lodwar – Lokichogio – Nakodok (A1) Road will contribute significantly in providing a major international artery through which Kenya will connect to her land-locked neighbours in the north. The road will not only bring benefits in the form of savings in transport costs to traffic diverted from the Northern Corridor artery through Uganda, but also add value to Kenya's economy in terms of additional economic activity, employment creation and poverty reduction.

2 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 Overview

Kenya has a legal, policy and administrative framework for environmental management. Under the framework, the National Environment Management Authority (NEMA) is responsible for ensuring that environmental and social impact assessments (EIA's) are carried out for new projects and environmental audits on existing facilities as per the Environmental Management and Coordination Act (1999). Projects subject to this requirement are specified in the Second Schedule of EMCA (1999). The World Bank through its IFC branch has also a policy on social and environmental sustainability that strives to ensure that projects are socially responsible and reflect sound environmental management practices.

ESIAs are carried out in order to identify potential positive and negative impacts associated with the proposed project with a view to taking advantage of the positive impacts and developing mitigation measures for the negative ones. An ESIA also ensures that baseline data for the proposed project are collected for use in monitoring and evaluating impacts during the project cycle. It is a requirement by both NEMA and IFC to have a clear management plan that describes and prioritises actions needed to implement mitigation measures. In this Chapter, a review of legal and policy regulations that govern ESIA of road projects is presented. Some of these regulations are contained in the Kenya Gazette Supplement No. 56, legislative supplement No.31, Legal Notice No.101 of 13th June 2003 and Environmental (Impact Assessment and Audit) (Amendment) Regulations, 2009.

2.2 The Constitution of Kenya

Chapter five of the constitution of Kenya covers "Land and Environment" in articles 69 and 70. The Chapter seeks to eliminate processes and activities likely to endanger the environment. Article 69 states that 1) The State shall a) ensure sustainable exploitation, utilisation, management and conservation of the environmental and natural resources, and ensure equitable sharing of the accruing benefits; b) work to achieve and maintain a tree cover of at least ten per cent of the land area of Kenya; c) protect and enhance intellectual property in, and indigenous knowledge of, biodiversity and the genetic resources of local communities; d) encourage public participation in the management, protection and conservation of the environment; e) protect genetic resources and biological diversity; f) establish systems of environmental impact assessment, environmental audit and monitoring of the environment; g) eliminate processes and activities that are likely to endanger the environment; and h) utilise the environment and natural resources for the benefit of the people of Kenya.

2.3 Legal Framework

2.3.1 Environmental Management and Coordination Act (EMCA) No 8 of 1999

The main environmental law in Kenya is the Environmental Management and Coordination Act No 8 of 1999. The main objective of this law is to provide for the establishment of an appropriate legal an institutional framework of the management of the environment in Kenya. The act further seeks to improve the legal and administrative coordination of the diverse sectoral aspects pertaining to the environment. In addition, the Act harmonizes the sector specific legislation touching on environment. The Act's ultimate

goal is to provide a framework for integrating environmental considerations into the country's overall socio-economic development.

The Environmental Management and Co-ordination Act (EMCA) No. 8 of 1999 has provisions on EIA studies. Environmental Impact Assessment (EIA) study and Environmental Audit (EA) are legal requirements in Kenya for all projects. Transportation projects including roads are included in the Second Schedule of the Act, as projects, which must undergo EIA studies in accordance with section 58(1-4) and 68 of the Act. These projects are considered to pose significant potentially negative environmental impacts. Part 3 of the Second Schedule, refers to transportation projects, which include inter alia, all major roads and all roads in scenic, wooded or mountainous areas and wetlands.

EMCA established two institutions, namely the National Environmental Council (NEC) which is chaired by the Cabinet Secretary for Environment and Natural Resources. The NEC is responsible for formulation of policies, goals, objectives and prioritization for environmental protection. The National Environment Management Authority (NEMA) is charged with supervising and co-ordinating all environmental activities including EIA and EA, and general supervision and coordination over all matters relating to the implementation of all policies relating to the environment. The EIA/EA reports are then submitted to NEMA for approval and issuing of license to proceed with construction. NEMA's other duties include research, investigations and surveys, education and awareness creation and making of legislative proposals to the Attorney General.

With the introduction of Environment Impact Assessment and Audit Regulations, (2003) issued through the Kenya Gazette Supplement No. 56 of 13 June 2003, the submission of environmental reports became mandatory. According to these regulations no proponent shall implement a project likely to have a negative environmental impact for which an Environmental Impact Assessment has not been prepared and approved in accordance with EMCA regulations.

2.3.1.1 The Environment (Impact Assessment and Audit) Regulations 2003

The Environmental Impact Assessment (EIA) is a critical examination of the effects of a project on the environment. The goal of an EIA is to ensure that decisions on proposed projects and activities are environmentally sustainable. An EIA is conducted in order to identify impacts of a project on the environment, predict likely changes on the environment as a result of the development, evaluate the impacts of various alternatives on the project and propose mitigation measures for the significant negative impacts of the project on the environment. The EIA also generates baseline data for monitoring and evaluating impacts during the project cycle as well as highlighting environmental issues with a view to guiding policy makers, planners, stakeholders and government agencies to make environmentally and economically sustainable decisions. It seeks to minimize adverse impacts on the environment and reduce risks. EIA also identifies measures to mitigate the negative impacts while maximizing on the positive ones.

2.3.1.2 EMCA (Waste Management) Regulations, 2006

These regulations guide appropriate waste handling procedures and practices. It is anticipated that, the proposed project will generate a large quantity of solid waste during construction and these will need to be managed through reduction, reuse, and recycling or appropriate disposal. It is therefore anticipated that, the amount of materials to be discarded as waste during project implementation will be minimum.

As regards waste reduction, it is recommended that the proponent will put in place measures to ensure that construction material requirements are carefully budgeted for so as to ensure that the amount of construction materials left on site after construction is kept minimal.

It is further recommended that the proponent considers the use of recycled or refurbished construction materials including those excavated from the existing roads. Purchasing and using used or recovered construction materials will lead to financial savings and reduction of the amount of construction debris disposed of as waste.

In addition to the above-mentioned recommendations; the proponent should undertake the following:

(i) Not allow disposal of any wastes on the highway, street, road, recreational area and public places;
(ii) Encourage segregation of wastes and group them according to their similarity, for example plastics, toxics, organics, etc.;
(iii) Ensure all wastes are deposited in designated dumping sites that are approved by the local authority;
(iv) Ensure all waste handlers engaged by the proponent are licensed by NEMA and possess all relevant waste handling equipment and documentation, such as waste transportation license, tracking documents, license to operate a waste yard, insurance cover, and vehicle inspection documents, amongst others;
(v) Implement cleaner production principles of waste management namely reduce, reuse and recycle;
(vi) Label all hazardous wastes as specified in Section 24 (1-3) of the regulation.

The fourth schedule lists wastes considered as hazardous and these include solvents, emulsions, waste oil, waste water and hydrocarbons.

2.3.1.3 EMCA (Water Quality) Regulations, 2006

These regulations provide guidelines on the use and management of water sources; and the quality of water for domestic use and irrigation. The proponent will be required to observe the requirements of these regulations and prohibit anyone from undertaking development within a minimum of 6 m from the highest ever recorded flood level. Section 4(2), 6 and Section 24 of the regulation prohibits pollution of water bodies and requires that all substances discharged into water bodies should meet the standards set under the Third schedule of the regulations. 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.

2.3.1.4 EMCA (Controlled Substances) Regulations, 2007

These regulations control the production, consumption, and export and import of controlled substances. Controlled substances are herein grouped into three categories:

- Group 1 consists of halogenated flouro-chemicals with ozone depleting substances
- Group 2 consist of hydrobromoflouro-carbons with ozone depleting substances
- Group 3 consist of bromochloro-methane 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 and pre-polymers. It is thus recommended that this regulation be observed to ensure that equipment, machinery, vehicles and chemicals containing such components are not imported for project use.

2.3.1.5 EMCA (Noise and Vibration Control) Regulation, 2009

These regulations provide guidelines for acceptable levels of noise and vibration for different environments during the construction and operation phase. Section 5 of the regulation warns on operating beyond the permissible noise levels, while Section 6 gives guidelines on the control measures for managing excessive noise.

In this context, the project team should observe the noise regimes for different zones especially so for working in areas termed as silent zones which include institutions and worship places, amongst others. For instance, these places are allowed sound exposure limits not exceeding 40 dB during the day and 35 dB at night.

The regulation states that a day starts from 6.01 a.m. to 8.00 p.m., while night starts from 8.01 p.m. – 6.00 a.m. Construction sites near the silent zones are allowed maximum noise level of 60 dB (A) during the day, whilst night levels are maintained at 35 dB (A). The time frame for construction sites is adjusted and the day is considered to start at 6.01 a.m. and ends at 6.00 p.m. while night duration starts from 6.01 p.m. and ends at 6.00 a.m.

Part III of the regulation gives guidelines on noise and vibration management from different sources. Sections 11, 12 and 13 of the stated part give guidelines on noise and vibration management from machines, motor vehicles and night time construction, respectively. Section15 requires owners of activities likely to generate excessive noise to conduct an ESIA.
It is anticipated that the proposed project will generate excessive noise and/or vibration due to demolition of structures which have encroached into the road reserve. The noise will essentially originate from construction equipment and machinery. The above time limits must therefore be observed.

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

The aim of these regulations is to ensure conservation and sustainable use of wetlands in Kenya. The regulations provide guidelines on wetland management even for those found on private land. These regulations indicate that clear guidelines on management of different types of wetlands found in the country have not been developed and thus it is recommended that while working in aquatic environments, the relevant lead agencies should be consulted to guide on the correct application of the law. The regulations also recommend the use of precautionary principal when working near wetlands in order to conserve them. Although the project does not traverse a major wetland, the various streams and rivers in the area must be conserved.

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

The regulations require proponents to conduct ESIA if their activities may have adverse impacts on ecosystems or lead to unsustainable use of natural resources or/and lead to introduction of exotic species. The regulation aims at increasing the coverage of protected areas and establishing new special status sites by providing guidelines for protecting endangered species. Section 5 of the regulations provides guidelines on conservation of threatened species, while Part III of the regulations guides on access to genetic materials. The section states that, the Authority shall, in consultation with the relevant lead agencies, impose bans, restrictions or similar measures on the access and use of any threatened species in order to ensure its regeneration and maximum sustainable yield.

It is recommended that landscaping programmes should involve use of certified plant species to prevent them from affecting project area negatively in terms of invading wetlands, vegetation and farmlands.

2.3.1.8 EMCA (Fossil Fuel Emission Control) Regulations, 2006

This regulation aims at eliminating or reducing emissions generated by internal combustion engines to acceptable standards. The regulation provides guidelines on use of clean fuels, as well as use of catalysts and inspection procedures for engines and generators.

The proponent will use vehicles and equipment that depend on fossil fuel as their source of energy. As such, it is recommended the regulation is implemented in order to eliminate or reduce negative air quality impacts. All equipment that will be used in the project should be kept to the manufacturers' specifications to reduce any incomplete combustion.

2.3.2 Government Land Act Cap 280

This Act provides for regulation of leasing and other disposal of Government land. It provides for the disposal of Government land within townships, agricultural land, and land for special purposes. The Act also provides for Licenses for temporary occupation of land, general provisions relating to leases, licenses and agreements, and registration of transactions relating to Government land.

2.3.3 Land Titles Act Cap 282

This Act regulates titles to land, and establishes the Land Registration Court. Specific provisions include guidelines on adjudication of claims, and registration of documents after certificate of ownership is granted.

2.3.4 Trust Land Act Cap 291

This Act makes provision for Trust land, through the establishment of divisions and divisional boards. The Act also establishes guidelines for the setting apart of land, as well as leases and guidelines.

2.3.5 Registered Land Act Cap 300

This Act provides for the registration of land titles, and provides for the regulation of dealings in land so registered. The Act elaborates on the organization and administration of the Act, the effect of registration on title deeds, certificates of lease and searches, instruments and agents, transmissions and trusts, restraints on disposition, rectification and indemnity, and decisions of registrars and appeals.

2.3.6 Land Control Act Cap 302

This Act provides for controlling of transactions in agricultural land. The Act further elaborates on the establishment of land control areas and boards, the control of dealings in agricultural lands, and rules governing Appeal Boards.

2.3.7 Public Health Act Cap 232

Part IX Section 115 of the Act states that no person or institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Any noxious matter or waste

water flowing or discharged into a watercourse is deemed as a nuisance. Section 116 requires County Governments to take all lawful necessary and reasonable practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to injuries or dangerous to human health. Part XII Section 136 states that all collections of water, sewage, rubbish, refuse and other fluids which permits or facilitate the breeding or multiplication of pests shall be deemed as nuisance.

The Act addresses matters of sanitation, hygiene and general environmental health and safety which is directly related to road projects and associated activities. It is therefore recommended that measures be taken in accordance to the Act in order to safeguard the health of project workers and the public at large.

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

Section 8 and 9 of the Act provides for the dedication, conservation or alignment of public travel lines including construction of access roads adjacent to lands from the nearest part of a public road. Section 10 and 11 allows for notices to be served on adjacent land owners seeking permission to construct the respective roads. Public meetings should be held for purposes of public consultations and notifications before implementing a road project.

2.3.9 Factory and Other Places of Work Act (CAP 514)

This Act requires that before any premises are occupied or used, a Certificate of Registration should be obtained from the Chief Inspector. The occupier must keep a general register with provisions for health, safety and welfare of workers on site. This Act provides guidelines on the safety of workers at the work place as well as regulates and evaluates the working condition. Factors considered in the Act that require implementation during project development are:

(i) Provision of protective clothing and firefighting equipment to the workers;
(ii) Provision of clean and sanitary working conditions;
(iii) Provision of quality and quantity wholesome drinking water; and
(iv) Protection of moving parts of machine and equipment among other safety measures.
(v) For safety purpose, fencing of the premise and dangerous parts must be done.
(vi) Provision of statutory cover during construction

The overall objective of the Act is to ensure safety at the work place. The objective of the Act is to uphold safety regulations during the construction and routine maintenance of the road project to ensure that the health and safety of workers and the general public are safeguarded.

2.3.10 Sexual Offences Act No. 3 of 2006

An Act of Parliament to make provision for the definition of sexual offences, prevention and the protection of all persons from harm from unlawful sexual acts, and related purposes. Section 8, (1) asserts that “A person who commits an act which causes penetration with a child is guilty of an offence termed defilement”. Subsection 2 further explain that if the person commits an offence of defilement with a child aged eleven years or less shall upon conviction be sentenced to imprisonment for life. Section (3) clarifies that any person who commits an offence of defilement with a child between the age of twelve and fifteen years is liable upon conviction to imprisonment for a term of not less than twenty years. The Act in section 23 gives more details on anyone in position of authority, or holding a public office, who persistently makes any sexual advances or

requests which are unwelcome, is guilty of the offence of sexual harassment and shall be liable to imprisonment for a term of not less than three years or to a fine of not less than one hundred thousand shillings or to both. This Act gives the public and the workers of the road project the right to report any indecent behaviour to a court of law, and protects children and young girls from defilement.

Section 26 (1) of the Act states that any person who, having actual knowledge that he or she is infected with HIV or any other life threatening sexually transmitted disease and intentionally, knowingly and wilfully does anything or permits the doing of anything which leads to the infection of another person, shall be liable for prosecution in a court of law.

The Act prohibits also a wide range of sexual offences including rape of all kinds, indecent acts, incest, pornography and child trafficking, etc.

2.3.11 Physical Planning Act, 1999

Section 29 of the said Act empowers the County Government to reserve and maintain all land planned for open spaces, parks, urban forests and green-belts. The same Section allows for prohibition or control of the use and development of such an area. Section 30 states that any person who carries out development without development permission will be required to restore the land to its original condition. It also states that no other licensing authority shall grant license for commercial or industrial use or occupation of any building without a development approval granted by the respective County Government. Since a road already exists in the proposed project area, no negative impact is anticipated.

2.3.12 Water Act 2002

The Act provides guidelines on use and management of water resources in the country. This Act prohibits the pollution of water. Part II, Section 3 of this Act states that “every water resource is hereby vested in the state, subject to any rights of user granted by or under the Act or any other law”. The Act and its subsequent supplementary regulations, namely Water Regulations of 2007 requires that, any organization/person intending to abstract water for supply to over twenty (20) users should obtain a permit from the Water Resource Management Authority via a Water Users Association (WUA). The Act further notes that, the issuance of the permit is subject to public consultation as well as an Environmental and Social Impact Assessment. It is recommended that abstraction in all water bodies during the road project must involve the local users to avert any possible water related conflicts.

2.3.13 Work Injury Compensation Benefit Act 2007

This Act provides guidelines for compensating employees on work related injuries and diseases contacted in the course of employment. The Act includes the provision of compulsory insurance for employees. The Act also defines an employee as any worker on contract of service with an employer. This Act is relevant to the proposed project and it is thus recommended that all workers contracted during the project implementation phase should have the required insurance covers so that they can be compensated in case of injuries arising from their work.

2.3.14 Traffic Act, Chapter 403

This Act consolidates the laws relating to traffic on all public roads. It also prohibits the encroachment on and damage of roads including land reserved for roads. The proposed project is essentially under the provision of this Act.

2.3.15 Use of Poisonous Substances Act, Cap 247

This Act provides for the protection of persons against risks of poisoning by certain substances. The purpose of this Act is to protect persons against risks of poisoning by toxic substances arising from the use, storage, importation, sale, disposal and/or transport. All machinery / equipment imported by the contractor must be free from poisonous substances.

2.3.16 Forest Act, 2005

The Forest Act No. 7 of 2005 guides the establishment, development and sustainable management, including conservation and rational utilization of forest and woodland resources for the socio-economic development of the country.

The Act also provides guidelines for management and registration of forests and woodlands. The contractor is advised against firewood collection by construction from any forest or woodland along the road corridor.

2.3.17 Malaria Prevention Act (Cap246)

This Act provides measures to curb the breeding of mosquitoes at development sites. Measures proposed in the Act to control the breeding of the vector include: maintenance of free drainage channels, removal of stagnant water from any land to prevent larvae breeding, removal of wastes and broken bottles, amongst others. The proponent should implement measures to control the malaria disease vectors by implementing relevant mitigation measures proposed in the regulation. No stagnant water as a result of road project should be allowed near workmen camp, burrow sites or homesteads.

2.3.18 The Standards Act (Cap 496)

This Act is implemented by the Kenya Bureau of Standards who provides standards on the requirements of equipment and project materials. Standards regulating security and safety of the public also have to be observed during the design phase of the project. The proponent is required to implement the relevant requirements of this Act, especially those on standardization of project inputs and equipment in order to reduce waste and pollution.

2.3.19 The Wildlife Conservation and Management Act 2013

This Act provides for the protection, conservation and management of wildlife in Kenya. The Act deals with areas declared as National Parks, under the Act. The Act controls activities within the park, which may lead to the disturbance of animals. Further the Act protects wildlife outside the parks. The Act prohibits killing of wildlife for any purpose whatsoever unless authorized by the KWS.

2.3.20 The Occupation Safety and Health Act, 2007

This Act applies to all workplaces and workers associated with it; whether temporary or permanent. The main aim of the Act is to safeguard the safety, health and welfare of workers and non-workers. 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 so as to protect all from work related injuries or other health hazards.

2.4 Project Listing in the Second Schedule

The proposed rehabilitation of Lodwar-Lokichogio-Nakodok 240km (A1) Road is in the category listed in the **Second Schedule** of the Environmental Management and Co-ordination Act (EMCA), 1999 under the following items:

- Item **1 General** – (a) an activity out of character with its surrounding; (b) any structure of a scale not in keeping with its surrounding; (c) major changes in land use and
- Item **3 (a) all major roads** and are therefore required to undergo Environmental and Social Impact Assessment (ESIA).

According to **Section 58** of the Environmental Management and Coordination Act (EMCA), the following requirements are clearly elaborated:

Subsection (1) Not withstanding any approval, permit or license granted under this Act or any other law in force in Kenya, any person, being a proponent of a project, shall before financing, commencing, proceeding with, carrying out, executing or conducting or causing to be financed, commenced, proceeded with, carried out, executed or conducted by another person any undertaking specified in the Second Schedule to EMCA Act, submit EIA Project Report to the Authority, in the prescribed form, giving the prescribed information and which shall be accompanied by the prescribed fee.

Subsection (2) The proponent of a project shall undertake or cause to be undertaken at his own expense an Environmental Impact Assessment Project Report and prepare a Project Report thereof where the Authority (NEMA), being satisfied, after studying the EIA Project Report under subsection (1), that the intended project may have or is likely to have or will have a significant impact on the environment, so directs.

Subsection (7) Environmental Impact Assessment shall be conducted in accordance with the environmental impact assessment regulations, guidelines and procedures issued under the EMCA.

Legal obligations relating to EIA which must cover all projects specified under the Second Schedule of EMCA, 1999 include compliance with Environmental Management and Coordination Act, 1999, Part V, Section 42 (3)

2.4.1 World Bank Operational Policies

Since the road already exists, the project is only likely to trigger the following three World Bank Operational Policies:
OP 4.01 - Environmental Assessment OP 4.11 – Physical Cultural Resources
OP 4.12 - Involuntary Resettlement

Refer to **Table 2** for Relevant Legislation and how the legislation is triggered by the proposed project.

Table 1: Relevant Legislation used in the ESIA Study

Nr	Legislation	Relevance of the Legislation	Trigger of Relevant Legislation by Project	Fulfillment
1	Environmental Management & Coordination Act, 1999 and Subsidiary Regulations	Ensure environmental protection during project implementation. • Environmental Impact Assessment EIA) • Environmental Audit and Monitoring, Environmental Quality standards and issuance of environmental protection orders • Generation of sector related regulations • Environmental Management and Coordination (Environmental Impact Assessment and Audit) Regulations, 2003 - Waste Management Regulations - 2006 - Water Quality Regulations - 2006 - Wetlands, River Banks, Lake Shores and Sea Shore Management Regulations - 2009 - Controlled Substances Regulations - 2007 - Conservation of Biological Diversity and Resources, Access to Genetic Resources, Benefit Sharing (BD) Regulations - 2006 - Draft Air Quality Regulations - 2008 - Noise and Excessive Vibration Pollution Control Regulations - 2009	• Generation of solid and liquid waste during construction and operation • Generation of excessive noise and vibration during construction • Trucks using facility will be transporting, controlled substances	• The execution of an ESIA in compliance with regulations has been commissioned. • Environmental Management and Monitoring Plan have been developed and included in this ESIA Report for implementation during project execution
2.	Environmental (Impact Assessment and Audit) Regulations, 2003	• No proponent shall implement a project if it is likely to have a negative environmental impact; or for which an environmental impact assessment is required under the Act or these Regulations unless an environmental impact assessment has been concluded and approved in accordance with these regulations. • No licensing authority under any law in force in Kenya shall issue a licence for any project for which an environmental impact assessment is required under the Act unless the applicant produces to the licensing authority a licence of environmental impact assessment issued by the Authority under these Regulations	• The Lodwar-Nakodok project is likely to generate impacts that require mitigation • Some people settled along the project route are likely to be affected by the project requiring compensation and resettlement.	• This ESIA report has been prepared in compliance with the requirements of the regulation. • It is recommended that the subsequent requirements of the Regulations which include monitoring and annual audits be fully observed
3.	EMCA (Noise and Vibration Control) Regulation, 2009	• 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. • Except as otherwise provided in these Regulations, no person shall - • make or cause to be made excessive vibrations which annoy, disturb, injure or endanger the comfort, repose, health or safety of others and the environment; or • cause to be made excessive vibrations which exceed 0.5 centimetres per second beyond any source property boundary or 30 metres from any moving source;	• Elevated noise levels may be generated from working machinery and trucks • Excavation works using compressors may also generate elevated noise levels.	• The project team should observe the noise regimes for the different zones especially so for working in areas termed as silent zones which include proximity to educational, health and religious institutions. • Construction sites near the silent zones should be allowed maximum noise level of 60 dB (A) during the day, whilst night levels are maintained at 35 dB (A).

Nr	Legislation	Relevance of the Legislation	Trigger of Relevant Legislation by Project	Fulfillment
4.	EMCA (Waste Management) Regulations, 2006	• No person shall dispose of any waste on a public highway, street, road, recreational area or in any public place except in a designated waste receptacle. • A waste generator shall collect, segregate and dispose such waste in the manner provided for under these Regulations. • A waste generator shall minimize the waste generated by adopting cleaner production methods: • A waste generator shall segregate waste by separating hazardous waste from non-hazardous waste and shall dispose of such wastes in such facility as shall be provided by the relevant local authority.	• Waste will be generated at the site during construction and operation at the	• The proponent to put in place measures to ensure that construction material left after construction is kept minimal • The proponent should consider using recycled or refurbished construction materials including those excavated from the existing roads • Waste collection bins are made available at the site. • Waste generated at the contractor's camp and construction site is to be handled by NEMA licenced handlers and possess all relevant waste handling equipment and documentations, such as waste transport license, tracking documents, license to operate a waste yard, insurance cover, and vehicle inspection documents, amongst others
5.	EMCA (Water Quality) Regulations, 2006	• Every person shall refrain from any act which directly or indirectly causes, or may cause immediate or subsequent water pollution, • No person shall throw or cause to flow into or near a water resource any liquid, solid or gaseous substance or deposit any such substance in or near it, as to cause pollution. • No person shall • (a) Discharge, any effluent from sewage treatment works industry or other point sources without a valid effluent discharge license issued in accordance with the provisions of the Act; • (b) abstract ground water or carry out any activity near any lakes, rivers, streams, springs and wells that is likely to have any adverse impact on the quantity and quality of the water, without an environmental impact assessment license issued in accordance with the provisions of the Act;	• Used oil will be generated at the site from service of vehicles and machinery • Sewage waste will be generated at the contractor's camp	• Containment area is to be provided for storage and handling of oils. • Used oil recovered from vehicles and machines is to be stored in drums for appropriate disposal • KeNHA and Contractor are to apply for water abstraction permits from WRMA to be allowed to abstract water from surface water sources or boreholes.

Nr	Legislation	Relevance of the Legislation	Trigger of Relevant Legislation by Project	Fulfillment
6.	EMCA (Wetlands, River Banks, Lake Shores and Sea Shore Management) Regulations, 2009	A person shall not engage in any activity that may- • have an adverse impact on any ecosystem; • lead to the introduction of any exotic species; • lead to unsustainable use of natural resources, Without an Environmental Impact Assessment License issued by the Authority under the Act.	• The road project crosses several streams and rivers • There is potential contamination of the water • There is potential siltation of the rivers courses.	• The execution of an ESIA in compliance with regulations has been commissioned. • Environmental Management and Monitoring Plan have been developed and included in this ESIA Report for implementation during project execution
7.	EMCA (Fossil Fuel Emission Control) Regulations, 2006	• Any internal combustion engine is subject to inspection under these regulations • Any person who operates or owns an internal combustion engine and permits it to be operated upon any road, street, public highway or any premises, which emits smoke or other air contaminants in excess of emission standards set out in the 1st Schedule commits an offence	• Trucks and construction machines have the potential to generate smoke in excess of the prescribed standards.	• Construction Machinery and trucks are to be regularly maintained. • Drivers and operators of such machines are to be instructed to avoid raving of engines.
8.	Land Act 2012	Promote Land Conservation including and need to prepare EIA Plan: • Conservation of ecologically sensitive public land • Conservation of land based natural resources • submit an environmental impact assessment plan pursuant to existing law on environment	The project has the potential to pollute land and other natural resources by oil and petroleum products from equipment and vehicles	ESIA study has been commission to address any potential impacts through implementation of proposed mitigation measures
9.	Malaria Prevention Act (Cap246)	Removal of stagnant water that forms breeding place for mosquitoes	Potential risk of having stagnant water at the excavated areas from construction activities	• The proponent is advised to implement measures to control the malaria disease vectors by allowing no stagnant water as a result of road project near workmen camp, borrow sites or homesteads • Use of nets is to be encouraged
10.	Work Injury compensation Benefit Act 2007	Every employer shall obtain and maintain an insurance policy, with an insurer approved by the Minister in respect of any liability that the employer may incur under this Act to any of his employees.	Construction work that will be carried out has the potential to cause injury or ill health from water or air pollution.	• All workers contracted during the project implementation phase must have the required insurance cover so that they can be compensated in case of injuries while working. • The contractor must provide for compensating employees on work related injuries and diseases contacted in the course of employment and for connected purposes

Nr	Legislation	Relevance of the Legislation	Trigger of Relevant Legislation by Project	Fulfillment
11.	The Public Health Act (Cap 242)	• No person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health. • It shall be the duty of every health authority to take all lawful, necessary and reasonably practicable measures for preventing or causing to be prevented or remedied all conditions liable to be injurious or dangerous to health arising from the erection or occupation of unhealthy dwellings or premises	House occupied by persons who require adequate lighting, ventilation and sanitary facilities. During construction there will be excess noise and dust generated.	• The contractor must ensure all collection of water, sewage, rubbish, refuse and other fluids which permits or facilitate the breeding or multiplication of pests are avoided especially at workmen camp site. • The contractor to provide sanitary facilities to prevent open defecation in the project area
12.	The Wildlife (Conservation and Management) Act, Cap 376	Provide wildlife conservation sensitisation to create public awareness	The Lodwar-Nakodok Road passes through areas with wildlife and there is possibility that animals can roam close to the road	Sensitisation of community on wildlife conservation to be part of the ESIA recommendations for implementation
13.	The Occupational Safety and Health Act, 2007	• Ensure the safety, health and welfare of persons at work; and • Protection of other persons against safety and health arising out of, or in connection with the activities of persons at work. • Use of Personal Protective Equipment by workers when on duty including use of safety harnesses when working at heights.	Construction crew will be exposed to injury from working with machines and falling objects. Some workers operating at heights will be exposed to the danger of falling.	ESIA Report provides recommendations on Health and safety to be followed by the Contractor and Construction Crew
14.	Public Roads and Roads of Access Act Cap. 399	• Ensure non-interference with the public (community) when constructing access road Developer to maintain access road to avoid inconvenience to road users and the community • Section 10 and 11 allows for notices to be served on the adjacent land owners seeking permission to construct the respective roads.	Traffic will be directed to use road deviations to allow construction activities	• Developer to apply proposed mitigation measures in the ESIA Report to minimise impact. • Already public meetings were held during public consultations and notifications to effect this
15.	Traffic Act	• Drivers shall not be permitted drive under the influence of alcohol • Designated speeds shall be observed by drivers	• Construction site area will require controlled speeds • Drivers shall be required to be sober when driving vehicles	• Contractor to ensure all drivers are sensitized on speed limits for the construction site area • All drivers should be confirmed to be sober before getting behind a wheel.
16.	Local Government Act. Cap. 265	• Enforcing protection of trees and other vegetation in urban centres • Approval of development designs before construction can begin • Enforce orderly development in an urban setting	The project involves construction of infrastructure facilities that require approval by local authority	• Project development plans are to be taken to Local Authority for approval. • Developer undertakes to comply with Local Authority requirements • ESIA Study already commissioned

Nr	Legislation	Relevance of the Legislation	Trigger of Relevant Legislation by Project	Fulfillment
17.	The Water Act, 2002	• Water permit required for use of water • Protection of surface and groundwater resources • Protection of water catchments • EIA Licence to accompany Permit Application for water abstraction	Project will require dedicated source of water during construction and operation Water drainages may carry sediments to neighbouring streams and rivers	• ESIA Study already commissioned • Developer to comply with ESIA recommendations of environmental protection and mitigation measures. • Design and implement an effective drainage and sediment control plan to contain excessive sediments that may be washed into the adjacent seasonal stream.
18.	Forest Act 2005	• Provides for conservation of water, soil and biodiversity • Provides for riverine and shoreline protection • Provides for Protection of Forests	• There is no major forest cover in the project area. However, the contractor is advised against firewood collection to be used on workmen camp on any patch of vegetation along the road corridor. • Project has the potential to pollute soil and water resources	• ESIA Study Commissioned • Proponent to comply with ESIA recommendations on environmental protection
19.	The Physical Planning Act Chapter 286	• Ensure there is controlled development • Proposed developments must be approved by the respective Local Authority and certificate of compliance issued accordingly. • EIA License is going to be required if Authority feels project is going to impact environment	• Project has potential to impact environment • Approval required for project	• Project Design to be submitted for approval • ESIA Study already commissioned
20.	Employment Act No 11 of 2007	• Prohibition Against Forced Labor • Prohibition of child labour	Project has the potential to attract underage persons looking for job opportunities	Project proponent undertakes to abide by the requirements of the Act
21.	Land Adjudication Act Cap 284	Provides for survey and demarcation map of the adjudication section, showing every parcel of land identified by a distinguishing number.	Land ownership documentation required for approval of ESIA	Each individual land parcel is to surveyed, demarcated and title provided
World Bank Safeguard Policies				
1.	OP 4.01 Environmental Assessment:	Used to identify, avoid, and mitigate the potential negative environmental impacts associated with a project. The policy covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources; and trans-boundary and global environment concerns.	Project has potential to impact the environment through pollution of air, soil and water and social impact t to local community	ESIA Study already commissioned to identify potential environmental and social impacts

Nr	Legislation	Relevance of the Legislation	Trigger of Relevant Legislation by Project	Fulfillment
2.	OP 4.11 Physical Cultural Resources	This policy addresses physical cultural resources, which are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.	During the course of civil works, there is a potential for "chance finds", however, along the road corridor there were no cultural heritage sites or other resources identified.	The ESMP contains provisions for managing cultural resources if encountered during construction phase. The contractor to follow a procedure to recover such resources.
3.	OP 4.12 - Involuntary Resettlement	The aim of this policy is to avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs. Where this is not possible resettlement action plan study is to be carried out and affected persons are identified and the loss of land, property and income streams determined for compensation and resettlement.	The project will affect some persons located within the road corridor requiring compensation and resettlement	Resettlement Action Plan (RAP) Study has been carried out and project affected persons identified for compensation and resettlement. A review of the RAP Study is underway.

2.5 Policy frameworks

Several policies have been developed over the years to guide the development and management of road projects in order to ensure economic and social sustainability.

2.5.1 The National Poverty Eradication Plan (NPEP)

The objective of the NPEP is to reduce the incidences of poverty in both rural and urban areas by 50 percent by the year 2015, as well as to strengthen the capabilities of the poor and vulnerable groups to earn income. It also aims to narrow the gender and geographical disparities as well as create a healthy, better-educated and more productive population. This plan has been prepared in line with the goals and commitments of the World Summit for Social Development (WSSD) of 1995. The plan focuses on the 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 which can be achieved through developing the transport and communication sector. The plan is implemented by the Poverty Eradication Commission (PEC) formed in collaboration with Government ministries, Community Based Organization (CBO), private sector, Non-Governmental Organization (NGO), as well as bilateral and multilateral donors. Through provision of employment opportunities, the project is expected to contribute positively to economic empowerment and poverty eradication.

2.5.2 Kenya National Aids Strategic Plan (KNASP III)

The Kenya National Aids Strategic Plan aims at supporting KNASP III to achieve its results through advocacy, information dissemination and social mobilisation on HIV / AIDS prevention and management. The strategy focuses on communicating KNASP III to stakeholders and providing guidelines for programmatic communication programmes. In this regard, the communication strategy targets a wide range of audiences including policy makers, development partners, implementing organisations, the media and key institutions coordinating the national response.
The key components of this strategy include:

1. KNASP governance, financing and strategic information: This component lays out strategies for communicating KNASP III, the coordination structures and strategic information, leadership, roles and policies and the KNASP III resources mobilisation and allocation.

2. Advocacy, communication and social mobilisation for the National HIV and AIDS Programme component which provides guidelines for communication programmes for HIV prevention, treatment and care and social protection programmes.

3. Guidelines for development of communication programmes and tools. The guidelines are meant to support the mainstreaming of communication programmes in service provision.

2.5.3 The National Policy on Gender and Development

The overall objective of this policy is to facilitate the mainstreaming of the needs and concerns of men and women in all areas in the development process in the country. To this end, the policy identifies eight critical areas of concern: the economy; poverty and sustainable livelihoods; law; political participation and decision-making; education and training; health and population; the media; and policy implementation framework and resource mobilisation.

The policy has made several important suggestions in respect of legal, regulatory and institutional reforms that can be undertaken to ensure that obstacles to equitable sustainable development are removed. The policy arose from the Government's realisation that without a coherent and comprehensive overall framework for guiding the different sectors and agencies involved in development, tremendous resources may continue to be lost unless mainstream development directly addresses gender concerns. The Policy recognises that traditional development theories have not facilitated the participation of women in strategic areas and positions of power and influence because they are based on traditional assumptions of the roles and responsibilities of women and men. The approach also recognises that without quality gender disaggregated data, the planning and programming process cannot be efficient and productive.

With regard to the environment, the policy advocates for programmes that take into consideration environment and natural resource management issues that concern women, men, girls and boys. The Government realizes that certain environmental issues have specific relevance to women. This could be through the negative effects of some environmental concerns which could have adverse effects on the female population or some special skills and knowledge women could possess in resolving environmental problems. For this project, it is foreseen that a majority of jobs would favour men due to the nature of the works (heavy equipment, site clearing, drilling, excavating, blasting and many long hours away from home. Social norms restrict women's sphere of activity but they are also likely to benefit if the contractor employs a quota system that would oversee a certain number of women given employment for unskilled labour. Women are also likely to take advantage of the influx of population in the area to be involved in small and medium enterprises that would boost their economic well-being.

2.6 International policy framework

Kenya is a signatory as well as a party to various international conventions, treaties and protocols relating to the environment that aim at achieving sustainable development. According to the Registrar of International Treaties and other Agreements in Environment (UNEP, 1999), there are 216 treaties, 29 of which are of interest to Kenya. The country is a signatory to 16 such agreements, which range from use of oil, through to protection of natural resources and to protection of the atmosphere. The agreements became legally binding on Kenya upon ratification thereof. The agreements of interest to Kenya can be categorized as those for protecting natural resources, atmosphere and the social well-being of man. There are 12 agreements of significance to Kenya under this category to which the country has signed and ratified. The Section below reviews a number of policies that are relevant to the proposed project:

2.6.1 United Nations Framework on Climate Change (UNFCCC) of 1994

The Convention requires state parties to take climate change considerations take into account in their relevant social, economic and environmental policies and actions. In this project, the proponent has undertaken this ESIA with the aim of minimizing adverse effects on the economy, public health and the quality of the environment. The requirements of this Convention can therefore be met by reducing project impacts on climate change by growing trees suitable for the area along the highway so as to act as carbon sinks. The proponent is therefore advised to enhance the positive impacts of the project through engaging in activities that mitigate climate change, by for example developing tree planting programmes with line ministries and local residents and conserving catchments through water conservation measures.

2.6.2 Convention on Biological Diversity, 1992

The Convention requires parties to implement ESIA recommendations effectively to avoid or minimize significant adverse impacts on biodiversity. It also introduces the Strategic Environmental Assessment (SEA) to assess environmental implications of policies and programmes particularly for those with major implications on natural resource use. The Convention also led to the establishment of the Cartagena Protocol on Biosafety, 1999. "The Cartagena Protocol on Biosafety to the Convention of Biological Diversity" was adopted on 29th January 2000 and entered into force on the same date. Kenya signed the protocol on 15th May 2000; ratified it on 24th January 2002 and became a party member on 11th September 2003. The protocol is an international treaty governing the movements, from one country to another of Living Modified Organisms (LMOs) resulting from modern biotechnology. The proponent is therefore advised to observe the requirements of this regulation, especially if activities such as landscaping are incorporated and involve the use of appropriate plant species some of which can be biotechnology products. On the other hand, the use of LMOs can have adverse environmental impacts if the correct materials are not used and this may lead to destruction of the micro-ecosystems, food webs and even plant invasion of farms.

2.6.3 The Convention on Wetlands of International Importance (Ramsar, 1971)

The Convention seeks to ensure wise use of all wetlands and provides stringent guidelines for the conservation of wetlands listed in the List of Wetlands of International Importance. According to the Ramsar Site listing, the proposed project is not located within an Important Bird Area (IBA) and thus this Convention thus need only be appreciated.

2.6.4 Kyoto Protocol of the United Nations Framework Convention

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction credits.

2.6.5 Convention on Protection of World Cultural and Natural Heritage, 1972

The Convention requires parties to adopt effective measures that include the assessment of the feasible project alternatives to prevent, minimize or compensate for adverse impacts. It also provides for the assessment of the nature and extent of potential impacts on natural heritage resources, and the designing and implementing of mitigation plans. The Convention also protects threatened plants.

2.6.6 Convention on Endangered Species (CITES) of Wild Fauna and Flora, 1990

This Convention protects forests as habitats for endangered species. The proposed project area has no forest in her immediate area and thus this Convention need only be appreciated.

2.7 Administrative framework

One of the strategic policies that the Kenya government has adopted for improving road maintenance of roads to strengthen administrative framework for roads. A study on road sector institutions was commissioned between 1995 and 1999 with support from the

European Union. The objective was to develop an institutional framework within which the management of the entire road network would most effectively be undertaken. In 1998, a Kenya Roads Board (KRB) Bill was drafted for establishing an autonomous, executive roads board to manage the Roads Maintenance Levy Fund (RMLF) and execute the maintenance, repair and rehabilitation of roads. The bill was passed by parliament in December 1999 as the KRB Act (1999). The Act outlines the main functions of the KRB as:

(i) Coordinate implementation of all policies relating to the maintenance, rehabilitation and development of the road network
(ii) Coordinate the maintenance, rehabilitation and development of the road network with a view to achieving efficiency, cost-effectiveness and safety
(iii) Administer funds derived from fuel levy and any other funds that may accrue to the board
(iv) Determine the financial allocations for road agencies and evaluate the delivery of works through technical, financial and performance audits
(v) Ensure that all procurement of works is conducted in accordance with the guidelines and criteria set by the board
(vi) Recommend to the Cabinet Secretary responsible for roads the areas for study and research; the specifications, design standards and classification of roads; vehicle types and dimensions for axle-load limits; and road safety measures

The board provides an institutional framework within which the entire road network is managed and is entrusted with authority to efficiently use KRB funds to develop, rehabilitate and maintain the road network. The KRB Act provides for broad allocation of funds, with 57% going to international, national trunk and primary roads while 24% goes to secondary roads, 16% to rural roads and 3% to KRB operations.

Stakeholders represented in the board include the Kenya Government, Institution of Engineers of Kenya, the Kenya National Chamber of Commerce and Industry, the Institution of Surveyors of Kenya, the Kenya National Farmers Union, the Automobile Association of Kenya, the Kenya Association of Tour Operators, the Institute of Certified Public Accountants of Kenya and the Kenya Transport Association.

The successful implementation of the KRB Act is expected to translate into the physical improvement of the road network, improved utilization of the fuel levy funds, reduction in vehicle operating costs, open and accountable procurement of road works and effective financial and technical auditing of road works.

2.7.1 The Kenya Roads Act No. 2 of 2007

This is an Act of Parliament to provide for the establishment of the Kenya National Highways Authority, the Kenya Urban Roads Authority and the Kenya Rural Roads Authority, to provide for the powers and functions of the authorities and for connected purposes. According to the Roads Act 2007 enacted by Parliament in July 2007, all roads in the country including those previously controlled by Local Authorities now fall directly under the new Authorities. The Cabinet Secretary for Roads will be responsible for all issues pertaining to roads in the country. In addition, the Cabinet Secretary for Roads will be the authority in the roads subsector and will coordinate policy, strategy and supervision in chief as well as investment plans for the whole sub-sector including urban roads.

The responsibilities of the three Authorities are:

The Kenya National Highways Authority (KeNHA)
This authority is the government's implementing agency endowed with the responsibility of managing and maintaining all road works on Class A, B and C roads. In addition to implementing road works, KeNHA advises the Ministry of Roads on technical issues such as standards, axle loads, and research and development. KeNHA reports to the Ministry of Roads that approves its development budget while the Kenya Roads Board approves the maintenance budget.

Kenya Rural Roads Authority (KeRRA)
The authority is responsible for all rural and small town roads, Class D and below including special purpose roads and unclassified roads.

The Kenya Urban Roads Authority (KURA)
This authority is responsible for managing and maintaining all road works on urban roads in cities and major municipalities. KURA also falls under the Ministry of Roads, which approves its roads development budgets. Kenya Roads Board approves KURA's road maintenance budget.

The Kenya Wildlife Service (KWS)
The KWS is also a roads agency responsible for roads under its jurisdiction as well as access roads allocated to KWS by the Ministry of Roads. KWS reports to the Ministry of Roads on development projects while Kenya Roads Board approves its maintenance works.

2.8 World Bank operational policies relevant to the project

The World Bank has safeguard policies that are intended to help promote socially and environmentally sustainable approaches to development as well as to ensure that Bank operations do not harm people and the environment. The safeguard policies require environmental assessment (EA) for projects whose policies fall within the scope of EA.

The overall proposed project (road rehabilitation from Lesseru to Nakodok) has been rated Category A under the World Bank Operational Policy on Environmental Assessment (OP4.01), requiring a full Environmental Assessment (EA).
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. The operational policies provide a platform for the participation of stakeholders in project design and implementation as a way of building ownership among local populations.

2.8.1 World Bank Operational Policy 4.01-Environmental Assessment

The Operational Policy on Environmental Assessment (OP 4.01) is applied to identify, avoid, and mitigate potential negative environmental impacts associated with Bank's lending operations. This policy is considered to be the umbrella policy for the Bank's environmental safeguard policies. In relation to public consultation, the OP 4.01 requires a two-stage process:
a) It applies shortly after environmental screening and before the terms of reference for the full ESIA are finalized, and
b) Once a draft ESIA report is prepared.

In addition, the project is required to consult with stakeholder groups throughout project implementation as a way to address ESIA-related issues that affect them.

The policy favours preventive measures over mitigation or compensation measures, whenever feasible. The operational principles of the policy require the environmental assessment process to undertake the following:

- 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.
- Stakeholder consultation before and during project implementation.
- Engage services of independent experts to undertake the environmental assessment.
- Provide measures to link the environmental process and findings with studies of economics, financial, institutional, social and technical analysis of the proposed project.
- Develop programmes for strengthening of institutional capacity in environmental management.

The requirements of the policy are similar to those of EMCA, which aim to ensure 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.

2.8.2 Bank Operational Policy 4.11-Physical Cultural Resources

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

Cultural resources are important as sources of valuable historical and scientific information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The loss of such resources is normally irreversible. The objective of OP/BP 4.11 on Physical Cultural Resources is to avoid or mitigate adverse impacts on cultural resources from development projects that the World Bank finances.

The World Bank requires that, before proceeding with a project that may risk damaging cultural property (e.g., any project that includes large scale excavations, movement of earth, superficial environmental changes or demolition), the cultural property aspects of the project site must be determined. The policy is relevant to the proposed road project because the proposed road corridor traverses two community cemeteries (in Lodwar and Kakuma towns). Measures will therefore be made to either avoid these sites or mitigate project impact on the sites.

2.8.3 Bank Operational Policy 4.12-Involuntary Resettlement

The objective of this policy is to avoid where feasible, or minimize and mitigate adverse social and economic impacts, by exploring all viable alternative project designs, to avoid resettlement. This policy is triggered in situations involving involuntary taking of land and property for purposes of re-alignments and preservation of the RoW. The policy covers direct economic and social impacts that result from Bank-assisted investment projects, and are caused by (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 or not 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 appraisal of proposed projects. The policy requires that 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 are 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 is relevant to the proposed project because there is high likelihood that the project will cause 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
4) Loss of land

2.8.4 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:

- Maximizing access to information.
- Setting out a clear list of expectations
- Safeguarding the deliberative process
- Providing clear procedures for making information available
- 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, resettlement and vulnerable and marginalized groups: OP 4.01, Environmental Assessments, OP 4.12 Involuntary Resettlement and OP 4.10 – Indigenous People) 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.

2.9 Alignment of WB policies with Government laws relevant to this ESIA

Both the World Bank policy safeguards and Government of Kenya laws are generally aligned in principle and objective. For instance:

- Both require environmental and social impact assessment before project design and implementation (which also includes an assessment of social impacts)
- Both require stakeholder consultation during preparation and public disclosure of ESIA reports
- While OP 4.01 of World Bank stipulates different scales of EIA for different category of projects, EMCA requires EIA for all sizes of projects, which require to be scoped as applicable.

- Whereas EMCA requires strategic environmental assessments, OP 4.01 requires that an environmental assessment be conducted depending on the project category while an ESMF should be prepared for municipal projects.
- EMCA recognizes other sectoral laws, while WB has safeguards for specific interests.
- The Bank requires that stakeholder consultations be undertaken during planning, implementation and operation phases of the project which is equivalent to EMCA requirements.
- Additionally, statutory annual environmental audits are required by EMCA.

In Kenya, it is a mandatory requirement under EMCA 1999 for all development projects (Schedule Two) to be preceded by an ESIA study. Thus, under the Laws of Kenya, environmental assessment is fully mainstreamed in all development processes that are consistent with World Bank policies.

3 PROJECT DESCRIPTION

3.1 Location of the road project

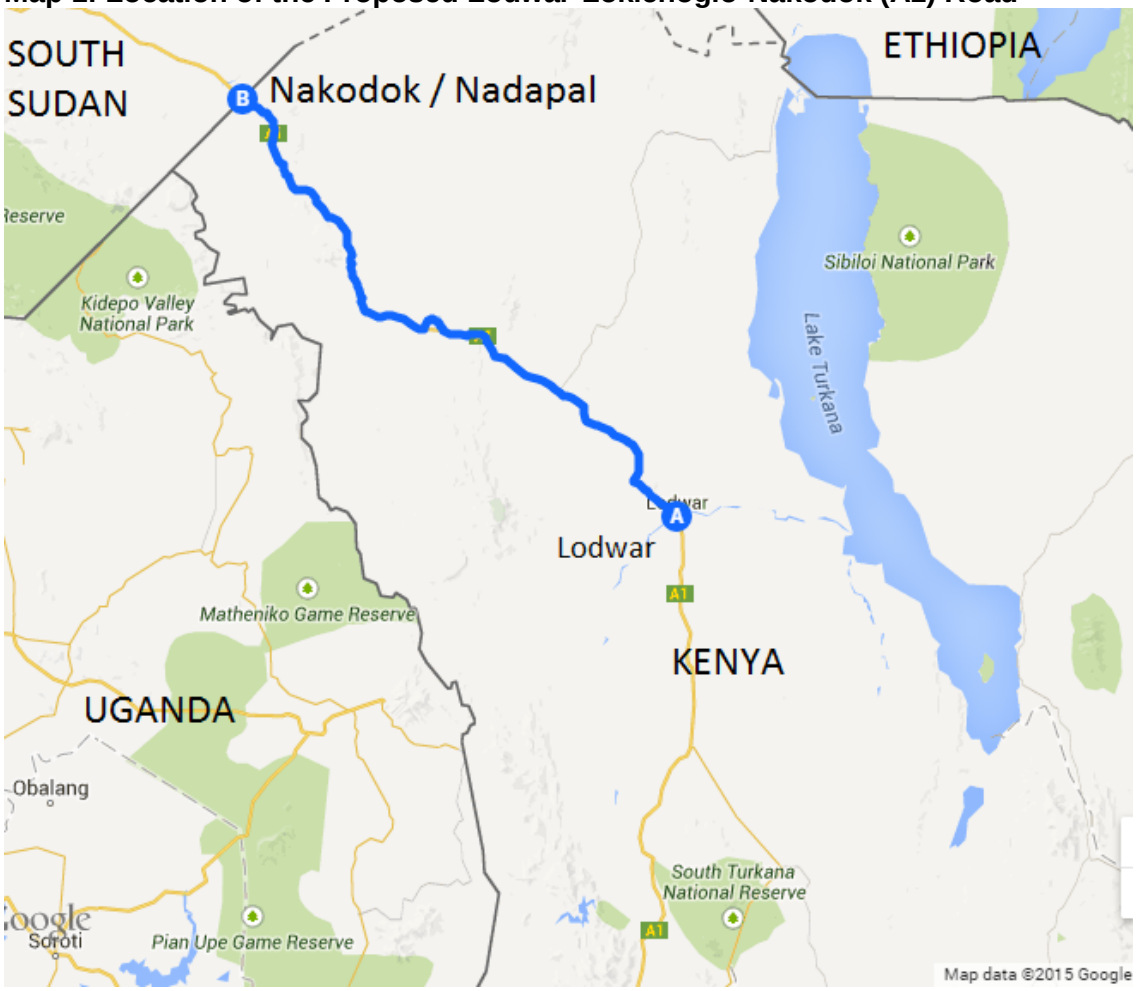
The Lodwar – Lokichogio – Nadapal/Nakodok (A1) Road is a 240 km road that is exclusively located within Turkana County in north western Kenya. The proposed road commences in Lodwar Town, at the roundabout where the Kitale – Lodwar (A1) Road enters Lodwar Town. The moves in a north westerly direction through Nasiger, Nakalale / Makutano Gold (junction of Lokitaung turn off), Kakuma, Kalobeyei, Songot, Lokichogio and Nadapal. Lodwar, Kakuma, Lokichogio and Nadapal are major towns with relative large human population and permanent buildings along the road. Nasiger, Makutano Gold, Kalobeyei and Songot, on the other hand, are fairly small market centres with relatively smaller human population and less sophisticated housing structures.

3.2 Present condition of the road

The existing road is a two-lane bituminous carriageway with a shoulder of 0.5 m on both sides of the carriageway. The 69 km stretch between Lodwar and Makutano Gold (Lokitaung turn off) was constructed between 1986 and 1989. The 146 km section between Makutano Gold was constructed from 1989 to around 1992. The 30 km two-lane earth track between Lokichogio and Nadapal (the border of Kenya and South Sudan) has never been tarmacked. The two-lane bituminous carriageway between Lodwar and Lokichogio has fairly thin layer of tarmac and is presently in a fairly poor state. The 69 km section between Lodwar Town – Lokitaung turn off is totally worn out with extensive potholes throughout the road stretch. The 146 km stretch between Lokitaung turn off and Lokichogio Town is dilapidated in many places, but most of it is in fairly good state. However, the embankment of the road, which is about 1 to 1.5 m, remains in a fairly stable condition in most of the sections.
The road was constructed mainly to cater for light traffic, such as cars, vans, buses and lorries, most of which were either transporting supplies or supporting refugee operations in Kakuma and Lokichogio. However, it is presently used by heavy commercial vehicles, which transport goods to and from Juba in South Sudan. The road its present state has serious limitations in its engineering design and maintenance, which should be addressed by the proposed Lodwar – Lokichogio – Nakodok (A1) Road project. Some these limitations include:

a) Too many drifts (23 drifts) and only one bridge along the over 200 km two-lane carriageway. Thus, motorists have to wait for between two and five hours for flush floods to subside during the rainy season. At least three drifts have been swept by flush floods and pose risk to motorists, particularly those who are unfamiliar with the road
b) Most of the road signs are erected on the road shoulder, which is only 0.5 m wide, thus most them are either broken or bent because they have been hit by moving vehicles. What is not clear is what happened to the vehicles that hit the road signs
c) Inadequate road signs to guide the movement of guide traffic(e.g. signs for cattle crossing, children crossing, etc. are missing), apart from those showing dangerous change in direction in areas near drifts and distance to destination
d) Lack of speed bumps along most of the over 200 km two-lane carriageway, except in Lokichogio Town

Map 1: Location of the Proposed Lodwar-Lokichogio-Nakodok (A1) Road



3.3 The design of the proposed road project

The proposed project road commences at Lodwar, at the roundabout on the road from Kitale, and ends at Nadapal at the border of Kenya with South Sudan. The proposed road has a total length of 240 km. From Lodwar the road runs in a north westerly direction generally traversing a flat to rolling terrain. It passes through the settlement of Uki and the towns of Kakuma and Lokichogio. In essence the engineering design has divided the route into three major sections:

a) The 69 km Lodwar – Lokitaung turnoff. This section is completely worn out
b) The 146 km Lokitaung turnoff – Kakuma – Lokichogio. The condition of this section ranges between poor to fairly good
c) The 30 km Lokichogio – Nadapal (South Sudan Border). This is essentially an earth track widened in many sections with a grader

3.3.1 Terrain of the alignment

The proposed design has come with four classifications for the topographic terrain for road project (Table 1).

Table 2: Terrain classification

#	Terrain	% Cross-slope
1.	Plain	< 10
2.	Rolling	10 – 25
3.	Mountainous / hilly	25 – 60
4.	Steep	> 60

The proposed road corridor falls mostly within plain to rolling and rolling terrain. However, short sections of the road pass through rolling to hilly terrain. The road traverses a primarily rural landscape except for sections passing through towns, and local settlement areas, such as Lodwar, Nasiger, Makutano Gold, Kakuma, Kalobeyei, Songot, Lokichogio and Nadapal. The elevations of towns within the project corridor are shown in Table 2.

Table 3: Elevation of Towns traversed by the Lodwar – Nakodok (A1) Road

#	Town	Elevation (m)
1.	Lodwar	502
2.	Kakuma	496
3.	Kalobeyei	608
4.	Lokichogio	649
5.	Nadapal	636

Based on cross slope of the Country, the proposed road stretch has been subdivided into 23 sections as listed in the Table 4. Although the proposed road corridor traverses rolling terrain for a substantial length, a reasonable width on either side of the alignment is relatively flat as the alignment is generally located on the flat bottom portion of the hill range. Hence, a better geometry, similar to that found in flat terrain, exists along most of the alignment except at locations where the alignment cuts across hills through saddles or across drifts. Locations where the alignment traverses a saddle or changes the direction of gradient from ascending to descending or vice versa were found at 24, 58, 98, 145 and 206 km.

Table 4: Terrain classification of the proposed Lodwar – Nadapal (A1) Road

#	Start chainage (km)	End chainage (km)	Terrain classification	Approximate location
1	0	20.4	Flat	Lodwar - Nasiger
2	20.4	28.4	Rolling	Lodwar - Nasiger
3	28.4	49.5	Flat	Lodwar - Nasiger
4	49.5	52.5	Rolling	Nasiger – Makutano Gold
5	52.5	57	Flat	Nasiger – Makutano Gold
6	57	70	Rolling	Nasiger – Makutano Gold
7	70	98	Flat	Makutano Gold - Kakuma
8	98	100.2	Rolling	Makutano Gold - Kakuma
9	100.2	108.5	Flat	Makutano Gold - Kakuma
10	108.5	113	Rolling	Makutano Gold - Kakuma
11	113	144	Flat	Makutano Gold - Kakuma
12	144	148.5	Rolling	Kakuma - Kalobeyei
13	148.5	189.6	Flat	Kakuma - Kalobeyei
14	189.6	192.2	Rolling	Kalobeyei - Songot
15	192.2	195.2	Flat	Kalobeyei - Songot
16	195.2	197.7	Rolling	Songot - Lokichogio
17	197.7	200.3	Flat	Songot - Lokichogio
18	200.3	201.7	Rolling	Songot - Lokichogio
19	201.7	204.2	Flat	Songot - Lokichogio
20	204.2	207.5	Rolling	Lokichogio - Nadapal
21	207.5	220.2	Flat	Lokichogio - Nadapal
22	220.2	232.5	Rolling	Lokichogio - Nadapal
23	232.5	End	Flat	Lokichogio - Nadapal

3.4 Technical specifications of the proposed road project

3.4.1 Geometric design

3.4.1.1 Cross section

The cross section of the geometric design of the proposed road project comprises three key elements:

a) The carriageway – comprises the section of the tarmac where vehicles move together with auxiliary lanes, such as acceleration and deceleration lanes, climbing lanes and bus bays and lay-bys
b) The shoulders
c) The ditches

Cross section type II as per Road Design Manual (RDM) Part III with some modification on shoulder widths to a minimum width of 2.0 m is recommended.

3.4.1.2 Climbing lanes

Climbing lanes are provided in accordance with Road Design Manual Part 1. Where longitudinal gradients are long and/or steep enough to cause significant increase in the speed difference between cars and heavy vehicles, both traffic safety and road capacity may be adversely affected. As the project road traffic in design year 10 is in between 2,000 and 6,000 pcu, climbing lanes are proposed at 21+490 to 21+985 for 495 m.

3.4.1.3 Side slopes

A variable slope depending on the embankment height is proposed as follows:
1V: 4H up to 1.0 m height; 1V: 2H from 1.0 m to 3 m height; and 1V: 1.5H from heights more than 3 m. A maximum side slope of 1V: 2H will be used on this project to minimize embankment erosion.

3.4.1.4 Realignments

The existing road geometry generally meets the required standards except at all drift locations and within town areas. In order to avoid conflict in urban with through traffic on the heavy transport route, potential bypass options have been explored for major urban centres. For instance, a bypass option has been recommended for Lokichogio. In addition to these town areas, the existing road has a number of drift crossings with substandard geometry. Realignments have been carried out at all the drift locations for the provision high level bridges with appropriate approach geometry to meet the design standards.

3.5 Traffic forecasts

Traffic surveys were done at seven selected stations along the existing road. The surveys comprised:

a) 24 hr classified traffic counts
b) 12 hr classified traffic counts
c) OD surveys
d) Axle load surveys

A summary of the projected traffic for each design section is presented in **Tables 5 and 6.**

Table 5: Project traffic (AADT) for the design section Lodwar – Lokichogio

#	Vehicle Type	Normal Traffic (AADT)	Diverted Traffic (AADT)	Generated Traffic (converted /Induced)	Generated LAPSSET Traffic	Total Generated Traffic (AADT)	Sub Total (AADT)
1.	Motor cycles	276	-	14	-	14	290
2.	Cars	58	-	3	-	3	61
3.	Pickups, jeeps, vans	175	-	9	-	9	184
4.	Matatus and Nissan Matatus	35	-	2	-	2	37
5.	Buses and Minibuses	5	-	0	20	20	25
6.	Light Goods Vehicles	19	-	1	-	1	20
7.	Medium Goods Vehicles (2 axles)	29	1	1	-	1	31
8.	Heavy Goods Vehicles (3 & 4 axles)	35	1	2	-	2	38
9.	Heavy Goods Vehicles (5, 6, & 7 axles)	10	34	1	75	76	120
10.	Others (Tractors, etc.)	2	-	0	-	0	2
11.	ADT (with m/cycles)	644	36	32	95	127	807
12.	**ADT (without m/cycles)**	**368**	**36**	**18**	**95**	**114**	**518**

Table 6: Projected traffic (AADT) for the design section Lokichogio - Nadapal

	Vehicle Type	Normal Traffic (AADT)	Diverted Traffic (AADT)	Generated Traffic (converted /Induced)	Generated LAPSSET Traffic	Total Generated Traffic (AADT)	Sub Total (AADT)
1.	Motor cycles	163	-	8	-	8	171
2.	Cars	131	-	7	-	7	138
3.	Pickups, jeeps, vans	151	-	8	-	8	159
4.	Matatus and Nissan Matatus	10	-	1	-	1	11
5.	Buses and Minibuses	0	-	0	20	20	20
6.	Light Goods Vehicles	17	-	1	-	1	18
7.	Medium Goods Vehicles (2 axles)	11	1	1	-	1	13
8.	Heavy Goods Vehicles (3 & 4 axles)	24	1	1	-	1	26
9.	Heavy Goods Vehicles (5, 6, & 7 axles)	12	34	1	75	76	122
10	Others (Tractors, etc.)	1	-	0	-	0	1
11.	ADT (with m/cycles)	520	36	26	95	123	679
12.	**ADT (without m/cycles)**	**357**	**36**	**18**	**95**	**115**	**508**

3.6 Materials investigation

Visual assessment was undertaken to record the current functional characteristics and state of the present pavement structure. The pavement condition is summarised in the Table 6 below.

Table 7: Summary of pavement condition survey

Chainage		Surface condition rating	
Summary of pavement condition survey			
From Km	**To Km**	**Rating**	**Remarks**
0	37	Failed	Numerous potholes, patching, edge failure, stripping and cracks
37	38	Good	
38	43	Failed	Numerous potholes, stripping and edge failure
43	44	Fair	Crocodile cracks
44	46	Poor	Extensive crocodile cracks
46	72	Failed	Numerous potholes, edge failure, extensive cracks and patching
72	73	Fair	Longitudinal and transverse cracks
73	78	Poor	Longitudinal and crocodile cracks
78	81	Fair	Crocodile, transverse and longitudinal cracks, and edge failure
81	82	Poor	Crocodile cracks and minor transverse and longitudinal cracks
82	84	Fair	Longitudinal and crocodile cracks
84	86	Poor	Longitudinal cracks, crocodile cracks and several potholes
86	88	Failed	Extensive crocodile cracks
88	89	Poor	Edge failure, crocodile cracks, numerous potholes and patches
89	92	Good	Minor cracks
92	98	Fair	Longitudinal and crocodile cracks
98	108	Good	
108	109	Fair	Longitudinal cracks
109	110	Good	
110	120	Poor	Extensive crocodile cracks, stripping and longitudinal cracks
120	121	Fair	Longitudinal and crocodile cracks
121	123	Good	Minor cracks
123	124	Poor	Several potholes, stripping and minor cracks
124	126	Fair	Longitudinal and crocodile cracks
126	130	Good	Minor cracks
130	134	Failed	Extensive crocodile cracks and longitudinal cracks
134	153	Fair	Minor crocodile, transverse and longitudinal cracks
153	156	Failed	Extensive crocodile cracks, longitudinal cracks and stripping
156	209	Fair	Cracks, stripping and bleeding
209	215	Poor	Extensive crocodile cracks, bleeding and stripping
215	217	Fair	Edge failure, longitudinal cracks and minor transverse cracks

Results from the trenches dug revealed the following about the existing pavement structure:

a) Surfacing (20mm – 60mm thick)
b) Km 0+000 – Km 120+000: Double surfacing dressing of 14/20mm and 6/10mm chippings; and,
c) Km 120+000 – Km 217+384: Triple surface dressing of 14/20mm, 6/10mm and 3/6mm chippings.
d) Base (60mm – 300mm thick)
e) Km 0+000 – Km 1+700: Natural gravel of CBR 20 – 30%;
f) Km 1+700 – Km 72+000:Graded Crushed Stone (GCS); and,
g) Km 72+000 – Km 217+384: Grizzly material/weathered rock.
h) Sub-base (160mm– 300mm thick)

i) Km 0+000 – Km 1+700: GCS; and,
j) Km 1+700 – Km 217+384: Natural Gravel.
k) Sub-grade (150mm – 510mm)
l) Km 0+000 – Km 217+384: Natural Gravel.

3.7 Pavement design

In flat/rolling sections: a carriageway width of 7 m (two lanes) with a 2.0m wide paved shoulder on either side is proposed. In major built up town sections: a carriageway width of 7 m, a parking lane of width 2.5 m and a 2.5 m wide footpath on either side of the carriageway is proposed. In village sections, a carriageway width of 7 m and a 2 m width paved shoulder on both sides of the carriageway is proposed. The extent of pavement layers is presented in **Table 8** below.

Table 8: Extent of pavement layers

	Pavement layer type	Total width flat/rolling terrain
1.	AC	11.00 m
2.	Base – DBM, GCS Shoulder	7.3 m Base + 2*2 m GCS Shoulders
3.	Sub-base – GCS (Base Quality)	Full width of road prism
4.	Improved Subgrade (325mm-S4)	Full width of road prism
5.	Subgrade (S1 Class)	Full width of road prism
6.	Width of roadway (m)	11

A design period of 20 years was adopted for the proposed road project based on the ToR for the project design. The axle load factors adopted was based on the Consultant's traffic surveys and a directional factor of 50 % was adopted for the design traffic. Even if a directional factor of 75 % was adopted, the Design Traffic would be in T1 traffic class.

3.8 Drainage structures (drainage design)

The Lodwar-Nadapal Road (A1) has a total of 491 existing drainage crossings of various types. The existing crossings constitute mainly of:

- Concrete pipe culverts of various sizes, combinations and lengths
- Concrete box culverts of various sizes and lengths
- Concrete drifts either vented or solid and of various lengths
- One 155 m long composite bridge across River Tarach, within Kakuma township
- Armco pipe culverts of various sizes.

The road drainage design has been optimized based on the condition of the existing structures, site conditions, flood estimates and required waterway openings among others. The summary Table 8 below gives the details on the existing structures.

Table 9: A summary of existing drainage structures

S/No	Structure type	No of existing crossings
S1	Bridges	1
S2	Drifts	23
S3	Box culverts of various sizes and cell combinations	158
S4	Concrete pipe culverts of various sizes and cell combinations	305
S5	Armco pipe culverts of various sizes	4
S6	Foot over bridges	0
	TOTAL	491

It is generally recommended that most of the small drainage structures between Lodwar and Lokichogio be retained, while most of those between Lokichogio and Nadapal be

replaced. It is recommended that the existing bridge across River Tarach in Kakuma be retained with a creation of a walkway for pedestrians. However, for all other major river crossings it is recommended that an alternative alignment be considered, particularly where the existing structures are not structurally sound, do not have adequate waterway capacity or are not functionally suitable. The retention of existing structures shall be used to facilitate traffic flows/management during the construction of the new river structures. Where these structures are structurally or functionally suitable they are recommended for retention with or without modifications or repairs as applicable.

3.9 Technology, procedures and processes

This section reviews the various procedures that will be used during the construction and operation of the proposed road project. Four stages are involved, namely:

- Outline of the construction of the road
- Testing and commissioning
- Site reinstatement
- Decommissioning and abandonment plans

3.9.1 Outline of the construction of the road

3.9.1.1 Construction overview

A pre-qualified Contractor capable of carrying out road construction will undertake construction of the road and associated works. The construction will require a number of temporary facilities such as equipment and workshop yard, labour camp and site offices.
The construction contract will be based on FIDIC (International Federation of Consulting Engineers) conditions, which stipulate that the Contractor must provide a performance bond as well as the following insurances:

- Insurance of works and contractors equipment
- Third party insurance

3.9.1.2 Ground investigations

Prior to actual construction work, the Contractor will undertake additional ground investigations over and above the one done by the Consultant. These additional ground investigations will be more elaborate. Samples from test pits will be subjected to both visual observations and laboratory tests.

3.9.1.3 Demolition and site clearance

This will include general clearance of vegetation including their disposal. Where necessary, trees will be cut, their stumps removed and resulting holes backfilled. Where the road requires slight realignment, or there is need to clear the entire width of the road reserve, existing structures, which are in the way of the construction, will be demolished and disposed. This is likely to be intense in Kakuma and Lokichogio where there is substantial encroachment into the existing road reserve. The demolished elements will include brickwork, concrete, masonry blocks, metal (largely steel) and timber.

3.9.2 Concrete works

There will be concrete works at certain sections of the road that require reinforcement. In addition new culverts and other drainage structures will be required.

3.9.3 Earthworks

Earthwork operations will be carried out in preparation of road sub-grade and drainage, in addition to auxiliary works within the road corridor. Earthworks will include:

- Site survey and setting out
- Excavation by cutting into topsoil, normal soil, rock or artificial material
- Trimming some excavated surfaces and disposing of excavated material(s)
- Filling to embankment and general filling with imported natural material other than topsoil. Natural materials include rock; sand and other approved naturally occurring materials
- Scarifying, watering and compaction of fill layers or in situ road formation level.
- Providing, placing and lapping geo-textile materials

3.9.4 Road pavement

The road pavement comprises of the following: -

- Construction of the carriageway
- Precast concrete kerbs and channels to act as restraint to road edges
- Non illuminated traffic signs
- Reflective road studs along the centre line of carriageway
- Road markings to designate carriageway from shoulders

3.9.5 Steel works

The steel works in the project are in the viaduct bridge guardrails and related subsidiary works of site bolts.

3.10 Commissioning: Operation and maintenance

3.10.1 Structural and civil engineering works

These types of works are usually ready for use after construction and construction testing. These works will be commissioned if and when, their functionality can be substantially achieved. As a part of the commissioning activity, the Consultant will prepare and finalize built drawings for the entire structural and civil engineering works.

3.10.2 Site reinstatement

Prior to the commencement of the reinstatement program, the contractor will be required to develop a project specific reinstatement plan.

3.10.3 Reinstatement philosophy

The reinstatement of the project will be based on the following principles:

- Disturbed areas which are not permanent works, will be reinstated to pre-construction conditions to the greatest practicable extent
- Disturbed areas will be stabilized to protect the integrity of permanent works
- Disturbed areas will be re-vegetated to achieve good and natural landscape ambience
- Regular monitoring of reinstated areas will be undertaken until environmental requirements and goals have been achieved.

3.10.4Timing of reinstatement

Reinstatement of the project area will be undertaken on a sequential basis dependent on the completion of construction and testing in each area. The site will be cleared of residual construction debris, construction signs and equipment as part of activities associated with reinstatement.

3.10.5 Site clean up

Prior to de-mobilization of construction personnel and equipment, clean-up activities will be carried out in accordance with environmental standards and industry best practice. Clean-up activities will consist of the removal and/or disposal of temporary structures, equipment, tools and excess material brought on site or generated during the construction and commissioning program.

3.10.6 Permanent reinstatement

Permanent reinstatement will be undertaken in all the areas that have been subjected to disturbance by the road and viaduct bridge construction. To facilitate natural re-vegetation of disturbed areas, the separately stockpiled excavated material and topsoil will be spread back in the reverse order in which they were excavated. The key reinstatement principles are summarized below:

- Minimize reduction in soil quality and structure during construction
- Reinstate all third party assets affected by project activities in accordance with the construction contract documents and other pre-entry agreements
- Carry out restoration activities on the basis of a landscape plan prepared by a landscape professional
- A target minimum cover of pre-existing ground vegetation should be established within one year of final reinstatement
- An aftercare monitoring and corrective action program will be developed and implemented based on examining the bio-restoration process periodically after reinstatement.
- Any fences, services, structures or other facility affected by the construction works will be repaired or replaced to a condition that is at least as good as that found prior to construction.

3.11 Decommissioning and abandonment plans

3.11.1 Decommissioning of existing facilities

Decommissioning of the road is not foreseen, however, decommissioning of related facilities, especially contractor's camps and workshops are inevitable. Further, decommissioning of quarries and borrow sites will be done upon completion of construction work.

3.11.2 Legal basis

For the components that will require decommissioning, the proponent will prepare a written abandonment plan within 30 days of determining decommissioning. The plan will detail how decommissioning will be carried out. The abandonment plan will be subject to approval by NEMA. An Environment Project Report (EPR) will be prepared prior to implementation of this plan, to assess and minimize potential environmental and social impacts arising from the abandonment operations. This abandonment EPR study will be submitted to NEMA for consideration.

Upon completion of abandonment operations, an assessment of contaminated land will be prepared recording the final contamination status of the location of the project facilities. This assessment will be subjected to NEMA approval.

3.11.3 Technical solutions for abandonment

The exact details of how facilities will be abandoned will be determined prior to abandonment and agreed upon with the Government. Therefore it is not possible to determine at this stage exactly what techniques will be used. However this will be in accordance with recognized international standards.

3.11.4 Products, by–products and waste

The construction of the project will generate inert, non-hazardous and hazardous waste over the period of construction. Operation of the road will result in relatively small volumes of routine waste generation for the life of the project. Maintenance and repair activities conducted during the operational lifetime of the project may generate limited volume of waste.

3.12 Project waste management strategy

Prior to the commencement of construction work, the contractor(s) will prepare a Project Waste Management Plan (PWMP). The PWMP will:

- Propose a minimization, collection, storage, treatment, re-use and disposal route for each waste stream
- Identify potential third party re-users
- Propose incinerator types if required
- Propose location of waste storage and duties of site personnel with regard to waste management
- Identify and describe possible locations of disposal sites or long-term storage sites.
- State the methods for properly managing wastes (i.e. training, storing, containerizing, labelling, transporting and disposing waste).
- Describe the transition of control from the contractors to the Proponent, including arrangements for wastes associated with commissioning.

3.12.1 Project waste management principles

Standards

The waste management standards to be used for the construction, operation and decommissioning of the roads should be based on the legal notice 121: Waste Management Regulations 2006. If these regulations do not cover certain aspects of the project then the Contractor and Proponent shall comply with international regulations on environmentally sound management of waste.

Duty of care

The principles of ‘duty of care’ (i.e. the responsibility of a generator or owner of waste to ensure that it is handled, transported and disposed of in an appropriate manner) for waste and waste ownership by the waste generator will be adopted by the proposed project throughout the construction, commissioning and operation of the project. During construction and commissioning, the contractor will be responsible for duty of care whereas during operations, the Proponent will be the duty holder.

Waste inventories and classification

Waste inventories will be created to quantify and characterize waste streams at each stage of the project. Separate inventories will be developed for construction wastes and for commissioning / operational wastes.

Table 10: Classification of waste by type

#	Waste type	Waste standard & description
1.	Inert	Waste as defined by EMCA Act - Waste Management Regulations.
2.	Hazardous Waste	Waste classified as hazardous according to EMCA Act - Waste Management Regulations
3.	Non-hazardous Waste	Waste that is neither inert, nor hazardous nor wastewater. It includes 'municipal waste' as defined in the EMCA Act - Waste Management Regulations
4.	Wastewater	Fresh water that is contaminated as a result of project activity.

Further subdivisions of these classifications may be developed and adopted on the basis of the treatment requirements (e.g. incineration) and ultimate disposal point (e.g., reuse, recycling and landfill) for each individual waste material.

The principal waste disposal options for each waste stream will be as indicated in the table below.

Table 11: Waste disposal options according to type

#	Waste Stream	Principal Disposal Option
1.	Inert Waste	Transfer to a third party for recycling or reuse Processed and used for construction and reinstatement purposes Disposal to a recognized disposal site.
2.	Non-Hazardous Waste	Transfer to a third party for recycling or reuse. A special case of this is to spread it on land for agricultural purposes. Disposal to a recognized disposal site.
3.	Hazardous Waste	Transfer to a third party for re-use Disposal as prescribed in the EMCA Waste Management Regulations of 2006.

The volumes of waste requiring ultimate disposal will be minimized both through the control of waste generation and through incineration. Inert and non-hazardous wastes that cannot be reused or recycled may be incinerated in an incinerator designed and operated in general accordance with Kenya's regulations on Municipal Incinerators.

3.12.2 Hierarchy of waste management practices

Each waste stream will be managed according to the following hierarchy of techniques, in which the technique chosen should be the first in the hierarchy that is safe and practicable:

- Eliminate or minimize the waste stream by choice of procedure or technology
- Re-use as a material
- Re-use as a fuel
- Process and re-use as a material
- Process and re-use as a fuel
- Incinerator or re-use or landfill the ash.

- Designated disposal site (Landfill)
- Landscape- Landfill with appropriate vegetation planted
- Discharge to a receiving water course (applicable only to wastewater)

3.12.3 Transfer of waste to third parties

It is expected that there will be a variety of potential third parties that may receive wastes generated during the roads construction. These third parties will include commercial waste disposal contractors and entities (corporate or individual) that have the capacity to reuse or recycle individual waste materials.
In general, transfer to third parties for ultimate disposal will only be permitted if the part of their operation that is used for the proposed project waste is licensed. However items such as timber wastes and other re-useable project wastes may be disposed to local population on the basis of case by case review by the contractor.

3.12.4 Construction waste and emission inventories

3.12.4.1 Construction and commissioning waste management

The Table below presents indicative characteristics of wastes that will be generated by the proposed project.

Table 12: Characteristics of potential project waste

SOLIDS	**METALS**
Bituminous material	Welding rods
Cement (dust)	Isolated steel siles wasted lengths
Paper and cards	Copper (Electrical Wires etc.)
Plastic bottles, cans, drums & packaging bags (both polythene and biodegradable)	Reinforcement steel
Aggregates	**SLUDGES**
Vehicle parts	Grease
Glass	Paint
Rags and oil adsorbents	Oil
Light bulbs and tubes	**LIQUIDS**
Paint cans and brushes	Wash down water and drum water
Stone and rocks	Oily water
Tyres	**DOMESTIC**
Cleared trees & branches	Food
Cleared undergrowth, shrubs etc.	
Waste timber	
Concrete shuttering	

It is expected that the special specifications will obligate the contractor to dispose of different categories of waste appropriately. For example, steel wasted lengths may easily be taken by the *Jua Kali* (informal) Industry.

In general, the contractor will be required to develop construction specific Waste Management Plans prior to the start of construction work. At the start of the construction contract, the contractor will undertake a waste minimization/treatment/disposal study, guided by the project waste management strategy. The study will identify and quantify the expected wastes and describe:

- Proposals for reduction, treatment processing
- Third parties to whom waste will be transferred for re-use
- Liaisons with the County Government and NEMA to identify and document suitable disposal sites ground, landfill and incineration facilities

- Other locations of landfills or waste storage sites to be adopted if local Council facilities are inadequate
- On site incineration facilities to be adopted if facilities by the County Government are inadequate

The findings of the study will be used in the development of the construction waste management plans which must adhere to the EMCA - Waste Management Regulations of 2006. At a minimum, these plans will include:

- A consolidated summary of the applicable regulations and restrictions governing the generation, handling, treatment and disposal of wastes generated during the construction/commissioning phases of the project.
- Any permitting requirements for waste treatment or disposal.
- Detailed method statement for each element of the waste management handling, treatment and disposal process
- Any third party agreements for waste handling, transfer or disposal

After construction of the road, the waste handling/disposal facilities established by the contractor under the construction program will be closed. If a waste handling/disposal facility procured by the contractor is closed, the contractors will be required to ensure that it is appropriately de-commissioned (i.e. including capping of any disposal sites) and the surface will be re-instated according to the project reinstatement strategy. If the facility is retained, it will be transferred to the proponent.

3.12.5 Release to the atmosphere

Atmospheric emissions will be generated by the proposed roads project activities principally during construction of road works. It is anticipated that the most significant components of such emissions will be combustion gases, specifically:

- Nitrogen oxides (NOx)
- Carbon monoxide (CO)
- Sulphur dioxide (SO2)
- Particulate matter (PM)
- Volatile organic compounds
- Aldehydes
- Secondary pollutants

3.12.6 General wastewater disposal

Wastewater includes all water flows from the temporary site office, work sites and subsidiary operations such as vehicle and equipment washing. Wastewater from the temporary site office should be treated in a septic tank and related soak-aways. Wastewater from the works will generally be from the roadside drains and during curing of concrete works. Such wastewater are not hazardous, but should be monitored to ensure that they do not cause adverse effects.

4 ESIA STUDY APPROACH AND METHODOLOGY

4.1 Lodwar-Lokichogio-Nakodok Road ESIA Study Activities

This ESIA study was carried out in accordance with the Environmental Assessment and Audit Regulation (2003) and the World Bank's operational policy on environmental and social safeguards. The study entailed desktop review of an existing draft ESIA report, review of relevant documents, field investigations and stakeholder participation. The methodology of the ESIA study comprised four key approaches, namely:

- Desktop review of existing information
- Detailed route assessment survey
- Public consultation meetings and questionnaire administration
- Preparation of an Environmental and Social Impact Assessment report

4.2 Desktop Review of Project Documents

Extensive review of available project information and Reports was carried out based on the TOR. This entailed a review of the following:

- The Draft ESIA Study Report for the proposed Upgrading of the Road Project which was prepared in 2013;
- Information on the project engineering design;
- Analysis of relevant legal, policy and administrative framework,
- World Bank Policy Safeguard Policies; and
- Review of environmental and social baseline condition.

4.3 Field Investigations

The Consultant made several visits to the project site to carry out a detailed route assessment survey. The purpose of the survey was to gather information on biophysical and socio-economic aspects of the project site and its environs, identify potential environmental and social impacts of the proposed project, and explore possible alternatives with a view to eliminating and / or minimizing potential negative impacts of the project. Field investigation was conducted using a checklist of physical, biological, socio-economic and culture features of the project site.

Field investigation was carried by a team that included:

- Team Leader/Environmental Management Expert
- Biologist/Ecologist
- Sociologist/Community Development Expert
- Environmental Scientist/Geologist
- Surveyor
- Enumerators

Physical characteristics of the project area that were assessed include the project location, topography, geology, soils and water resources. Biological parameters that were assessed include flora, fauna and any environmentally sensitive sites. Socio-economic aspects that were investigated were land use and economic activities, employment opportunities, settlement pattern, demographic features, availability of and access to social amenities such as education and health facilities, social value systems and cultural heritage including artifacts, monuments and historical relics located along the road corridor.

All relevant parameters were recorded and their photographs taken, where necessary

4.3.1 Method used for Evaluating Site Bio-Physical Data

Information on the bio-physical environment of the project area was collected through site physical assessment and collection of the following information:

- Types of plants and animals (flora and fauna) present at the project site and the impact of vegetation cover on the ambiance and visual impression of the site;
- Presence of surface water points (rivers, streams and springs);
- Site area soils and geology;
- Site topography and how this affects the site visual impression and surface water flow.
- Recording of accurate location coordinates in Geographic and UTM Arc 1960 using a Garmin 12XL GPS;
- Taking of photographs of the different features relevant to the environmental and social assessment;

4.3.2 Method used for Site Infrastructure Evaluation

- Lodwar-Nakodok Road infrastructure was also assessed. Physical evaluation of the road infrastructure was done by assessing the type and condition of the road.
- Photos of the infrastructure components have been taken.

4.3.3 Method used for Stakeholder Consultation

Stakeholder consultations involved questionnaire survey of key stakeholders and households who were likely to be affected by the project, and Public Consultation Meetings (PCMs) with local communities and their leaders in selected sites along the proposed road corridor. **Seven PCMs were convened from December 2-5, 2014.**

One set of questionnaires was used to gauge the perception of key stakeholders, such as staff from Kenya Wildlife Service, County Government, National Environmental Management Authority, Kenya Forest Service, selected NGOs and CBOs about the proposed road project. Another set of questionnaires was used obtain the opinion of households, which were located in areas / settlements that were likely to be affected by the project, about the proposed road project.

Public consultation meetings were held in all towns and market centres that were likely to be affected by the project. The intention was to obtain the opinion of local communities, community leaders, political leaders, religious community and business owners about the project. These meetings were used to provide an overview of the road project, potential benefits, potential adverse impacts and the likelihood of disturbance and the need for alternatives or compensation. Feedback forms/questionnaires were distributed towards the end of PCM to get feedback from the meeting participants.

The process of consultations was carried out as follows:

i. Carrying out key informant interviews by using key informant guide;
ii. Administration of ESIA questionnaires to key stakeholders including local administration officers, service providers and lead agencies;
iii. Holding a question and answer session with PCM participants;
iv. Administration of ESIA feedback forms/questionnaires to PCM participants;
v. Administration of socio-economic questionnaires to the community.

i. Key Informant Interviews

Key informant interviews were carried out with the local administration including Chiefs and Assistant Chiefs and other local leaders to obtain information regarding the local community, their candid views of the local community's perception on the project.

ii. ESIA Questionnaires

To obtain views of stakeholders, service providers and lead agencies the consultant administered ESIA questionnaires. These questionnaires were administered during consultation visits to the offices of key stakeholders including the local administration, service providers and lead agencies. This is intended to obtain stakeholder views regarding the proposed resettlement site project and the potential impacts of the project that require mitigation. The questionnaire provides the opinion on whether they support the project or not. The views are summarized in **Table 13** of this ESIA Project Report.

iii. Question and Answer Session with PCM Participants

In order to be able to interact with the community to get their views regarding the proposed project, a question and answer session after conducting a presentation during the PCM. The participants were given a chance to exhaustively ask any questions regarding the resettlement site project, its positive and negative impacts and the proposed mitigation measures.

iv. Administration of ESIA Feedback Forms/Questionnaires

At the end of each PCM the study team administered ESIA feedback form/questionnaire to all participants to obtain their views regarding the project. The feedback forms were administered after conducting presentation on the proposed project to ensure that participants are well informed about all aspects of the proposed project including positive impacts, potential negative impacts and proposed mitigation measures.

v. Administration of Socio-economic Questionnaires

In order to be able to evaluate baseline socio-economic aspects of the project area community, socio-economic questionnaires were administered. The socio-economic information collected includes:

- Characteristics of household members;
- Household income;
- Household expenditures;
- Housing characteristics
- Water and sanitation;
- Health facilities;
- Education institutions;
- Energy sources for cooking and lighting; and
- Social amenities

Table 13 provides details of the activities performed during the field visit.

Table 13: Visit to Project Site, Data Collection and Convening of PCM

Nr	Day	Date	Activity	Data Collected/Measurements done
1.	Wednesday to Friday	November 12, 2014 to November 14, 2014	• Field Reconnaissance Survey along the Lodward-Lokichogio-Nakodok Road, • Visit to local administration offices • Visit to offices of key stakeholders and lead agencies	• Collected site biophysical information data • Took coordinate measurement of important features using the Garmin 12XL GPS • Discussed the proposed Lodward – Lokichogio-Nakodok Road Project with Local Administration Officers.
2.	Thursday To Monday	November 27, 2014 To December 1, 2014	• Carried out oral interviews • Administered key informant, stakeholder and socio-economic questionnaires	• Gathered Project Area Information • Gathered Completed Questionnaires • Planned for Public Consultation Meetings
3.	Tuesday - Friday	December 2, 2014 To December 5, 2014	Carried out Public Consultation Meetings (PCMs) as Follows: *1) Mikeka Grounds – Tuesday 02/12/2014 – 10.30am* *2) Nasiger – Tuesday – Tuesday 02/12/2014 - 2.00pm* *3) Makutano Gold – Wednesday 03/12/2014 – 9.30am* *4) Kakuma Town (Baraza Park) – Wednesday 03/12/2014 – 2.30pm* *5) Kalobeiyei – Thursday 04/12/2014 – 9.30am* *6) Songot Chief's Office – Thursday 04/12/2014 – 2.00pm* 7) *Anglican Church Grounds(Lokichogio) – Friday 05/12/2014 – 10.00pm*	• PCM Attendance Registers • PCM Feedback Forms/Questionnaires • Minutes of PCMs

4.3.4 ESIA Project Report Preparation

The information/data that was obtained was analysed, synthesised and used to prepare this ESIA Study Report. An Environmental and Social Management Plan was developed as part of the ESIA Study Report to guide the implementation and monitoring of project activities.

This ESIA Study Report has been prepared following NEMA EIA Guidelines. These guidelines require that the project proponent prepares an ESIA Study Report that identifies and evaluates all the potential negative impacts of a proposed project. The impacts have been identified and are presented in this ESIA Project Report including appropriate mitigation measures and subsequent monitoring.

Local Legislation and World Bank Safeguard policies on Environmental and Social Considerations have been reviewed. All the information and data collected during the ESIA have been evaluated and form the basis of compiling this Environmental and Social Impact Assessment (ESIA) Study Report.

Contents of the ESIA Study Report
The ESIA Study Report contains findings of the assessment, stakeholder consultations & Public Consultation Meeting findings and proposed Environmental and Social Impacts that require mitigation measures and monitoring. .

Structure of the ESIA Study Report
This ESIA Report has been prepared under the following chapters:

Executive summary: This chapter presents a summary of the project activities and alternatives, significant findings, expected impacts, mitigation measures and recommended actions.

Chapter 1: Project Introduction and Background: This chapter gives description of the project scope, background, location, objectives of the ESIA Study, Study Methodology and the Report Structure.

Chapter 2: Policy, legal and institutional framework: This chapter outlines the overview of legislative framework, regulatory, international guidelines and conventions relevant to this project.

Chapter 3: ESIA Study Approach and Methodology: This chapter gives the Desk Top Study and Reconnaissance, ESIA Study Field Assessment Survey, Public Consultation Meetings and Questionnaire Administration and ESIA Study Report Preparation.

Chapter 4: Description of Project Baseline Information: This chapter gives description of the Physical Environment, Project Setting and the Socio-economic baseline.

Chapter 5: Description of Proposed Project: This chapter outlines Project Objectives, Scope, project Justification, Project Planning, Site Alteration during Construction, Project Decommissioning Activities and Cost of Proposed Project.

Chapter 6: Project Area Socio-economic Information: This Chapter evaluates the Project Area Socio-economic Data and Information. This covers Occupation, Housing, Education, Distance to Market and Health Facilities, House Hold Income and

Expenditure, Drinking Water Source, Energy Source for Lighting and Cooking, Housing Structure.

Chapter 7: Public Consultation and Participation: This chapter presents Population and Livelihood Outlook, Social Impact Assessment, Stakeholder Consultations and Interviews and Public Consultation Meeting Outcome.

Chapter 8: Analysis of Project Alternatives: This chapter gives The "No Action" Alternative, Alternative of Compensating PAPs Land for Land, Alternative Resettlement Site Location, Alternative Design and Alternative Energy Source for Cooking

Chapter 9: Potential Impacts and Mitigation Measures: This chapter provides Potential Positive and Negative Impacts and Mitigation Measures.

Chapter 10: Environmental and Social Management Plan: This chapter presents the Environmental and Social Management Plan, Internal and External Audits.

Chapter 11: Conclusions and Recommendations: This chapter gives the Conclusions and Recommendations of the ESIA Study.

Chapter 12: ESIA Study Team Members: This chapter gives a table containing ESIA Study Team member names and involvement.

List of Maps, Tables, Figures & Plates;

Bibliography;

Annexes

5 PROJECT SITE BASELINE INFORMATION

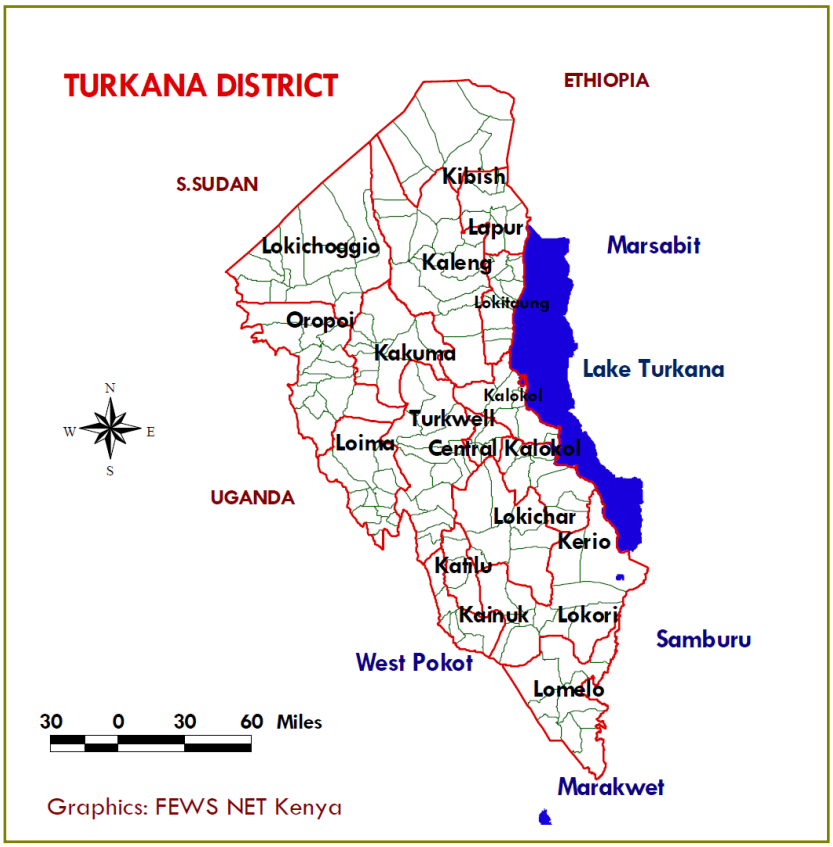
5.1 Physical Environment

5.1.1 Geography and Topography

Turkana County, where the Lodwar – Lokichogio – Nakodok (A1) Road project is entirely located, is the largest county in Kenya and is located in the northwestern part of the country. It is bound by the following Coordinates Western boundary **33º 59' 28" E**, the Eastern boundary is at **36º 43' 28" E**. The Southern boundary is at **1º 49' 24" N** while the Northern boundary is at **6º 21' 10" N.** The county covers 77,000 km², which constitutes approximately 12 % of Kenya's land area. Turkana County shares international borders with Ethiopia to the North, South Sudan to the Northwest and Uganda to the West. Within Kenya, the county borders Marsabit County to the East, Samburu County to the South East, Baringo County and West Pokot County to the South. Much of the Eastern flank of the County is on Lake Turkana, which stretches North-South for more than 200 km. The County lies within the Great East African Rift valley and is bordered by chains of ridges and mountains to the West. Located in between these ranges of hills are the plains of Turkana, on a north to south axis.

The administrative headquarters of Turkana County is at Lodwar Town while the county has been divided into six administrative sub-counties, namely: Turkana Central (with Kalokol, Kerio and Central divisions), Turkana North (with Lokitaung, Kaaleng, Lapur, Kaikor, Kataboi and Kibish divisions), Turkana West (made up of Kakuma, Oropoi, Lokichoggio and Nanam divisions), Loima (composed of Turkwell and Loima divisions), Turkana South (Lokichar, Katilu, Kainuk and Loreng'elup divisions) and Turkana East (comprising of Lokori and Lomelo divisions). There are 56 locations and 156 sub-locations in the county **(Figure 1)**

Figure 1: Administrative areas of Turkana County



The proposed road project traverses three major towns in Turkana County, namely: Lodwar Town, which is Turkana's main administrative centre; Kakuma Town, which hosts one of the largest refugee camp in Kenya; and Lokichogio Town, which is located about 30 km away from the Kenya - South Sudan border and was the launching point for relief operations into the once war-torn Sudan.

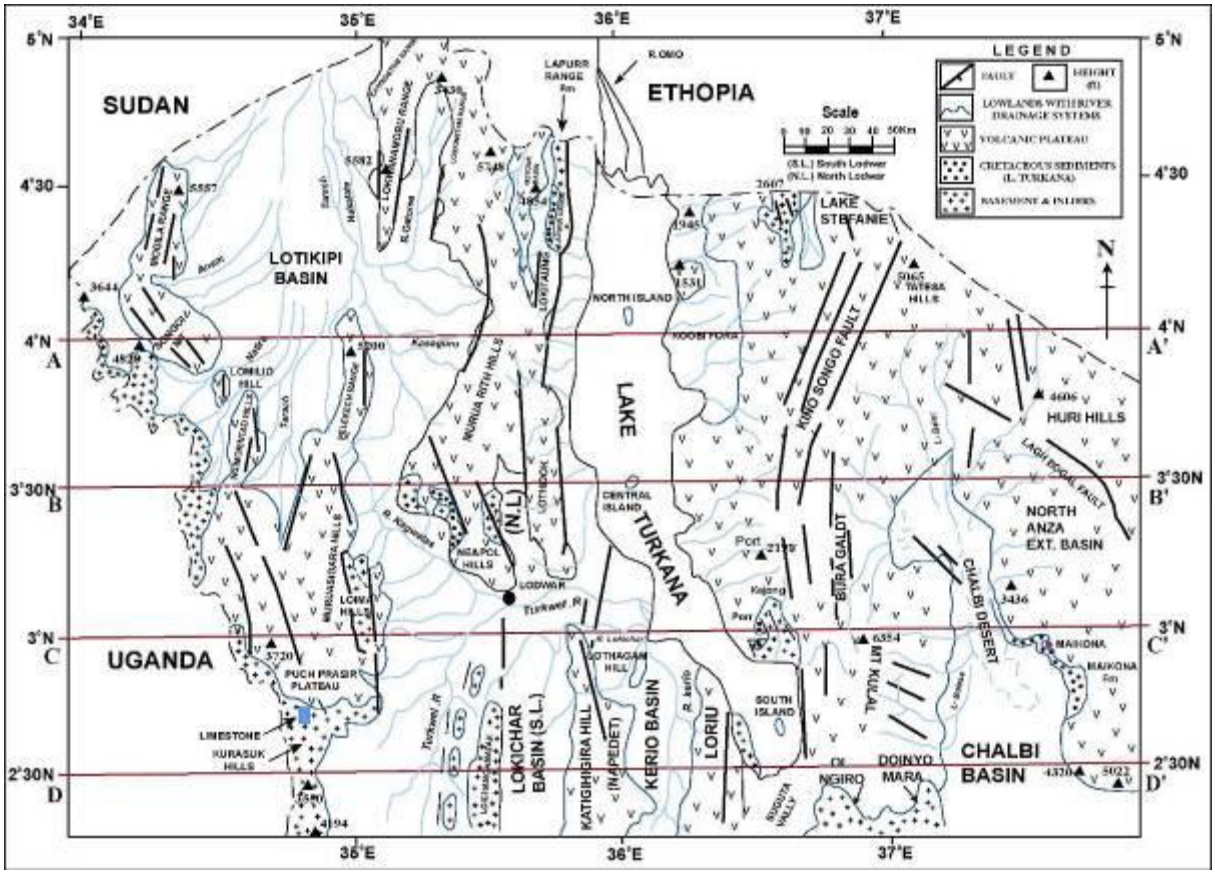
Most of Turkana County consists of low-lying plains. The elevation of the county rises from 360 m above sea level at the shores of Lake Turkana to 2,285 at the peak of Mt Kulal. Most of the other areas in the county lie between 375 and 914 m above sea level.

The open plains consist of the Central, Kalapata and Lotikipi plains. The plains form part of the more arid areas in the county, which receive the lowest amount of rainfall, around 180mm per annum and are dominated by dwarf shrubs and grassland which provide forage for livestock during and shortly after the rainy season. However, this forage dries rapidly at the onset of the dry season. The Napass, Natira and Nanam Rivers drain the highlands along the Uganda border in the west. These rivers overflow their banks and indeed the existing road after heavy rains and, sometimes may inundate an area of the plain 120 km long, and up to 120 km wide at the northern end in Sudan. However, the rivers do not always flood together, and indeed may not flood at all in dry years. Thus the area of the plain that is inundated is usually far less than the maximum given. Essentially it is a grassy floodplain with reeds and papyrus in the wettest sites, and scattered *Acacia* and *Balanites* trees. Figure 4 shows the main physiographic features in Turkana.

In the centre of Turkana County are the plains; while in the south are isolated barren landscapes of extinct volcanic mountain ranges. In the north and north western part of the County, are mountain ranges, such as Lorengipi Range, Lokwanamoru Range, Lorioneteom Range, Pelekech Hills, Mogilla Range, Loima and Songot, Moroto, Lotikipi and Puch Prasir Plateau. In the south are Kamorok, Kailongkol, and Laiteruk mountain ranges. The altitude of the mountains ranges between 1500m and 1800m above sea level in the east reaching the peak at Loima, which forms undulating hills for an area of some 65 square kilometres.

The major rivers in Turkana County are Kerio, Turkwel, Tarach and Suguta. The Tarach River crosses the proposed road in Kakuma Town. As these rivers get to the low-lying areas of Turkana County, they disappear under the sandy soil of the riverbeds. Most of these rivers are seasonal, except Turkwel and Kerio rivers. Volcanic rocks cover about one third of the county, while outcrops from basement rocks occur in several hills and mountains scattered in the area. The plains which form the main topography of the county are mostly below 600 metres above sea level.

Figure 2: Physiographic Features of the Project Area



5.1.2 Climate and meteorology

Turkana County is classified as an arid area whose climatic conditions are characterized as hot and dry. It has a fairly uniform temperature throughout the year, which ranges from a low of 24 ºC to a high of 38 ºC with a mean of 30 ºC. The low-lying plains in Turkana are hot and dry, and temperatures are high and are seldom lower even at night. During the day, the extremely high temperatures are accompanied by strong easterly winds sweeping across the largely barren countryside, carrying large quantities of sand.

Turkana is a low rainfall area. The low rainfall is attributed to orographic influence of the Ethiopian and Kenyan plateau and N-S alignment of the east coast of Africa, which causes widespread divergence of S-E Monsoon to the north of equator (Nicholson 1996). Rainfall is expected during March-May in the East and northern parts of the county and during March - June in the south and western parts. When it falls, rainfall increases with rising altitude. Thus, areas of mountain ranges on the western border with Uganda and South Sudan receive more than 500 mm per year. The highlands in the north-eastern parts bordering Ethiopia and the hills in the south and southwest bordering Pokot also register higher rainfall. The lowest rainfall occurs along the shore of Lake Turkana and in the central plains around Lodwar with an annual average 150 mm per year.

Thus, the plant growing season ranges from 60 to 90 days (April-June) during normal years, leaving a 9-10 month dry season with little or no plant growth. Occasional good

years occur when a short rainy period interrupts the dry season in October or November, causing another 20-30 days of plant growth.

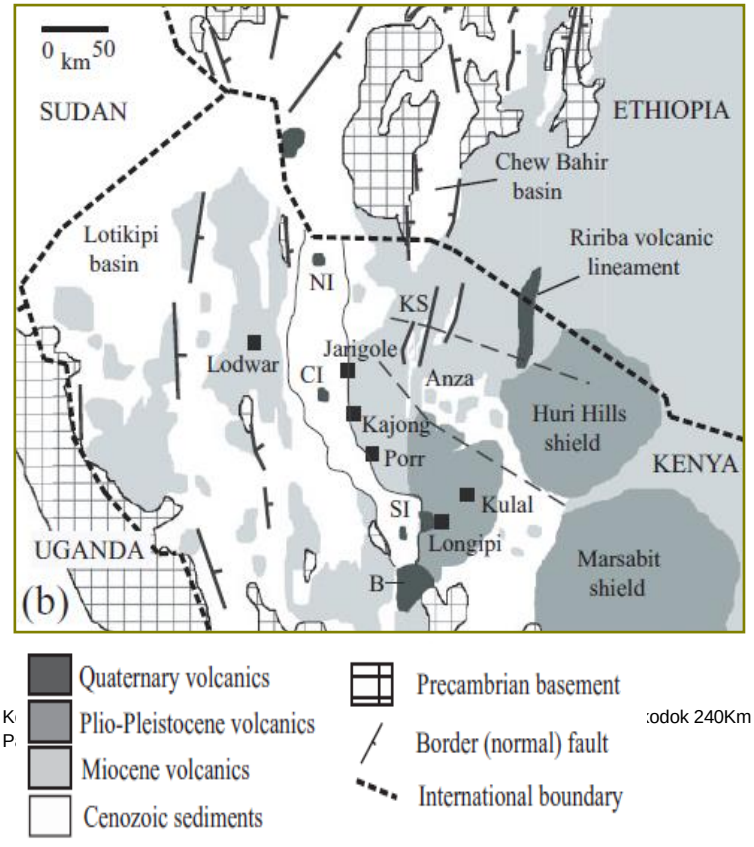
5.1.3 Geology

The region is characterized by four dominant geological formations which include: Cenozoic sediments, tertiary volcanic rocks; Quaternary volcanic rocks and Quaternary to recent sediments. The Mozambique Belt rocks underlie the entire region except for the western parts of Turkana, which are completely covered by volcanic formations (Figure 7). The geology of the rest of the region is characterized by the deposits of sediments originating from Quaternary to Recent period. These formations occur almost entirely over Turkana County. The sediments are basically lacustrine and fluviate deposits. A large part of the Turkana geology also consists of the Precambrian basement rocks and the Tertiary volcanics that have covered many of sedimentary basins, which are now considered to be potential basins for oil exploration.

The entire area is volcanically and seismically active, even throughout the Quaternary period, shown by the thick alluvial cover concealing the entire eroded surface of the older sedimentary sequences as well as the basement rocks. The landscape consisting of flat alluvial plains and high plateaus with intervening ranges indicates the control of block faulting. The drainage follows most recent strikes of faulting in a north-south direction. The small rivers flow perpendicular to the ranges and terminate to join the main rivers flowing in north-south direction.

Most of the county is covered by lava flows, which generally occur in a north-south direction and, because of their altitude, form the major central hills. The landscape is generally called uplands and peneplains. These features are covered with shallow, poor soil with no organic matter. Directly below the top soil is unconsolidated weathered rock. This means that middle soil between the top soil and the rock is lacking. The soils have a tendency to seal strongly on the surface leading to a low infiltration rate and hence a lot of run-off.

Figure 3: Geology of Turkana Region



5.1.4 Soils

The soils in the Turkana are highly variable. They are shallow and generally of light and medium texture. They are not well developed due to aridity and constant erosion by water and wind and are often capped by stone mantles. Most of the county is covered by lava flows, which generally occur in a north-south direction and, because of their altitude, form the major central hills. The landscape is generally called uplands and peneplains. These features are covered with shallow, poor soil with no organic matter. Directly below the top soil is unconsolidated weathering rock. This means that middle soil between the top soil and the rock is lacking.

On the western side of these uplands and peneplains are the piedmont plains, which have been developed under dry climatic conditions. Soils are weakly developed and are low in organic matter. The drainage condition of these soils ranges from well to poorly drained. The Lotikipi Plain is a flood plain composed of young soils which have been developed on alluvium of recent origin. The soils occur mostly on either side of the Tarach River. Fluvisols, which have irregularly decreasing organic matter, are encountered in the Lotikipi Plain.

Most of the mountains and major scarps that border Uganda are covered by Cambisols (young weathered soils). They have relatively high natural fertility and a texture finer than sandy loam. These soils extend into the Cherangani Hills. Between these scarps and the central lava flow is a narrow band of soil that runs from Lokichar southwards. This soil is poor in organic matter and is shallow, stony and rocky, thus the area is not well suited for arable agriculture. The only good arable soils are confined to the Ugandan border.

Due to the predominantly arid climate, there is relatively little vegetative cover to stabilize the soils and as a result, they are easily eroded. Wind erosion and deposition is an important feature in the county and areas of strong sheet erosion occur on all steep slopes where vegetation cover has decreased due to grazing by animals (Figure 8). There are local occurrences of highly saline soils and of soils with low mineral contents. Only a small part of the county's soils have potential for irrigated agriculture and most of the cultivation is carried out communally.

Colluvial soils tend to be reddish over the basement system and generally grey buff or white over the volcanoes. Aeolian soils are dune sands either active or fossil; Alluvial soils range from coarse sands to flash flood silts, while black or brown clays occur locally in areas of impended drainage. Due to the low rainfall and high temperatures, there is a lot of evapo-transpiration resulting in deposition of salt in the soil and capping on the surface. As a result only 25% of the county soils can be rated moderately suitable for agricultural production. These moderately fertile soils are found in the central plains of Lorengippi, the upper Loima and the lowlands of Turkwel, Nakaton and Kawalathe drainage along the lake at Todonyang plains, the lower Kalokol and Turkwel, Kerio Rivers and a portion of Lorin plateau.

Figure 4: Soil Erosion Status in Turkna County

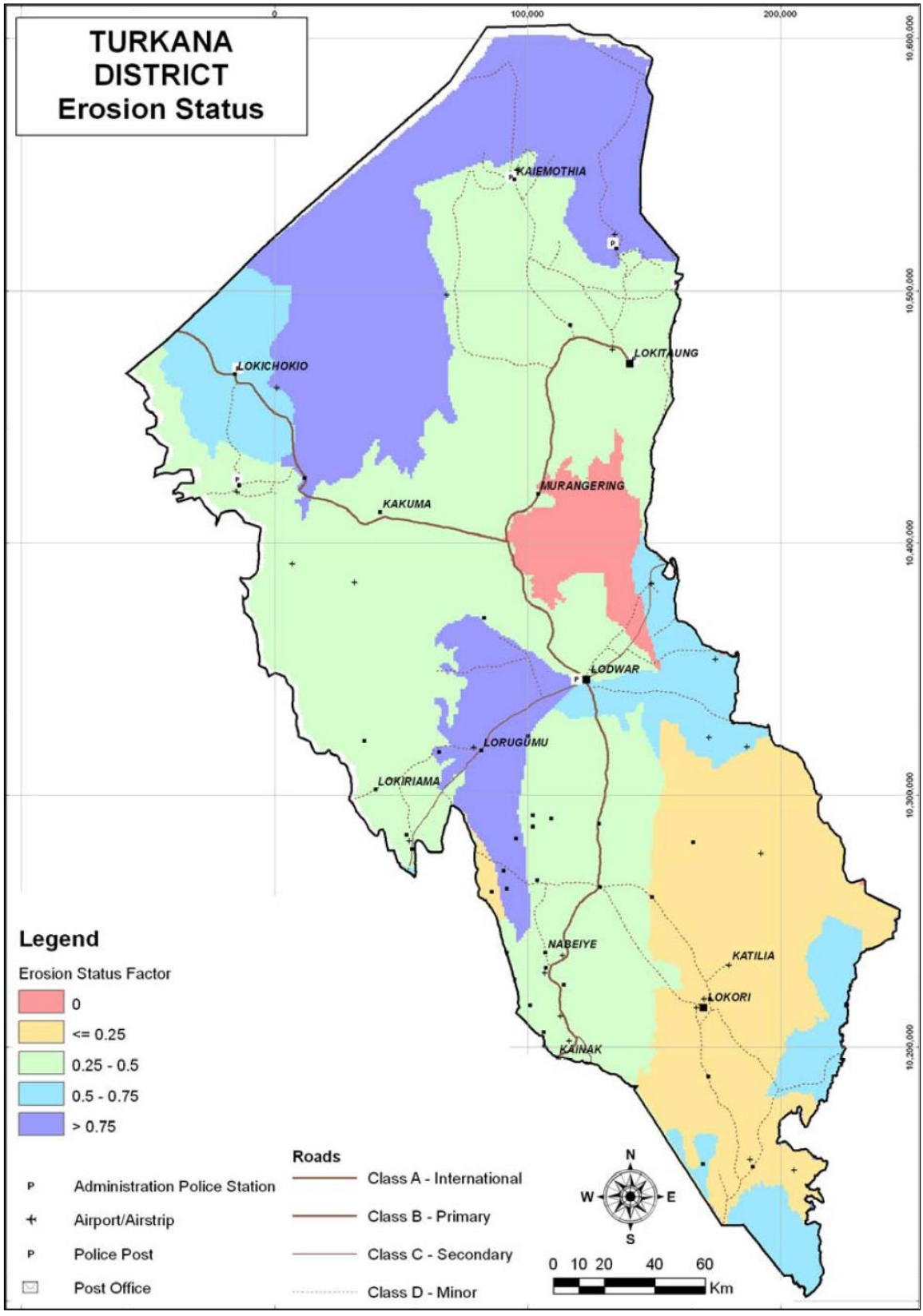


Plate 2: Soil Erosion covering one of the drifts

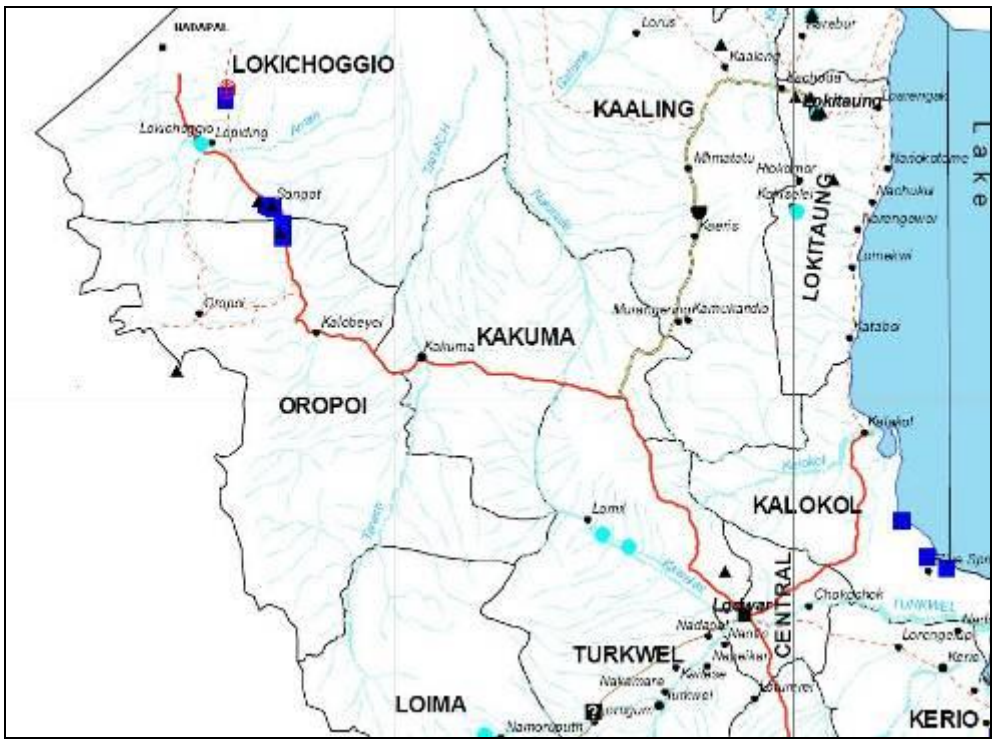
Plate 1: Soil Erosion at Kakuma Area

5.1.5 Water resources

5.1.5.1 Surface water resources

Water is crucial to sustaining the Turkana pastoral livelihoods; for use by their herds and for domestic purposes. Surface water resources in Turkana include rivers, lake, swamps and water pans. There are two main rivers (Turkwel and Kerio) whose flow is more or less permanent. Other rivers in Turkana include the Tarach (which passes through Kakuma town, Kawalase (which is located near Lodwar), Kosipir, and Suguta. These rivers have water for between three and ten months of the year. Immediately after a rainfall event, these seasonal rivers rage with flush floods, flow for a brief period, and then cease leaving pools of water and deposits of silt and debris.

Figure 5: Major rivers and a network of seasonal laggas in Turkana



Water is generally a scare resource in Turkana County. On average, only 15 per cent of the people have adequate access to water, compared to the national average of 57 per cent. For many of the communities, the main source of water is open 'scoop wells' dug into dry riverbeds. The water scarcity is felt more during the dry season when people travel more than 10 km in search of water for domestic use and for livestock. They are often compelled to dig dry river beds in search of water from shall ground aquifers associated such river beds. Thus, conflict over water sources and pasture between the Turkana and their neighbours is common.

Local communities obtain water also from water pans. A number of such water pans are located along the proposed Lodwar – Lokichogia – Nadapal (A1) Road Corridor. Most of

Plate 3: Illustration of lagga just after a flush flood in Turkana County

them hold water for just a few months after a rainfall event, but a few of them hold water for several months.

Plate 4: Water Pan in Kalobeiyei Area located about 40m from the Project Road

5.1.5.2 Groundwater Resources (Boreholes)

Although springs and wells have been a source of groundwater in Turkana for a long time, the drilling of boreholes was only introduced recently, albeit with mixed success. By 1994, five hundred boreholes had been drilled in Turkana, but less than 50% are operational. Many intervention agencies continue to drill boreholes. For instance, Oxfam has drilled over 100 boreholes in the area since 2007, with a success rate of 70-80%. In order to enhance the success rate, UNESCO recommends that there is need for capacity building in the water well drilling sector.

Recently, groundwater exploration efforts identified two major groundwater reserves in Turkana County. The two aquifers are located in the Lotikipi Basin and the Lodwar Basin at a depth of just over 80 m. The Kenya Government and UNESCO, who spearheaded the exploration efforts, have indicated that further studies are required to accurately quantify the reserves and to assess the quality of the water. The total renewable groundwater resource for the two aquifers is presently estimated at 1.36 BCM/year at depths ranging between 202 and 330 metre.

There are about 80 boreholes within a 10km corridor of the Lodwar-Nakodok Road. 32 of these were drilled to facilitate construction of the existing road out of which 16 are productive and have since been converted to community boreholes. The depth of the boreholes are less than 160m and the water rest levels are below 40 metres with majority being between 15m and 30m. Groundwater is still the most reliable option for supplying water for construction of the proposed road rehabilitation.

5.2 Biological environment

5.2.1 Ecological classification

The ecological potential of Turkana County is very low. Though the county occupies 12% of Kenya's total area, it represents only 0.6% of the country's ecological potential (TDDP, 1980) (Table 7). According to the ecological classification adopted by the survey of Kenya (Republic of Kenya 1992), Turkana falls within five agro-climatic zones (zones III-VII) of which 'arid' and 'very arid' zones (ecological zones V and VI) comprise about 90%. These agro-climatic zones have been classified based to annual rainfall and evapotranspiration potential.

The arid zone V (with a moisture index of - 42 to -51) is characterized by wooded and thorn-bushed grassland; while the very Arid Zone VI (with a moisture index of -51 to -57) has dwarf shrub grassland with acacia trees mostly confined to water courses and depressions.

Table 14: Ecological zones in Turkana County

#	Ecological zone (land use)	Proportion of total county area (%)
1.	Zone III (agriculture, forestry, intensive grazing)	2
2.	Zone IV (high-potential grazing)	8
3.	Zone V (medium-potential grazing)	49
4.	Zone VI (low-potential grazing)	41
	Total	**100**

5.2.2 Flora

According to Barrow (1996), vegetation is critical and forms the foundation for the pastoral production system as it provides important browsing for livestock, fruit and food, medicine, as well as wood based products for pastoral people. The woody vegetation of Turkana comprises mainly *Acacia tortilis, Acacia reficiens* and *Prosopis juliflora*.

The distribution and status of the woody vegetation is determined primarily by water availability, evapotranspiration rate, topography and soils. A quarter of the county is devoid of trees and two thirds support only scattered trees (Norconsult, 1990) while reliable sources of grass with high productivity are small and widely scattered. The presence of plant biomass is related to altitude except for riverine areas. The two main types of woody vegetation found in Turkana are riparian and non-riparian.

The vegetation of the area is characterized by annual grasses and shrubs in the plains, and perennial grasses and large tress on the higher grounds. The permanent river courses such as Turkwel River Basin, support dense gallery forests of *Acacia* and palm trees. The seed pods the Acacia trees are a prized feed for goats and crushed seeds are also used as food for humans.

In the terrestrial habitat, mountains and hills, which receive higher rainfall, support richer vegetation growth, whereas the plains, which receive lower rainfall, have lower vegetation cover (Olang, 1983).

The dominant vegetation type in most of the proposed road corridor comprises *Acacia tortilis*, *Acacia reficiens* and *Prosopis juliflora* shrubland. The woody vegetation cover can be estimated at about 40 % with a height ranging between two and four metres. *Acacia tortilis* is the tallest of the three. The vegetation has no herbaceous cover. *Prosopis* in

locate mainly along the drainage basin of the existing road where water collects when it rains.

Plate 5: Acacia shrubland vegetation along the Lodwar – Nakodok Road

The plant species of Turkana County are used as fruits, vegetables, food, and medicine processing. *Hyphaena compressa (Doum palm)* for example produces edible fruits and is used for local brew production and blood preservation. Honey production in Turkana is increasing rapidly, as the number of modern beehives has increased by over 1,000% in the last 9 years, though indigenous methods of honey production are still used.

The upper region of Turkwel River has considerable potential for honey production. Despite the increase in honey production, proper marketing of honey is still a challenge, due to poorly developed marketing infrastructure and a general lack of quality control.

The wood, fruits, leaves, bark, and gums from these trees are used by the Turkana people in many ways. Fruits, seeds and leaves are foods for livestock and people. The temperature difference offered by shade (about 7-10 ^{o}C) is another high value. The wood is used for fuel and making charcoal and for building homes, fences, furniture (traditional stools; chairs; and beds), and fashioning many traditional utensils, containers for milk and oil, and watering troughs.

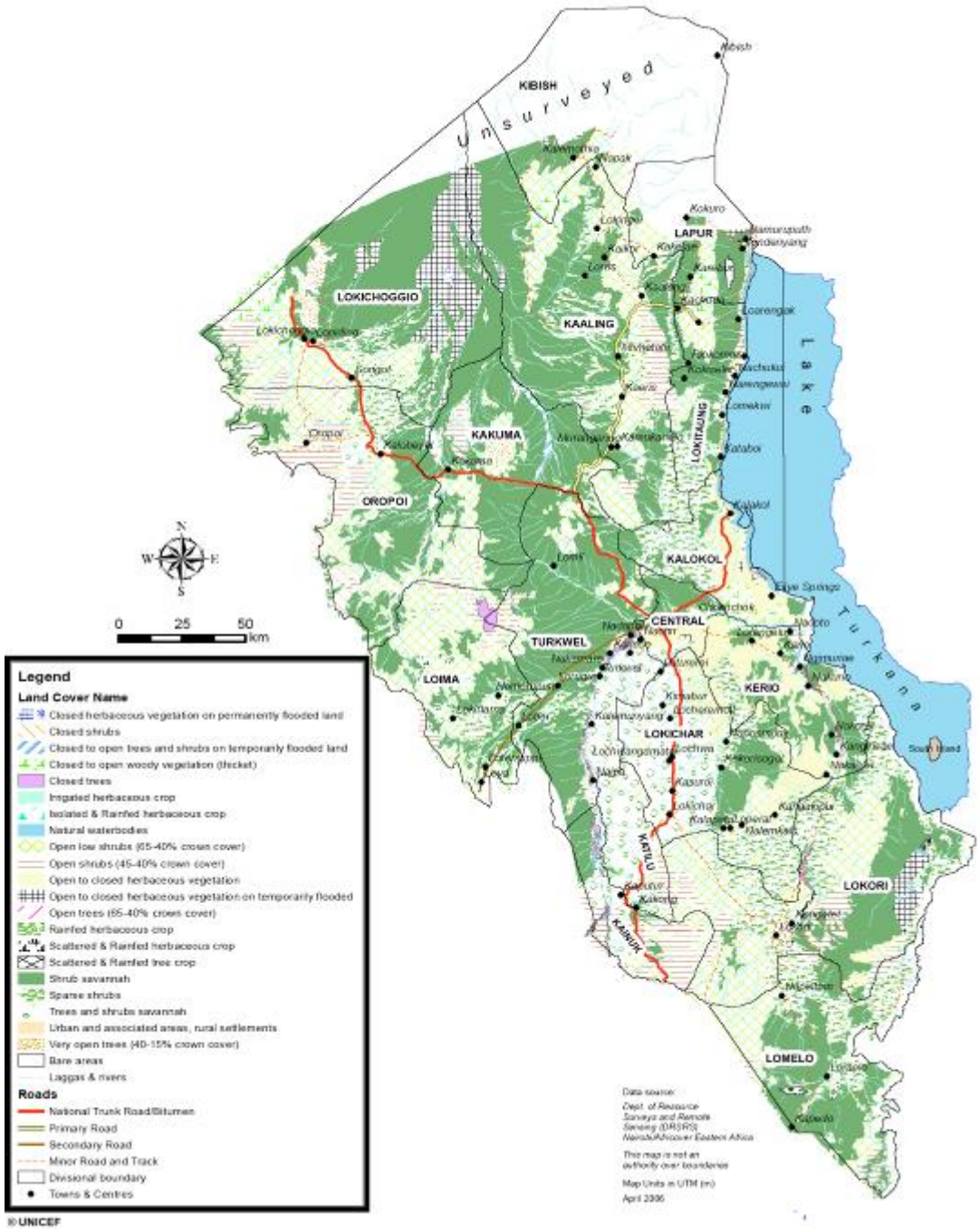
Wood is made into toothbrushes, walking sticks, spears, bows, arrows, and a type of club used against wild animals. Fibre is woven into rope, baskets, packing carriers for donkeys, and thatched mats used for bedding. Medicines, ornaments, dyes, and perfumes are some of the other uses of tree products.

While the woody vegetation is critically important for the livestock sector, it is also an essential source of products for households in terms of fuel (99.3% of energy use in Turkana comes from fuel wood and charcoal (Norconsult 1990). This represents nearly 80,000 tons of fuel wood per annum – a value of approximately Kshs. 200 million per annum (at a value of approximately Kshs 2.50 per Kg of wood fuel equivalent). In addition, large amounts of timber (posts and poles, and thinner connecting beams and rafters) are required for building traditional Turkana houses as well as other forms of building.

Gums and resins are important dry land products whose potential is yet to be fully exploited in Kenya. Arid Lands Resources Limited has established collection and processing centre in Turkana. Over the last two years, various participating communities have earned about Kshs. 350,000 from the sale of gum Arabica.

Plate 6: Charcoal on sale along Lodwar– Nakodok Road

Figure 6: Turkana County detailed Land Cover Type



5.2.3 Invasive species

Prosopis juliflora is an introduced tree species that is rapidly gaining the status of an invasive weed in a large swathe of the East and Horn of Africa dry lands.

In Kenya, the Prosopis species were introduced from mid 1970s and early 1980s, mainly in arid and semi-arid areas to mitigate the impacts of drought and famine and to safeguard the existing natural vegetation from over exploitation due to rising human population. However, due to its prolific invasive nature, the species has spread to many areas, mainly on disturbed sites and in some places replacing the indigenous vegetation. The highest Prosopis invasion in Kenya has been reported in Tana River, Garissa,

Baringo and Turkana counties, where pasturelands, farmlands and wetlands have been invaded.

However, due to low rainfall in Turkana, *Prosopis* has only managed to establish along river banks and other areas where water collects when it rains, such as road drainage sites. It has found it relatively harder to compete with *Acacia tortilis* and *Acacia reficens* in fairly dry habitats.

5.2.4 Fauna

There are generally no fauna species in the low lying plains where the proposed road corridor is located. Most of the wildlife are found in the mountains and hills areas, such as Loima hills. Although it has been indicated that wildlife may have migrated from the plains to the mountains because of incidences of hunting by Turkana herdsmen, it is likely that low vegetation cover and harsh habitat conditions in the plains are not conducive for their survival. The mountains have significantly higher vegetation cover and more reliable water sources.

The mountains and hilly terrain of Turkana County have the desert warthogs, olive baboons (*Papio anubis*), vervet monkeys (*Chlorocebus pygerythrus*), and patas monkey (*Erythrocebus patas*), Guenther's dik-dik (*Madoqua guentheri),* common duiker (*Sylvicapra grimmia*), porcupine (*Hystrix sp*.), bat-eared fox (*Otocyon megalotis*), buff-crested bustard (*Eupodotis gindiana*), and helmeted guinea fowls (*Numida meleagris*), among other species. However, even those who have documented fauna species agree that it is extremely hard to see them move around. All they have done is to identify them using cameras hidden in the wild.

Plate 7: Dik dik in Loima Hills (Photo by Yvonne de Jong and Tom Butynski)

5.2.5 Environmentally sensitive habitats

5.2.5.1 Laggas

Laggas are habitats of environmental significance in Turkana County. They harbour riverine vegetation comprising diverse plant species and also serve as habitats various fauna species.

Moreover, the local community uses trees that grow on the edge of laggas as shade, feed for livestock (tree pods) and human food (ground seed). The trees that grow along the lagga assist in holding the soil on the edge of the lagga thereby controlling the expansion of the lagga and associated soil erosion. Thus, disturbance to a lagga lead to environmental degradation, loss of biodiversity and loss of cultural heritage. It may also lead to change in river flow, which may cause damage to an existing road.

Plate 8: Monkey on a palm tree along riverine vegetation in Kalawase lagga near Lodwar Town

5.3 Socio-cultural and economic environment

5.3.1 Population dynamics

Population density and distribution in Turkana partially reflects the prevailing ecological conditions, due to dependency on natural resources. About, 40% of the county is uninhabited, and 35 % is devoid of livestock. The areas with little or no population are in southern, south-western and north western sections bordering West Pokot County and the Sudan respectively. About 40% of the population is found in and around settlements and irrigation schemes.

5.3.2 Human population size and density

Turkana County has a population of 855,399 of which 53% are male and 47% female (KNBS, 2009). The population density in this vast county is low and varies from 1 person per Km^2 in Kibish Division to 29 persons per Km^2 in Kakuma Division, with a county average of 6.9 persons km^2, with a sex ratio of male/female 92:100. There are 123,191 households in the County. The age distribution in the county is as follows: 0-14 years (46.0%), 15-64 years (51.6 %), 65+ years (2.4%)

Table 15: Population of Turkana Central and North where the Project is located

Area			Population				
District	**Division**	**Location**	**Male**	**Female**	**Total**	**Households**	**Density**
Turkana central			**126,539**	**128,067**	**254,606**	**41,120**	**17**
	central		28,531	29,759	**58,290**	11,437	70
		Lodwar township	17,690	17,816	**35,506**	7,072	65
		Kanamkemer	10,841	11,943	**22,784**	4,365	79
Turkana North			**197,508**	**176,906**	**374,414**	**53,634**	**11**
	Kakuma		49,361	45,330	**94,691**	16,084	27
		Kakuma	37,624	34,126	**71,750**	12,787	113
		Pelekechi	6,769	6,647	**13,416**	1,863	12
		Nakalale	4,968	4,557	**9,525**	1,434	6
	Oropoi		32,144	29,390	**61,534**	8,265	11
		Kalobeyei	9,442	8,830	**18,272**	2,577	7
	Lokichogio		47,348	41,754	**89,102**	11,440	11
		Lokichongio	11,575	10,385	**21,960**	3,489	21
		Songot	4,404	3,774	**8,178**	1,077	6
		Lotetelet i	3,820	3,487	**7,307**	867	16

Source: *Population and Housing Census - Kenya National Bureau of Statistics (2009).*

5.3.3 Human settlements

The Turkana are one of the most mobile populations in the world. Traditionally, there were no permanent settlements occupied by them. Small settlements were built during the colonial period, but very few Turkana were attracted to them. Following the droughts of the 1980s, approximately one-half of the Turkana population settled in, or adjacent to, large famine-relief camps. Today it is estimated that about one-third to one-half of the Turkana population remains settled.

Permanently and semi-permanently settled areas in the Turkana are found along Turkwel and Kerio rivers where irrigated farming is practiced and water is accessible and near Lodwar town. Along these areas, there exist peri-urban market centres with the necessary social and economic infrastructures like schools, health facilities and shopping centres.

Proximity to urban centres also affects the number and range of options open to those interested in livelihood diversification. According to research undertaken by Little (2005), pastoralists residing less than 40 km from towns typically have more alternative income generating options than those living further away. Proximity to an urban centre is also beneficial to residents because they can easily access societal amenities like hospitals, water, electricity and schools. Most charitable organizations are located in the urban centres and residents can benefit from their assistance, especially food. Casual and

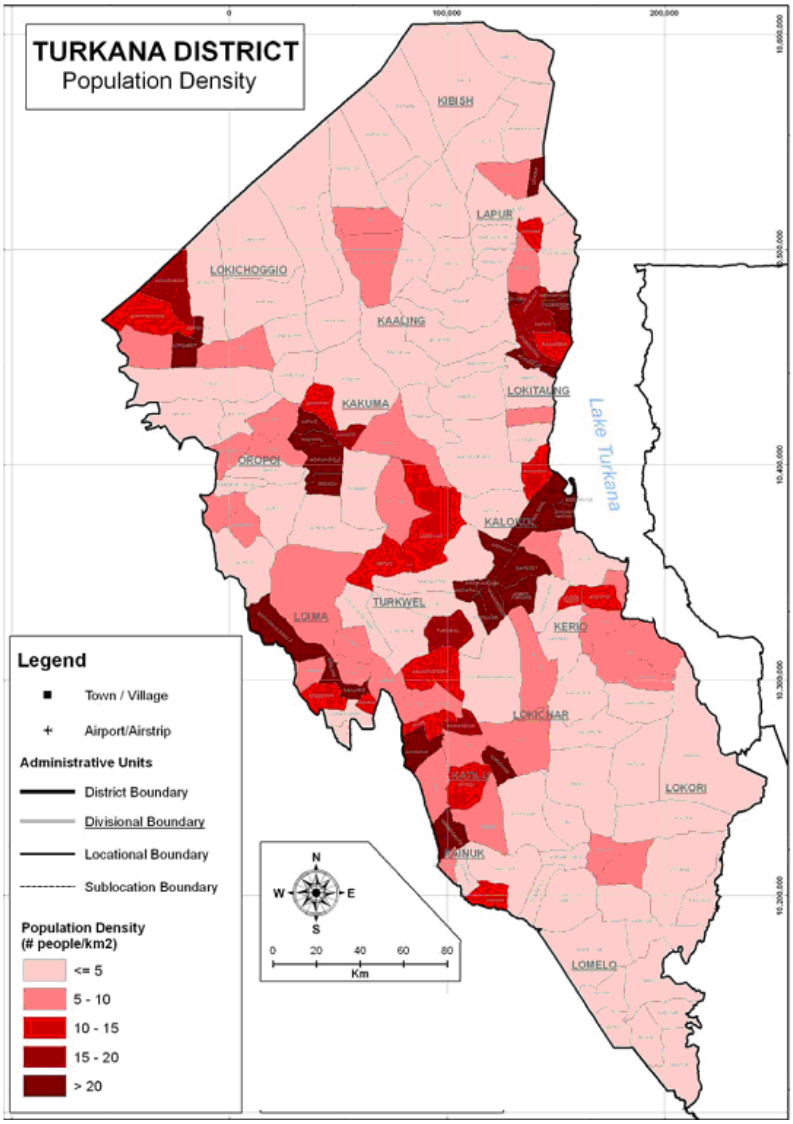
permanent jobs are readily available in urban centres. In addition, there is ready market to sell food stuffs and other things like charcoal and woven items.

5.3.4 Population Distribution along Lodwar- Nakodok Road Corridor

Along the project road corridor, the highest population density (>20 persons/km^2) is noted to occur in major towns of Lodwar, Kakuma and Lokichogio. According to the Population Census of 2009 from Kenya National Bureau Statics the Population Density of Lodwar Township where the road project starts has 65 persons/km^2, Kakuma has 113 persons/km^2 and Lokichogio has 21 persons/km^2. Slightly lower but still significant population densities occur in areas between these major towns following the road corridor (See **Figure 7**). This pattern is noted in the rest of the county where higher population density is influenced by major roads or natural resources.

It is also noted that it is in these major town centres where service institutions like schools, hospitals etc. are located. Since the project has the potential to generate impacts affecting resources and human populations, a much higher threshold of mitigations will be required to minimise impacts/inconveniences in the populated areas of the road corridor. These are also the major areas where significant displacements and resettlement due to the road project are expected to occur.

Figure 7: Population density Distribution of Turkana County


TURKANA DISTRICT
Population Density
KIBISH
LAPUR
LOKICHOGGIO
KAALING
KAKUMA
LOKITAUNG
OROPOI
Lake Turkana
KALOKOL
TURKWEL
LOIMA
KERIO
LOKICHAR
LOKORI
LOMELO
Legend
Town / Village
Airport/Airstrip
Administrative Units
District Boundary
Divisional Boundary
Locational Boundary
Sublocation Boundary
Population Density
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0 20 40 60 80
Km

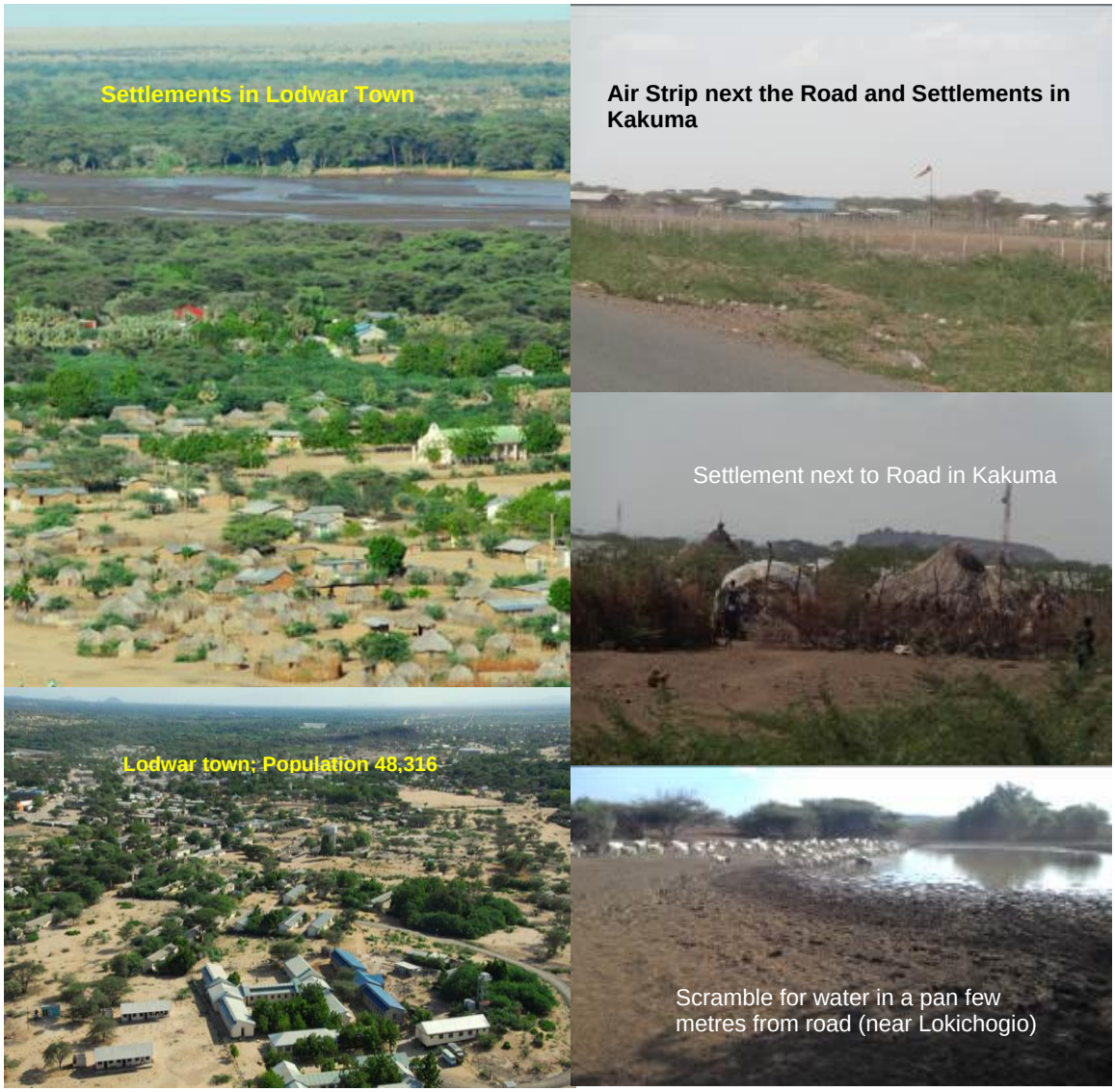


Plate 9: Selected Towns and Features along the Project Road

5.3.5 Land Tenure and Land Use

5.3.5.1 Land tenure

Since independence to date land tenure in Turkana County has been only as Trust Land and all land in the county is administered under the Trust land Act. The existing land tenure in the trust lands can be described as a quasi-customary/communal in that land rights are held in trust by the county councils. Because there have been no formal surveys or land adjudication in the whole of the county, land is still held communally by various communities under customary tenure, and is managed by the Local Authorities (Turkana County Council and Lodwar Municipal Council) on behalf of the communities. Under the new Constitution, 2010, the land is now considered as community land with all rights vested in them.

There are two categories of Trust land in Turkana County administered as centres that have development plans including; Lodwar, Lokichoggio, Kakuma, Kibish, Lokichar, Katilu, Lorugum, Kapedo Lokitaung, Lokori, Kainuk, Kaputir, Lopur, Kalokol where allotment letters are issued and the rest of the land under Turkana County Councils.

The Lodwar County council deals with Lodwar Town. Individual communities have no title deeds for the parcels they own. However, demarcation is being done in township areas to control haphazard developments. This has been done particularly in Lodwar and the main town of Kainuk, Kakuma and Lokichogio. The only currently available legal documents for proof of ownership of land are the allotment letters issued by the relevant Local Authorities and only in urban centres.

Within the countryside away from urban centres, the land-tenure system in Turkana is similar to that of many pastoral peoples. Grazing resources are open to all members of a territorial section. In general, water in rivers and streams when they are flowing, open pools, and shallow wells are not owned but open to all community members. However, deep wells dug through sand such as riverbank aquifers, clay, or rocks are owned by the individuals who dig them, and can be used by close relatives and friends. In northern Turkana, the rules governing access to grazing do not appear to be as strict as those found among the sections living in the south.

5.3.5.2 Land use

Nomadic pastoralism is the dominant land use in Turkana County. Other land use activities include small scale agriculture along river banks and flood plains, scattered settlements, urban centres etc.

The Turkana County, although largely marginal, contains pockets of high potential rangelands, which are crucial to land use patterns. The mountains, hills, plains, streams, rivers and valleys create a highly heterogeneous ecosystem, but the marginal nature of the environment creates survival risks, which the pastoralists must cope with by multi-resource exploitation. In contrast to many East African pastoralists, the Turkana employ diverse food-procuring strategies that include fishing, farming, and gathering of wild foods, in addition to multi-species pastoralism. It is, however, the latter, which characterizes their economy.

Mobility is the principal mode of resource use, in response to the patchy rainfall distribution and concomitant patchy vegetation productivity. To take the best advantage of the diverse land resources and environmental variability, the Turkana manage multiple species of livestock, comprised of camels, goats, sheep, cattle and donkeys. Since each species has distinct dietary needs, the Turkana are able to exploit different expanses of the range during any period of the year. Cattle are confined to mountain areas and river courses during the dry season, and moved to the plains during the wet season, while the plains are endowed with sufficient browse for sheep and goats and camels during the wet and the dry season as well (Little, 1985).

Pasture and water resources seldom reoccur from year to year with any uniformity; rather, their distribution is characterized by patchiness. Thus, movements between different pastures are varied; firstly because of variable fodder and water supplies, secondly, because of poor security and thirdly, because of the particular requirements of each species (McCabe *et al*. 1985, Little 1985).

Table 16: Land use potential and agro-ecological zones in Turkana County

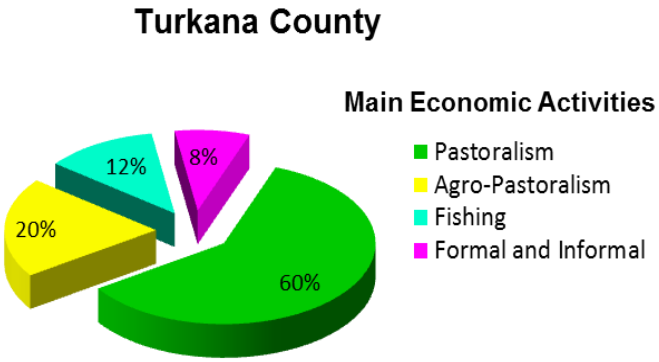
#	Division	Area (Km^2)	AEZs	Current use	Potential land use
1.	Lokochigio	9126	Lower midlands (LM5) Inner lowlands 6 (IL6)	Livestock keeping	Livestock keeping, water harvesting for farming
2.	Kaaleng	10830	Inner lowlands 6 (IL6) Inner lowlands 7 (IL7)	Livestock keeping	Livestock keeping
3.	Lapur	4652	Inner lowlands 7 (IL7)	Livestock keeping	Livestock keeping
4.	Lokitaung	5208	Inner lowlands 7 (IL7)	Livestock keeping	Livestock keeping
5.	Kibish	5127	Unsurveyed area	Livestock keeping	Livestock keeping, water harvesting for farming
6.	Lokichar	2913	Inner lowlands 5, 6 & 7 (IL5, 6 & 7)	Livestock keeping	Livestock keeping
7.	Oropoi	5348	Lower midland 5(IL5) Inner lowlands 6 (IL6)	- Livestock keeping - Sorghum growing	Livestock keeping, water harvesting for farming
8.	Lokori	5008	Inner lowlands 4, 5, 6 & 7 (IL 4, 5, 6 & 7)	-Irrigation sorghum and maize growing; Livestock	Livestock keeping, water harvesting for farming, irrigation
9.	Lomelo	5962	Lower midlands 5 (LM5) Inner lowlands 5, 6 & 7 (IL5, 6, 7	Livestock keeping	Livestock keeping
10.	Katilu	1187	Inner lowlands 5 & 6 (IL5 & 6) Lower midlands 5 (LM5)	- Irrigation scheme - Sorghum and maize growing, livestock	Livestock keeping, water harvesting for farming, irrigation
11.	Kainuk	2504	Inner lowlands 4 & 5 (IL5 & 6) Lower midlands 5 (LM5)	- Irrigation scheme; Sorghum and maize growing; Mangoes and paw paws; Livestock keeping	Livestock keeping, water harvesting for farming, irrigation
12.	Central	2099	Inner lowlands 7 (IL7)	Livestock keeping, very little agriculture	Livestock keeping, water harvesting for farming, irrigation
13.	Kerio	2703	Inner lowlands 7 (IL7)	Livestock keeping, very little agriculture	Livestock keeping, water harvesting for farming, irrigation
14.	Kalokol	3470	Inner lowlands 7 (IL7)	Livestock keeping, very minimal agriculture	Livestock keeping, water harvesting for farming
15.	Turkwel	3093	Inner lowlands 5, 6 & 7 (IL5, 6 & 7)	Irrigation scheme and livestock keeping	Livestock keeping, water harvesting for farming, irrigation
16.	Loima	2174	Inner lowlands 5 & 6 (IL5 & 6)	Livestock keeping	Livestock keeping
17.	Kakuma	5596	Inner lowlands 6 & 7 (IL6 & 7)	Livestock keeping, little farming	Livestock keeping, water harvesting for farming
	TOTAL	**77,000**			

Source: *Eco-Climatic Zones of Northern Kenya Map*

5.3.6 Livelihoods

The Turkana County is subdivided into four main livelihood zones based on their sources of income – pastoralism (64%), agro-pastoralism (16%), fishing based (12%), and peri-urban and urban (8%).

Figure 8: Livelihood Categories in Turkana

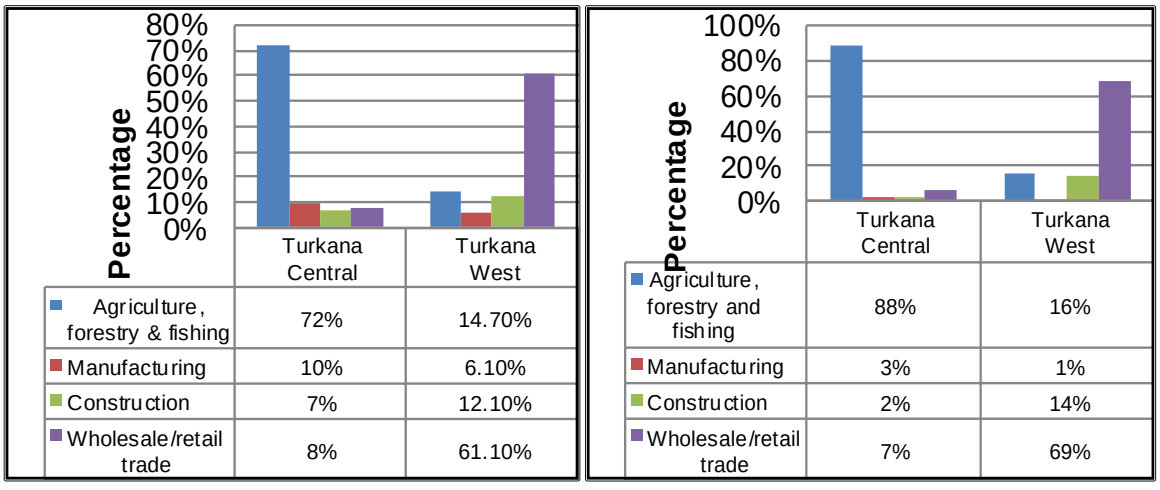


- *Pastoral:* covers most parts of northern and central divisions and supports 60% of total population. Main livestock kept are cattle, goats, sheep and camels.
- *Agro-pastoral:* located along the riverine areas of Turkwel and Kerio and supports 20% of the total population. The agro-pastoralists keep livestock and also practice small-scale farming. There are two rivers that support agricultural activities, Rivers Kerio and Turkwel.
- *Formal and informal employment, petty trade*: mainly in urban and peri-urban centres support 8% of total population.
- *Fishing*: supports 12% of total population mainly practiced along the western shores of Lake Turkana.

Source: *University of Cambridge – Gregorry Akall (Department of Geography)*

Pastoralism is the main subsistence and economic activity in the county. It is estimated that about 60% of the population derive their livelihood from livestock-based activities. Fishing is an important activity along the lakeshore. Over the years, fish yields from the lake have been declining due to the drying of the Ferguson gulf and the state of insecurity in Todonyang (the mouth of river Omo). One section of the Turkana, the Ngibocheros, live along the shore of Lake Turkana and depend on fishing and aquatic hunting, as well as herding for subsistence

Figure 9: Sector Contribution to Household Income

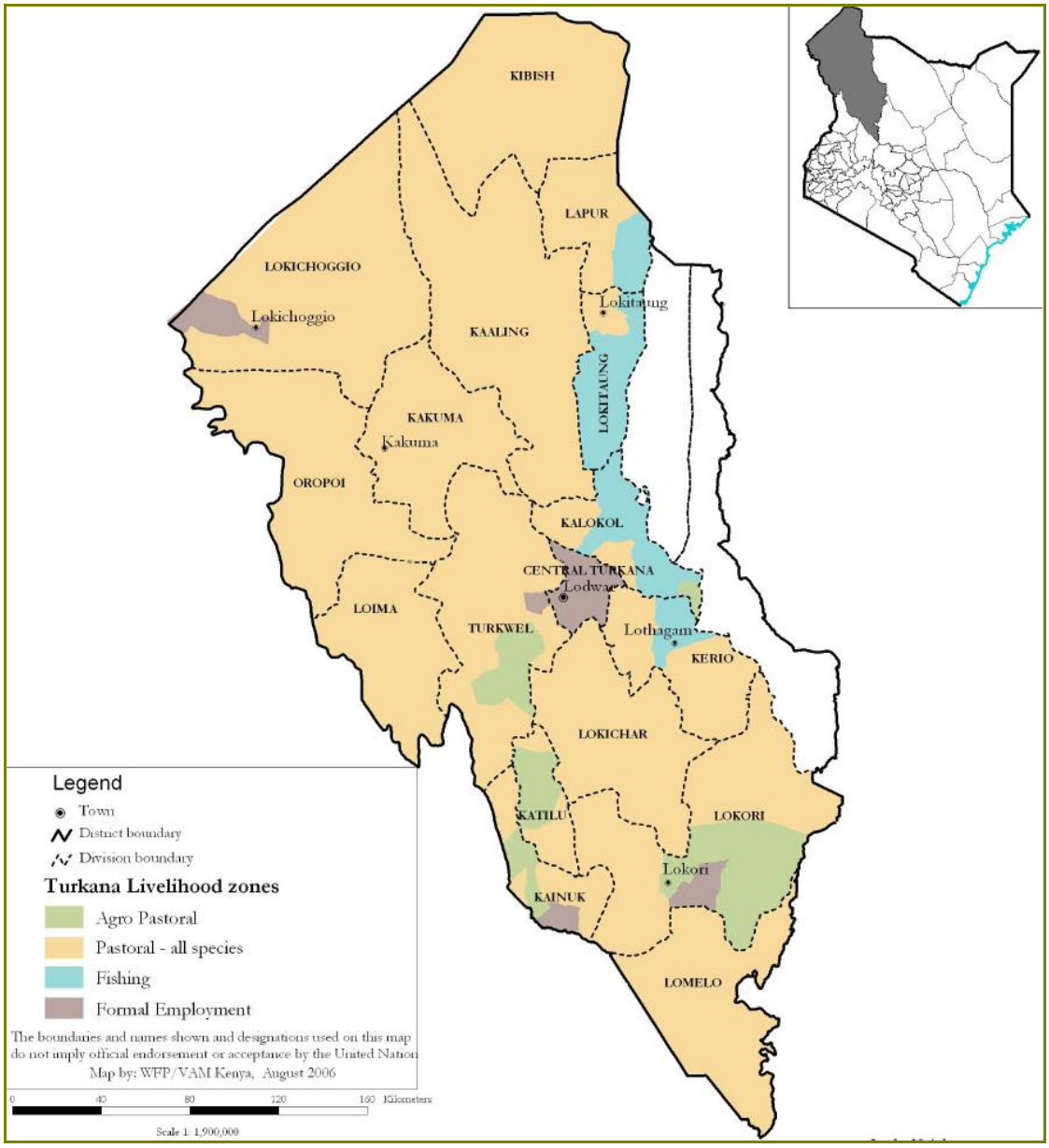


Source: *Analysis from District Development Plans - Turkana*

The Turkana who live along the major water courses engage in small-scale agriculture. Crop production is practiced by agro-pastoralists mainly on pockets of arable land within flood plains and along riverine areas. The harvest is dependent largely on the amount of rain realized in a year, and the volume of water flowing in the two major seasonal rivers; the Turkwel and Kerio.

Indigenous fruits/foods are important sources of food particularly during dry spells. Of the wild fruits, Doum palm is the most widely used. It is used for basket and mat making. Acacia tortilis is utilized for livestock feed, firewood and charcoal production. Other livelihood activities include fisheries, trade in charcoal and firewood, mining, and employment.

Figure 10: Sector Turkana Livelihood Zones



5.3.6.1 Livestock production

The Turkana people have adapted to the aridity and the spatial and temporal variability in climate by herding different species of livestock and by moving frequently. They are therefore primarily a pastoral people, with about 60% of the population depending on five species of livestock for their subsistence: Camels, cattle (Zebu), sheep, and goats provide most of their subsistence needs while donkeys are used to transport household goods during migrations. The livestock provide such products as milk, meat, hides, skins and ghee. The rest of the population depends on agro-Pastoralism, fishing and casual or formal labour in the urban areas. The highest numbers of livestock in Turkana are found in Lokitaung and Lokori divisions with the heaviest average concentrations being evident around the catchment areas of Kakuma, Kalokol, Lokori and Lorugum, but low around Lodwar and Katilu.

Plate 10: Animal Herding and Women Fetching Water at Lomidat

The Turkana pastoral system makes optimal use of the vegetation in time and space through this transhumant system of wet- and dry-season grazing combined with the setting aside of specific dry-season grazing reserves (*epaka* or *amaire*). Such a system of resource management is made more complex by a variety of social controls concerned with sharing, flexibility and mobility (Barrow 1986; Norconsult 1990). However, general patterns do exist based on the environment. The pastoralists and their livestock come together during the wet season in their '*ere'*, the area where sorghum may be planted and a stand of trees, or *ekwar*, may be owned. As conditions become drier, herd-owners begin to separate their herds by species and production characteristics.

Forage Production and Range Condition

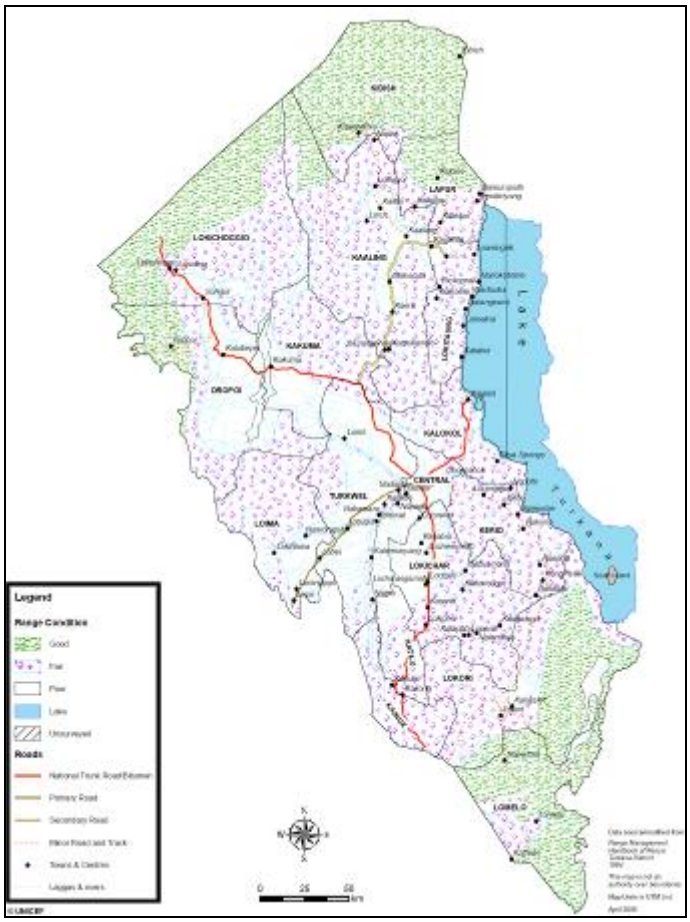
In semi-arid regions, precipitation, more than any other factor, determines plant growth. There are many indications of an almost linear relation between annual rainfall and annual production of rangelands. In Turkana, there is a close relationship between rainfall and standing crop in the range within areas receiving less than 300 mm annual having a standing crop ranging from 160 to 340 kg/ha. Areas receiving 300 to 500 mm annually have on average 680 to 1600 kg/ha and above 2000 kg/ha in areas with more than 500 mm annually.

Table 17: Livestock Population by Type in Turkana County

#	Livestock type	Sub-County			Total
		Turkana Central	Turkana North	Turkana South	
1.	Cattle	196,492	652,288	685,832	**1,534,612**
2.	Sheep	560,671	1,274,062	1,682,418	**3,517,151**
3.	Goats	1,273,445	1,874,668	2,846,748	**5,994,861**
4.	Camels	150,700	269,185	41,577	**461,462**
5.	Donkeys	90,067	194,434	273,686	**558,187**
6.	Pigs	220	132	218	**570**
7.	Indigenous Chickens	27,405	23,876	114,068	**165,349**
8.	Chicken Commercial	3,773	3,441	8,230	**15,444**
9.	Bee Hives	1,985	307	30,289	**32,581**

***Source**: KNBS, 2009*

Figure 11: Turkana County Range Conditions



5.3.6.2 Crop production

Over recent years, the Turkana pastoralist communities have had to use other supportive activities to supplement pastoralism, which has proven to be ineffective in meeting all their economic and social needs. Key areas of activity include sedentary agriculture, particularly along the Turkwel River, where settled farmers and agro-pastoralists grow maize, sorghum, sukuma, oranges, mangoes, bananas and vegetables (UNDP, 2006). Crop production is practiced by agro-pastoralists mainly in pockets of arable land within flood plains and along riverine areas. The harvest is dependent largely on the amount of rain realized in a good year, and the volume of water flowing in the two major seasonal rivers of Turkwel and Kerio.

It is estimated that 25% of the soils in Turkana County can support limited agricultural production, but this is limited by the low and variable rainfall (250-500 mm per annum). The principal centres of irrigated agriculture include areas such as Katilu (irrigation scheme), Lokori, Turkwel (irrigation scheme), Kalemunyang, Nakwamoru, Kaptir, Juluk, and Lokui along the Turkwel River and Lotubai and Morulem irrigation schemes along the Kerio River, the Lotikipi plains, upper parts of the Loima Hills, Nakaton and Kawalathe drainage, lower parts of Kalokol and the Kerio Valley. In addition, irrigated agriculture has also been practiced along major seasonal rivers such as the Tarach River.

Most cultivation is based on low-input sorghum farming (where the Turkana have some of the fastest maturing, though low yielding varieties of sorghum in Kenya), maize, green grams, cowpeas, bananas, mangoes, oranges and guavas, with maize and sorghum comprising 80% of irrigated crops in the county. In the past, cotton and okra were grown but there is currently no market for these commodities Production is low-input so if the crops fail, the losses are not large as such crop production only complements the livestock sector, and people do not necessarily depend on the crop.

Although irrigation has been tried for many years in Kalokol and other areas along the Turkwel River with huge financial inputs from both the Government and donors, success has been limited mainly due to management and administrative problems. It may however still be possible to improve existing schemes to the estimated 10,000 hectares, up from the present 1,187 ha by increasing the acreage of stable food crops (e.g. sorghum, maize and pulses), improving the local capacity for management, and providing farmers with germplasm, bulking, dressing, storage of drought adapted seed varieties and marketing.

5.3.6.3 Fishing

Fishing in Lake Turkana is another, long standing economic activity. Fishermen along Lake Turkana migrate to follow the patterns of fish movement. Fishing supports 12% of total population and is mainly practised along the western shores of Lake Turkana. The pastoralists also supplement their livelihoods by selling the fish.

5.3.6.4 Aloe production

Aloe turkanensis is a native plant found in the hills on the Turkana/Ugandan border and has been valued for many years for its ethno-medicinal qualities. In places such as Oropoi and Latea, it is used locally to treat malaria, flesh wounds, and eye infections and to moisturize dry skin. Recently, however, the production and processing of Aloe has been seen as a potential candidate activity for livelihood diversification.

Several organizations e.g. KEFRI and ITDG Practical Action have attempted to promote the production, processing and marketing of commercial Aloe.

However, the key challenges related to Aloe production include absence of market information and the poor organization of production and processing. There is substantial scope for the profitable expansion of Aloe in Turkana.

5.3.6.5 Charcoal production

Charcoal is primarily produced along the Turkwel and Kerio Rivers and is sold along the main highway between Kainuk and Lokichogio. Although charcoal production is illegal in Turkana, the production offers small returns to those that produce it and its, destructive nature, the production and sale of charcoal continues and several bags for sale can be seen along the .the project road.

Plate 11: Charcoal on sale along the project road

5.3.6.6 Collection and sale of wild fruits

The collection and home use or sale of wild fruits is widespread throughout the County. The most common fruits sold include Doum Palm, Ngakalalio, Edong and Edapal, and Ebei. Trade in *Prosopis* pods especially around Lodwar and Kakuma is also becoming an important source of income. The pods are bought by Animal feeds manufacturing companies such as Sigma Feeds.

5.3.6.7 Mining

Gold mining has been prevalent in Turkana for many years. Whilst most gold mining operations in the contemporary period are labour intensive one man operations, gold mining in the recent past has been the domain of large businesses backed by significant political support. Currently, gold mining occurs primarily in Nakoriyek (on the road to Kanakurdio), Kimagur (on the main road before Lokichar), Lokiriama, Namorupus and Nadunga (west of Nakoriyek). Small-scale gold mining is also found in the southern part

of the County at Nakwamoru and central parts at Makutano ('*Gold*') between Kakuma and Lodwar, where mining is not of a large-scale commercial nature, though an alluvial type of it is being exploited Turkana has abundant building sand and quarry materials.

5.3.6.8 Casual, waged labour and trade

The demand for casual labour in Turkana is in the form of agricultural or building jobs. However, in the case of agriculture, most casual jobs are available in the wet season with some herding opportunities are available in the dry season. Unfortunately, there is generalized lack of work opportunities in the area has led to many youngsters, often having completed their schooling, turning to crime. Within Turkana, there is a distinct lack of opportunities for waged or salaried labour. Formal and informal employment, petty trade; mainly in urban and peri-urban centres support 8% of total population.

Although one of the more isolated ethnic groups in Kenya, the Turkana still trade in small scale, selling livestock to buy grains and household needs. The Turkana traditionally traded livestock for iron with ethnic groups in the highlands of Uganda.

5.3.6.9 Honey production

According to Mwangi (2005), honey production is a commercially viable enterprise, especially along the riverine ecosystems (Turkwel and Kerio Rivers) and higher altitude locations close to the Ugandan border. The principal areas of honey production include Turkwel, Kalemunyang and Toyarabon (Turkwel Division); Lokapel and Kanaodon (Katilu Division); Kainuk, Loyapat (Kainuk Division), Lokwar, Ekwar, Kaptir, Nakwamuru, Kapelibok and Oropio. Local beehives are manufactured from logs cut from special types of trees. The most popular trees used to make beehives are the 'Echoke', locally known as a sycamore, and the 'Edurukoit', a type of Acacia.

5.3.6.10 Basket-making and handicrafts

Commercial basket-making (and associated activities) supports a network of producers, traders and transporters in Turkana and is especially important for the livelihoods of households located near urban centres and along dry-river valleys close to Lake Turkana. The most important sites for these types of activities include Lodwar, Kalokol and Eliye Springs (for basket-making); Kataboi, Kerio and Turkwel (for mat-making). Weaving material is readily available from the Doum Palm. In Turkana, women are the main producers of baskets, other woven goods and handicrafts, while men dominate the production of carved wooden products. The principal products produced include: mats, baskets and brooms, and the assortment of wooden goods produced include Turkana seats/stools, dolls, spoons, milk jugs, and cow skin jugs. In addition, modern earrings, bracelets and necklaces are also produced. Lodwar is the only centre that produces and sells modern bead work. Traditional beads made from local materials are still produced, for both sale and own use, by women throughout Turkana.

5.4 Public health

The lack of water in the area is a major cause of the poor standard of health endured by the Turkana. The health services in the area estimate that approximately 50% of the population are suffering from water borne diseases due to lack of clean water.

The major diseases that have regularly been reported in the Turkana are malaria, skin diseases, respiratory tract infections, and diarrhoea (Republic of Kenya 2007). Malaria

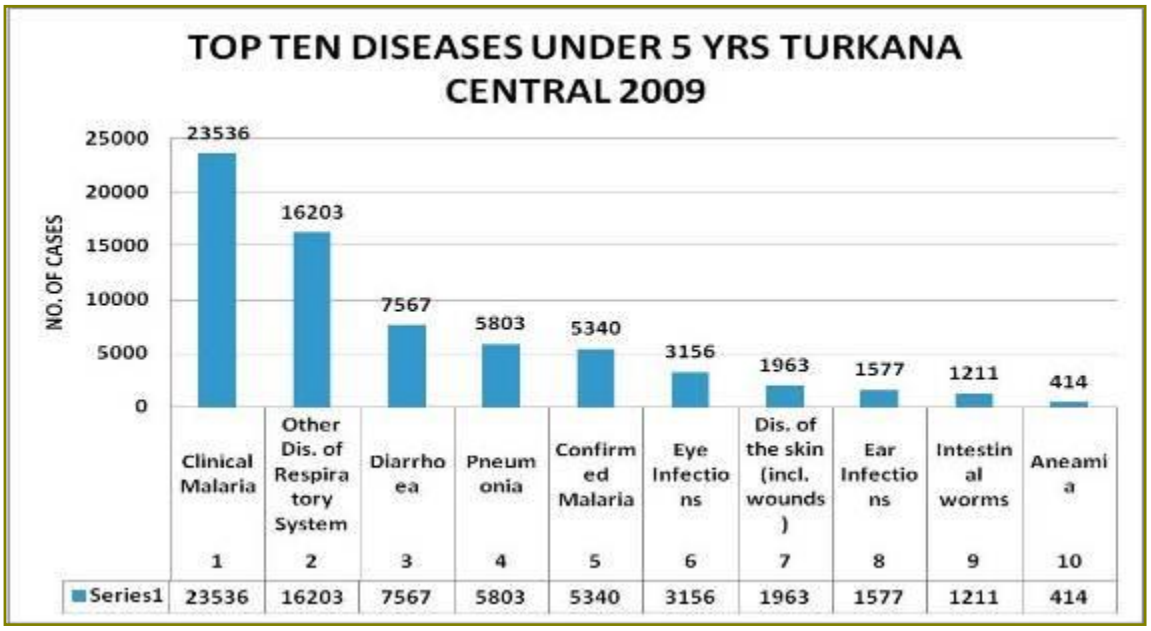
can be prevented by the use of bed nets, but not everybody has the financial means to acquire nets. Most of these diseases are associated with poverty.

Despite the fact that Turkana people are exposed to various diseases, there are very limited health centres in rural areas with and a doctor/patient ratio is estimated at 1:285,000 (Republic of Kenya 2011).

The average distance to the nearest health facility is 50 km. As mentioned elsewhere in this report, infrastructure is very poor, and there is no reliable public transport system. The result is that many people who need assistance never reach health facilities.

According to a 2007 study carried out among the rural Turkana population, HIV prevalence was 4.1% in rural areas and 8% in urban centres. In the same year, data from the AIDS and Sexually Transmitted Infections Coordinator (DASCO) in Turkana Central district indicated a prevalence rate of 6.7%, increasing to 14% in some urban centres.

Figure 12: Prevalent Diseases in Turkana Central – 2009



Source: *Ministry of Health*

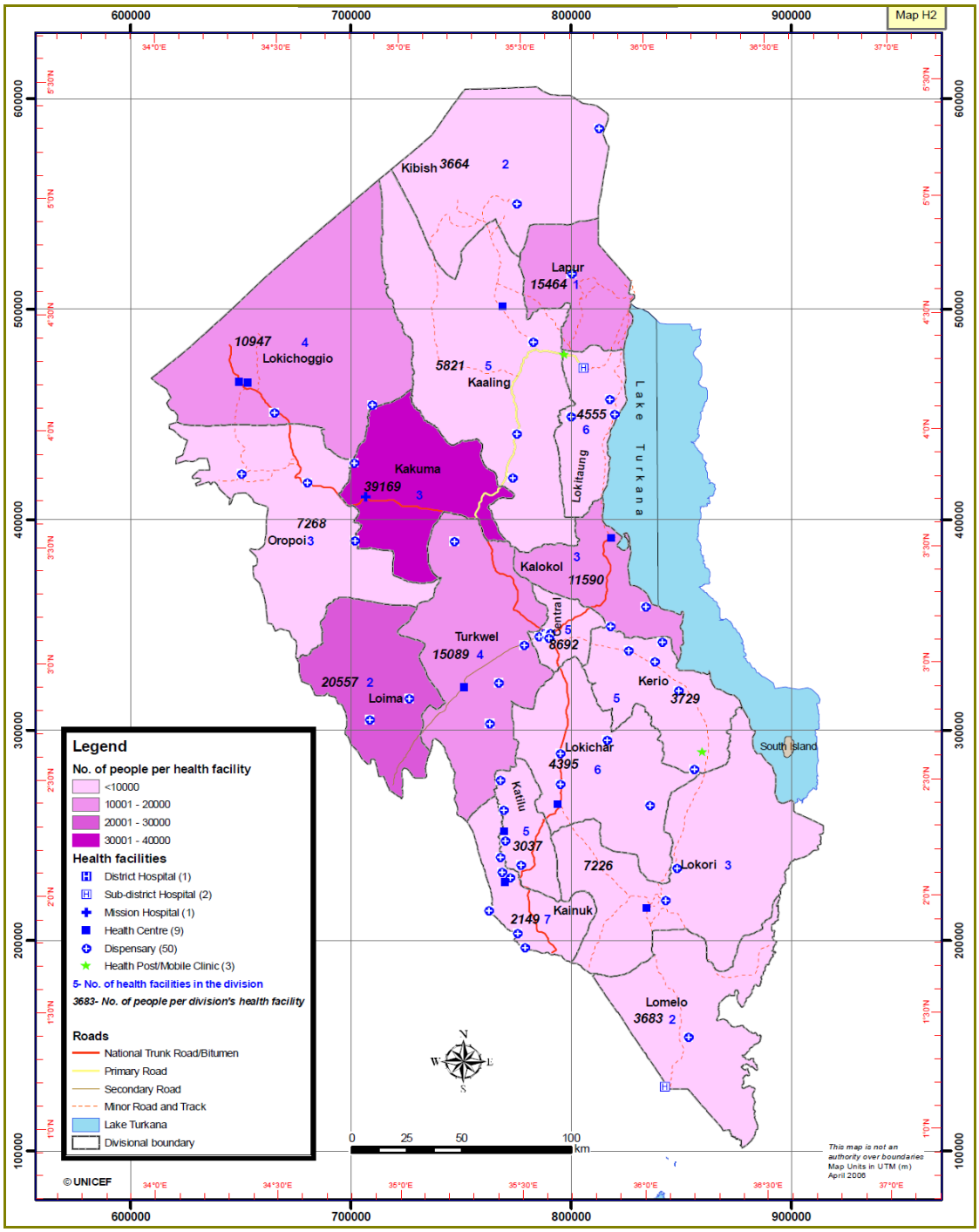
Table 18: Health Statistics for Turkana, 2010

#	Parameter	Sub County			County
		Turkana Central	Turkana North	Turkana South	
1.	Total Population 2009	254,606	374,414	226,379	855,399
2.	Women of reproductive age (15-49) years	55,192	70,139	24,402	149,733
3.	Men of reproductive age (15-49 years)	50,175	63,763	22,184	136,121
4.	Total population of reproductive age	105,367	133,902	46,586	285,854
5.	Estimated HIV Prevalence (15-49 years)	3.83%	3.83%	3.83%	3.83%
6.	Est # of HIV positive individuals 15-49) 2009	8,793	11,174	3,888	23,855
7.	Total number of house holds	45,917	58,200	20,301	124,418
8.	Children under 1 year (12 months)	5,579	11,145	2,467	19,191
9.	Proportion Children under 1 yr (12	2.43	3.82	2.43	2.9

	months) %				
10.	Children under 5 years (60 months)	27,550	52,519	12,181	92,250
11.	District Proportion children under 5 yrs (60 months) %	12.00	18	12.00	14.0
12.	Under 15 year population	100,329	127,499	44,358	272,186
13.	Proportion Under 15 yrs population %	43.70	43.70	43.70	43.7

Source: *Ministry of Health*

Figure 13: Prevalent Diseases in Turkana Central – 2009



One of the leading causes of death among people living with HIV/ AIDS is tuberculosis (TB) with high prevalence rates among both pastoral and urban communities. A 2008 study showed that 80% of TB patients in Lodwar District Hospital were HIV positive.

The existing health facilities in Turkana County include 3 District Hospitals at Lodwar, Katilu, and Lokitaung, Sub-District Hospitals (2), Dispensaries (91), Health Centres (6), Medical Clinics (19), Health Programs (3) and others (3). Infant mortality rates stand at 60 per 1000 while under five mortality rates are 12 per 1000. Malnutrition is also common.

The Diocese of Lodwar's health programme provides 65% of all healthcare in Turkana. Through its Mission Hospital in Kakuma, 9 primary healthcare centres and 2 health clinics, almost 400,000 men, women and children in Turkana benefit from some aspect of the Diocese's health programme. The reach of the health programme is further extended to isolated nomadic communities through outreach work and a health education programme in all schools across Turkana.

5.4.1 HIV and Aids

The HIV and Aids pandemic is currently a major development problem in the County. HIV prevalence stands at 8.3 % which is way above the national prevalence rate of 7.4 %. However, it is higher in central (9.1%) than in Turkana West (7.4%). The most affected areas are the townships along the Kitale - Lokichoggio high way and major fishing centres along Lake Turkana. The age group most affected is that of 15-49 years, which is also economically most productive. The County has 5 VCT sites and 3 institutions offering ARVs.

The possible reasons for rapid increase in the HIV/AIDS cases can be attributed to the men who migrate in search of employment and leave their families behind, the morbidity of pastoralists, migration, and influx of refugees from neighbouring countries, presence of high risk groups in the district like the security officers, high rates of divorce and polygamy.

In the management of the disease, the proposed roads project should focus on behavioural change, offering VCT services and home based care and support as well as the other thematic areas spelt out by the Kenya National HIV and Aids Strategic Plan (KNASP).

5.5 Education

The Turkana County has 175 pre-primary schools, 136 primary schools, eight secondary schools, two youth polytechnics and one medical training college. Enrolment in primary school is 122,883, with a **t**eacher to pupil ratio of 1: 51 while **s**econdary school enrolment is 48,004 with **a** teacher to pupil ratio of 1: 27.7. There are 2 tertiary institutions. Adult Literacy Classes have an **e**nrolment of 562.

Many people in Turkana have not accepted formal education as a social value leave alone as a human right. Many parents still deny their children their right to study and to be educated. In spite Free Primary Education, Turkana districts register one of the lowest gross enrolment, retention, and completion rates in the country:

- 33% of children with the age group 5-10 actually start school

- 69.2% drop out before finishing primary school
- Around 11% sit the Kenya Certificate of Primary Education (KCPE "Standard 8") exam and 4.9% go to secondary schools
- 22% drop out of secondary school before completing "Form 4"
- 4% sit Kenya Certificate of Secondary Education (KCSE "Form 4") exams.
- According to government estimates, 70 out of every 100 adults cannot read and write in any language.
- Illiteracy is considerably higher in females, with only 15 out of every 100 women able to read and write in any language.
- More than 50% of school age children do not attend school

The districts have 290 ECD centres, 125 primary schools, 11 secondary schools and 4 Tertiary Institutions. The number of each type/level of education institution and its respective dropout rate is presented in Table 1 below:

Table 19: Types of Education institutions and their Respective Drop-out Rates

#	Level of education institution	Number of education institution	Drop-out rate (%)
1.	ECD Centre	290	2.9%
2.	No. of primary schools	125	3.8%
3.	No. of secondary schools	11	2.5%
4.	Tertiary Institutions (Science & Technology Institutes, Youth Poly techniques and others)	4	-
	% Literacy rate	9.50%	

Source: *Turkana Central and West District Development Plans*

The education institutions along 2kms within the road corridor by district are as follows:

- Central District - Friends School, Kare Academy, River Side Academy and Lokyo primary school.
- Turkana West - Natuat, Nakaleri, Pelekecha, Aridzone, Lopwarim, Nagolomereti, Kalobeyei, Natira, Lukwaduyi, St. Luke Nakurulum, Lokudule, St. Mark, Terenkus, St. Patrick, Lomidet, Ann Mokila and Songot Primary schools. secondary schools include AIC Songot Secondary, Kakuma and Kakuma Boys secondary, Kakuma, Lokichogio Girls and St. John Lokichogio mixed

5.6 Poverty levels

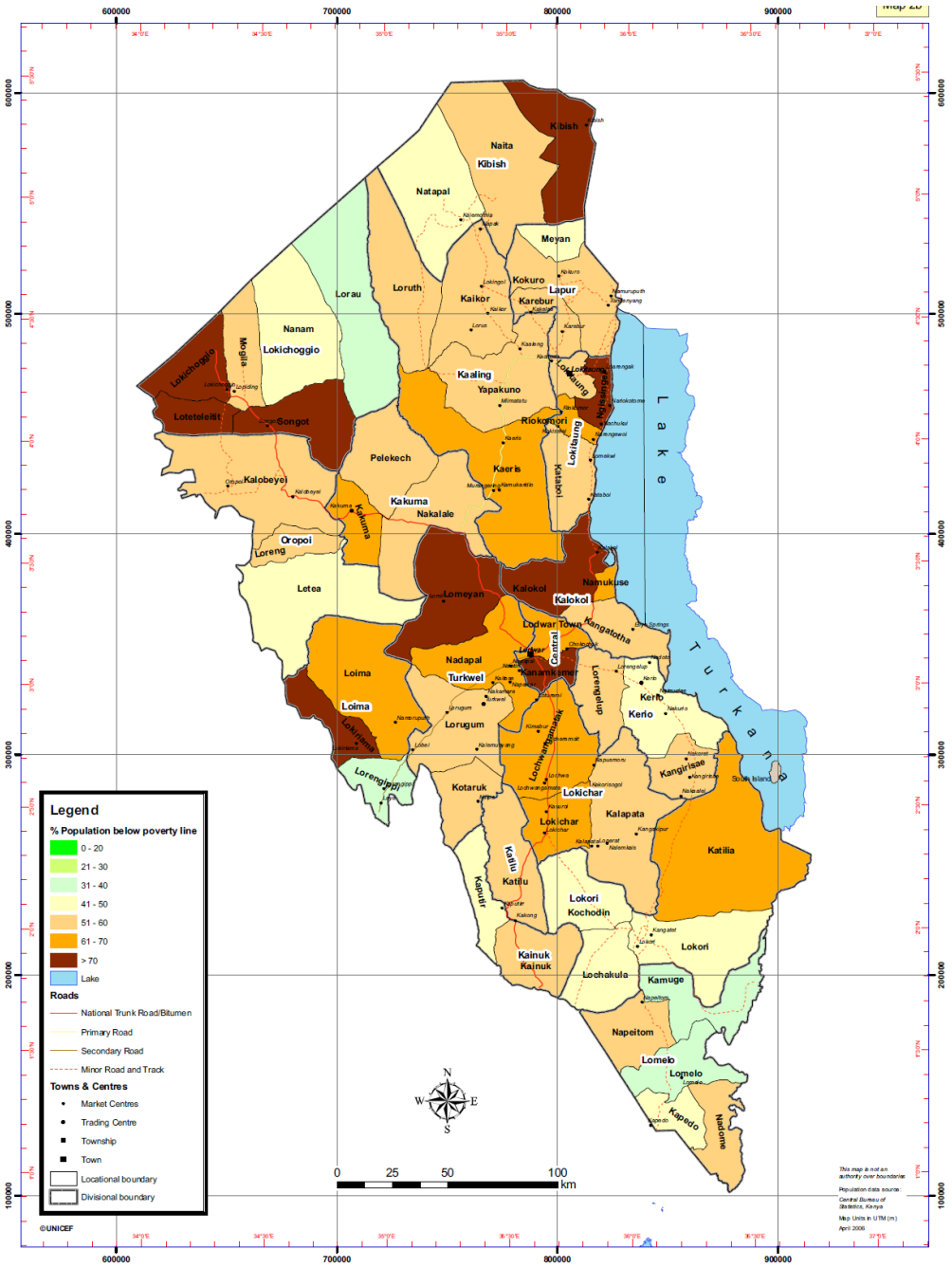
The people of Turkana fundamentally depend on the natural systems and natural resources for existence and development. However, due to the harsh environmental conditions prevalent in the area, poverty levels are high, with 71% of the Turkana population living below poverty line. Poverty hinders access to basic needs such as health care, nutrition and education and in the area, poverty often leads to over-use and destruction of the environment.

While the county has a poverty level of over 71%, these level varies with the divisions as follows; Central (72%) Kaaling (57%) Kakuma (66%) Kalokal (71%) Katilu (51%) Kerio (52%) Kibish (59%) Lapur (55%) Loima (61%) Lokichar (65%) Lokichoggio (67%) and Lokitaung (67%).

There is no clear pattern of poverty distribution in the county as the poor and the rich exist side by side especially in the rural areas. However, most of the poor are found in the

northern part and central plains due to recurrent droughts and diseases. Cattle rustling from the neighbouring countries have worsened the situation. The Poor are also found in the major towns and market centres.

Figure 14: Poverty Incidence at Locational Level in Turkana County



5.7 Gender dynamics

Among the Turkana, division of labour exists along gender lines, dictating general social roles and distinct daily activities performed by members of the society. As with most societies in Kenya, women's roles among the Turkana continue are centered on the

house. Within the household, it is the general responsibility of the women to provide food and comfort for the household.

Their specific roles given include: Fetching firewood and water for household use; preparing food and gathering wild fruits for domestic consumption. Other roles include: watering the livestock other than cattle (goats, donkeys and camels) by scooping water from the wells; Preparation for migration to new locations; Milking the stock and portioning it out into different uses for the household; Care for weak animals that are left around the homestead when the men move with the other stock including weak and sick cattle, goats and camels and pregnant livestock that cannot cover the long distance in search for pasture and water; and Processing of hides and skins after the animals are slaughtered.

Due to scarcity of water and harsh environmental conditions, the role of women in searching for water and firewood puts a lot of strain as they often walk long distances, especially in the dry season.

Women also socialize the children into the Turkana way of life. As the children grow older, women concentrate on guiding and counseling girls into responsible adults who can function effectively in the Turkana society

The Turkana men have the following related roles: Ensuring that the livestock get pasture, exploration of good grazing land and water when the drought sets in, providing health care for the animals in the form of traditional herbs or modern veterinary medicines when available and providing security to the animals and household members. This is because the area is prone to cattle raiding and bandit attacks from neighbouring ethnic communities.

The men also play a role in organizing family meetings to deliberate on matters relating to the clan and family, socialization of young boys into adult roles in the Turkana society by teaching them skills in herding (how to locate and identify good pasture/water source, herbs to cure diseases infecting the herd, etc.), social adult skills of being a good husband and father and protecting the herd and family, and as custodians of cultural values and morals. Men also make all decisions related to animal slaughter, migration, marriage and dowry payment and rituals and their performance

Joint or common roles between men and women include:

- Agriculture: For the Turkana living along Turkwel River, the men plough, while women plant, weed, and harvest;
- Fishing: This is done mostly by men, while women process and sell the fish;
- Weaving: Weaving of mats, baskets and hats for sale is mostly done by women although a few men also do it; and
- Business: Both men and women start small business activities such as charcoal selling, kiosk ownership, etc.

5.8 History and culture of the Turkana Community

The main tribe in the study area is the Turkana. They are divided into two broad groups; the forest people (*Nimonia*) and the people of the plains (*Nocuro*) which are divided into roughly twenty clans (*ategerin*). These are: Ngibelai, Ngibotok, Ngibocheros, Ngichoro, Ngigamatak, Ngijie, Ngikajik, Ngikuniye, Ngikwatela, Ngilukumong, Ngimamong, Ngimazuk, Ngimonia, Ngiseto, Ngisiger, Ngisonyoka, Ngissir, Ngiturkan, Ngiwoyakwara and Ngiyapakuno. Each one of the clans is associated with a particular brand for its

livestock, so that any Turkana can identify a relative in this way. Each clan also occupies a defined territory. No individual rights to forage exist and crossing to other territories requires permission from the elders and the “emuron” or seer of that territory. Each clan defends its territory and during periods of stress the elders may deny outsiders the access to the grazing area or impose a toll in livestock.

The Turkana generally live in extended family households (awi), and the family *awi* often involves two enclosures. One is the *awi napolon*, which is the main enclosure where the head of the family lives. The other is the *awi abor*, where the additional wives and their children, as well as married sons, live. The homestead's main entrance faces east, with the chief wife's day hut (*ekal*) and night hut (*akai*) on the west. Turkana families often build next to the *awi* of other families, creating the neighbourhoods that are the Turkana's effective communities. An “*awi”* consists of 9-15 people

The individual *awi* would congregate together into several units called *adakar* (*ngadakarin* in plural). Movement and management decisions are made at the *awi* and *adaka*r levels. During dry periods the *ngadakarin*, household members and the animals are dispersed in different orbits to spread risk and capture existing opportunities. Among the different Turkana traditional institutions, the *Adakar* (grazing social unit) is the most important. The *Adakar* structures are based on security i.e. protection from organized raids, natural resources management and social-cultural links. It is headed by an elder’s council, which has representation of all the herdsmen. All Turkana speak one language and follow one basic set of customary laws, but they do not recognize one global traditional governance or leadership. Consequently, the Adakar units are quite independent and autonomous.

Turkana marriages take place over a three year period. Marriage is not complete until the first child has reached walking age. The purpose of this extended time is to ensure the ritual, spiritual, and social wellbeing of those involved. The bride price (paid by the bridegroom) usually involves quite cattle or camels, which come from the herds of the suitor, his father, his father's and mother's brothers, stock associates, and bond-friends. The wife occupies an important position in the *awi*, and maintains close ties with both her husband and her father and brothers.

The majority of the Turkana still follow their traditional religion: they believe in a God called *Kuj* or *Akuj*, associated with the sky and creator of all things. He is thought to be omnipotent but rarely intervenes in the lives of people. Contact between God and the people is made though a diviner (*emuron*). Diviners have the power to interpret dreams, foresee the future, heal, and make rain. Estimates are that about 15% of the Turkana are Christian

According to oral traditions the ‘original’ Turkana was the eastern vanguard of the ‘Ateker,’ groups of the eastern Nilotic linguistic family known as the central para-nilotes, which replaces the incorrect and misleading term ‘Nilo-hamitic’. Traditionally, these tribal groups which share close linguistic ties with the Turkana are the Karamojong, Jie, Dodoth, Iteso, Ngangatom, and Toposa (Lamphear 1992). These tribal groups were Turkana neighbours and inhabited the Korten-Magos hills in the present day Karamoja district of Uganda at the beginning of the 18th century.

From the 1850s onwards, due to unfavourable climatic conditions in the Turkana region, leading to variable fodder and water supply, poor security, and because of the unique requirements of each stock species, Turkana pastoralists developed a flexible social system and a pastoral system well augmented with agriculture, hunting, gathering, and

fishing (Lamphear 1992). Turkana people also had competitive raiding relationships with the surrounding pastoralist tribes, except for a short period of cessation during British domination.

The Turkana, like their neighbours, have a livestock raiding culture. Raiding of traditional enemies was previously a means of expanding grazing lands, gaining access to new water sources and most importantly, an economic stratagem of self-restocking and improving social status by acquiring livestock from defeated enemies (Oba, 1992). This means that each raid is spontaneously followed by counter raids. Other motivation for raids in pastoral communities is the desire to reduce poverty and hunger, and acquire bride wealth.

5.8.1 Conflicts and cattle rustling

Cattle raids and resource-based conflicts are the main types and manifestations of conflicts in Turkana. The County's proximity to Ethiopia, Sudan, Uganda and hostile neighbouring districts in Kenya makes it one of the most affected areas by insecurity incidences.

The leading aggressors (communities) include Toposa from Sudan and Pokot from Kenya and Uganda. Other includes Dodoth, Tapeth and Matheniko from Uganda, Didinga from Sudan, Merille from Ethiopia, Dongiro from Ethiopia and to a lesser extent the Samburu from Kenya. Traditionally, the Turkana do not raid amongst their people.

Figure 15: Conflict Prone Areas of Turkana

Environmental factors have also led to widespread drought in the area causing scarce resources such as arable land and water to become scarcer. Documented conflicts between various groups started in the late 1950s with cattle raiding and killings over territorial claims and grazing grounds. This has continued to date. The level of conflict still related to resource access (water, land) and is heightened during times when these resources are scarce but also now related to economic gain.

5.9 Physical infrastructure

Roads and means of transportation are essential to diffusing knowledge and technology, which facilitate the development of communities (either rural or urban). In the Turkana County, the infrastructure is generally very poor. There is only one major road passing through Turkana to Sudan and when it rains this is impassable in some sections. In the interior parts of Turkana, most of the roads and bridges are either damaged or destroyed. There is no reliable public transport system, and most people have only one option when traveling from one place to another: to walk. Some people have bicycles, but it can be hazardous to use them on bad roads.

The problem of poor roads and public transportation has negatively affected the livelihoods of Turkana people, for example, it is hard to get supplies into rural areas, and this limits trade with other regions. The Turkana people have no tradition of using carts and animal power to transport commodities and goods, and rely on carrying everything themselves.

There is only one Class A all-weather road from Kainuk to Lokichogio, covering a distance of 438km and another class B road running from Lodwar to Kalokol and covering a distance of 60km. There are two Class C roads, one of which runs from Lokichar to Lokori (a distance of 68km) while the other runs from Lokori to Kapedo (134km). Both are earth roads and are impassable during the rainy seasons. There are five post offices and six sub-post offices.

There is also a poor road link between Kapenguria and Lodwar. However, the road is relatively good from Lodwar-Lokichogio. During the rainy season feeder roads to the Food Distribution Points (FDP) may be inaccessible thus delaying program implementation especially towards the northeast and south. During the same period overflowing *laggas* are also impassable. The road network in the county consists of 319.2 km of bitumen surface, 296.7 km of gravel surface and 2030.5 km of earth surface.

5.10 Relief operations

Kenya has over the years hosted a large number of refugees fleeing conflicts in their countries. Most of the refugees are hosted in camps located in Kakuma and Dadaab in the arid Northern parts of the country. The Kakuma Refugee Camp is located within Kakuma town.

The camp was established in 1992 to cater for Sudanese refugees, majority of whom at that time were the Dinka people fleeing fighting between the Government of Sudan and the Sudanese People's Liberation Army (SPLA). Since 1992, the camp has expanded considerably and now covers an area of about 25 square kilometres (Kariuki, 2008). The number of refugees seeking asylum in Kakuma Refugee Camp had increased to over 80,000 by January 2010. To cater for the refugees and the local population, there are over 32 aid agencies operating in the Turkana.

The aid/relief agencies operating in Turkana include the United Nations High Commission for Refugees (UNHCR) is responsible for protection and assistance programmes in refugee camps, the World Food Programme (WFP), responsible for food distribution in the camp and sometimes to the local communities. Food aid is provided through Lutheran World Federation (LWF). International Rescue Committee (IRC) is responsible for implementation and management of health and nutrition programmes in the Kakuma refugee camp while GTZ-Rescue is responsible for firewood distribution and rehabilitation in the camp. GTZ also purchases firewood from the local communities.

Other relief agencies that also target the local communities are WFP, the Red Cross, the World Vision, Oxfam, UNICEF, the Samaritan's Purse, Jesuit Relief Services, Don Bosco, World Relief and USAID. In all, there are about 32 agencies operating in Turkana, including various Church organizations especially the Catholic.

The agencies mentioned above mainly deal with food and health issues. A nutrition survey conducted in Turkana in May 2010 put the Global Acute Malnutrition (GAM) at 16%, severe acute malnutrition (SAM) at 2% and moderately severe malnutrition at 16%. Nutrition surveys conducted in May 2009 indicated rates ranging from 20.2% to 28% for GAM and 2.5% to 3.4% for SAM respectively. Recently there has been policy shift in that families with children in supplementary and therapeutic feeding programmes are being included in general food distribution. Currently over 300,000 people are dependent on food aid in Turkana districts.

5.11 Oil exploration

A large part of the Kenyan geology also consists of the Precambrian basement rocks and the Tertiary volcanics that have covered many of sedimentary basins, which are now considered to be potential basins for oil exploration. For exploration purposes, the potential oil producing areas have been divided into exploration blocks. The Turkana region is under Block 10BA and 10A. Several wells have been sunk in the area including: LT-1 (Loperot) and LT-2 (Eliye Springs), drilled in 1992 by Shell Exploration and Production Kenya (SEPK) in Lokichar-Kerio sub-basins, penetrating chiefly the Palaeocene or younger strata;

Block 10BA is located in Turkana, which is part of the East African Rift System. The Block includes onshore areas to the east and west of Lake Turkana and offshore portions of the northern two thirds of Lake Turkana. Within the Block are several sub-basins and structural fault blocks that are considered part of the Kenya Rift. The Sub-basins include Lake Turkana North, Lake Turkana Central, Lodwar North and Kerio North. Tullow (50%) in partnership with Africa Oil operates Block 10BB on 50:50 basis.

Loperot-1 well was drilled in the southern portion of the block in the Lodwar South sub-basin. Shell's Eliye Springs-2 well was drilled in the northern portion of the Block. Block 10BB is about 500 km northeast of the commercial discoveries in Blocks 1 and 3A in Uganda, and 600 km southeast of producing fields in the Melut and Muglad Basins in Sudan. Block 10BB is in a similar rift valley system; however it is separated from these producing basins by major fault zones. Canadian oil and gas firm Africa Oil Corp is drilling in block 10BB in the Lokichar Basin.

Oil has been discovered in Turkana North District by British company Tullow Oil Turkana county is one of seven basins mapped in Tullow's 100,000 square kilometre exploration areas in Kenya and Ethiopia.

5.12 Trade, tourism and industry

5.12.1 Trade

The project County and districts connects the rest of Kenya and is a transit area from port of Mombasa with the emerging markets of Southern Sudan. Internally, the major sectors that enable trade to thrive are the food sector where Turkana is a net importer of food stuffs such as maize and beans. The County is a major producer of animal products which includes live animals that are transported to other parts of the country. Beside these, the County produces a huge supply of fish which forms the bulk of trade with other parts of Kenya.

The main towns namely: Lodwar, Kainuk/Lake Turkana area, Kakuma, Lokichar and Lokichogio area the main economic centres. Lodwar itself has three centres and a large population. Kakuma will also grow because it has a settled population. Lokichogio boasted to have hosted 52 NGOs but has now collapsed after many left to South Sudan or other parts. The proposed road may revamp the collapsed town. Currently there are 10 trading centres lying along the project route as presented in the Table below:

Table 20: Towns along the Project Road and Tax Income Generated

#	Name of market centre	Tax income generated

1.	Nasiger	0
2.	Gold	862,080
3.	Lokore	0
4.	Kakuma	4,889,280
5.	Kalobiyei	697,200
6.	Arumrum	0
7.	Songot	0
8.	Lomidat	372,000
9.	Lokichogio	4,103,640
10	Nadapal	0
	Total	**10,924,200**

Source: *County Council of Turkana*

Trade in the districts revolves around livestock products, general merchandise, and hospitality and service industry. Factors that inhibit trade development include poor road infrastructure, high cost of business and low purchasing power.

5.12.2 Industrialization

Kakuma and Lokichoggio towns are the major beneficiaries of all major trade investments in the County. Currently, it hosts all the major hotels, wholesale shops and manufacturing industries. Only *Jua Kali* establishments can be considered as industries in the project districts besides fish mongering.

5.12.3 Tourism

The County has tourism potential due to the presence of a rich cultural heritage of the Turkana people, Lake Turkana, Fishing and various species of wild animals. In addition, there is great potential for producing tourist goods such as mats and hats produced from the rampantly available palm leaves. The districts have 52 hotels but only two are classified. The only existing financial services are Commercial Banks.

6 PROJECT AREA SOCIO-ECONOMIC INFORMATION

6.1 The Socio-Economic Profile

This section looks at the social terrain of the project area. It focuses on the demographic and socio-economic characteristics of people in the project area with a view to providing a picture of the baseline socio-economic situation and to provide a basis for anticipating socio-economic impacts and designing appropriate mitigation measures. Refer to **Annex 7** for the socio-economic questionnaires. The population demographic data is secondary data obtained from Population and Housing Census - Kenya National Bureau of Statistics (2009). The data used to evaluate the project area socio-economic status is primary data obtained from the socio-economic survey conducted by the ESIA Study team between **November 12, 2014** and **December 5, 2014.**

6.2 Population and Demography of Turkana County

Turkana County has a population of 855,399 of which 53% are male and 47% female (KNBS, 2009). The population density in this vast county is low and varies from 1 person per Km^2 in Kibish Division to 29 persons per Km^2 in Kakuma Division, with a county average of 6.9 persons km^2, with a with a sex ratio of male/female 92:100. There are 123,191 households. The total population almost doubled changing from 450,860 in 1999 to 855,399 in 2009 this population change is almost double (89.7%) when compared with the National population change of 34.6% from 1999 to 2009.

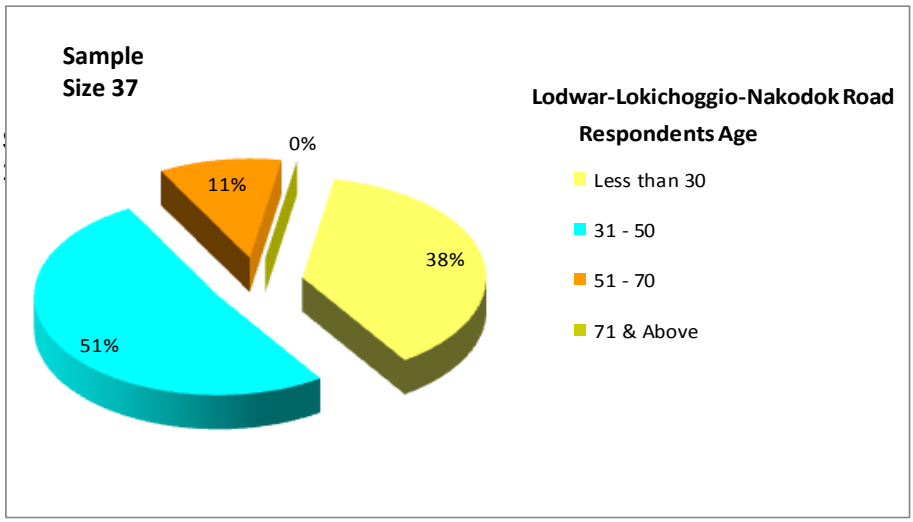
6.3 Socio-economic Survey Results

The primary data collected during the socio-economic survey has been used to evaluate the baseline status of the project area community.

6.3.1 Age Distribution of Lodwar-Nakodok Road Corridor Residents

In **Figure 16**, majority of the respondents fall under the 31-50years age bracket (51%) followed by respondents under the age of 30years (38%) with the minority being within the 51-70years age bracket (11%) (n=37). This implies that the population that will be affected by the project is largely economically active.

Figure 16: Lodwar-Nakodok Road Area Respondents According to Age

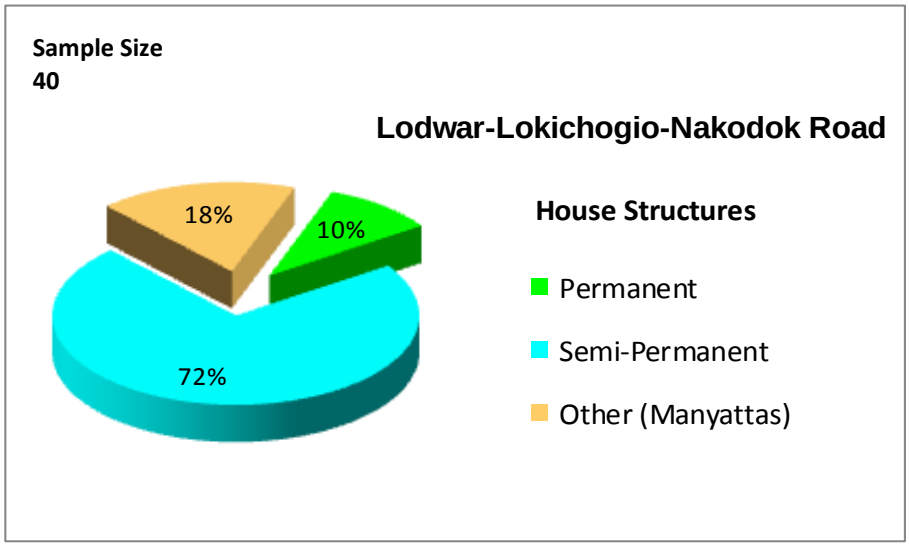


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.2 Quality of Housing of Residents along Lodwar-Nakodok Road

Majority of the Lodwar-Nakodok Road corridor respondents live in semi-permanent houses (72%) and another 10% live in permanent houses. This shows that the road corridor communities have changed their livelihood status and are slightly urbanized. The tradional housing unit (Manyattas) form 18% of the house structures in the road corridor (Figure 17) (n=40).

Figure 17: Quality of Housing along Lodwar-Lokichogio-Nakodok Road

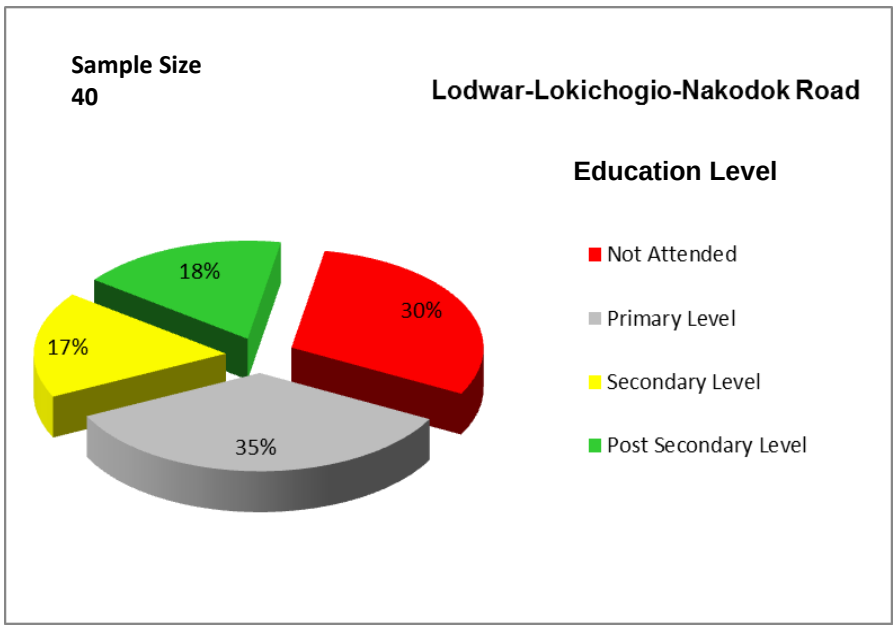


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.3 Level of Education of Respondents along the Lodwar-Nakodok Road Corridor

Majority of the road project respondents has attained primary school level of education 35%) while an almost similar percentage (30%) have not attended formal education.

Figure 18: Education Levels of Lodwar-Nakodok Road corridor respondents

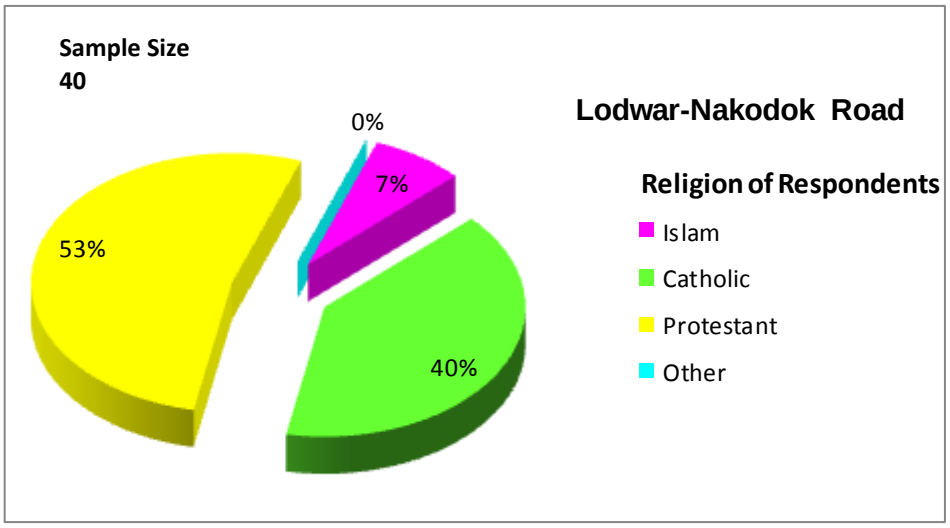


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.4 Religious Following

Majority of the Lodwar-Nakodok Rod corridor respondents were Protestants (53%) followed by Catholics (40%).

Figure 19: Lodwar-Nakodok Road Respondents According to Religious Following

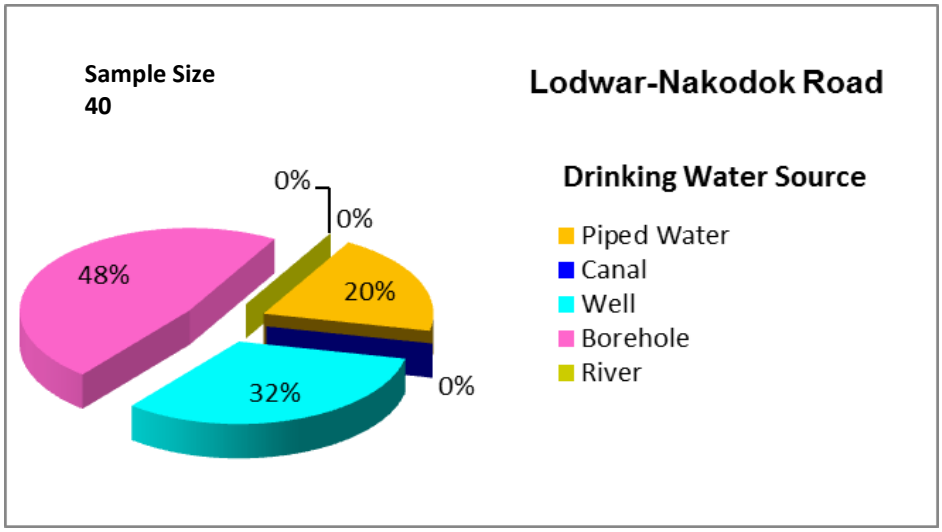


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.5 Drinking Water Sources for Lodwar-Nakodok Road Corridor Respondents

When the study turned to the respondents' sources of drinking water along the Lodwar-Nakodok Road corridor, the results obtained were as shown in **Figure 20.** Majority of them use piped water source (70%) which reflects the urban nature of the project area. The 30% who use other source largely rely on water purchased from water vendors. The water vendors were noted to distribute the commodity on hand carts.

Figure 20: Drinking Water Sources for Lodwar-Nakodok Road Residents

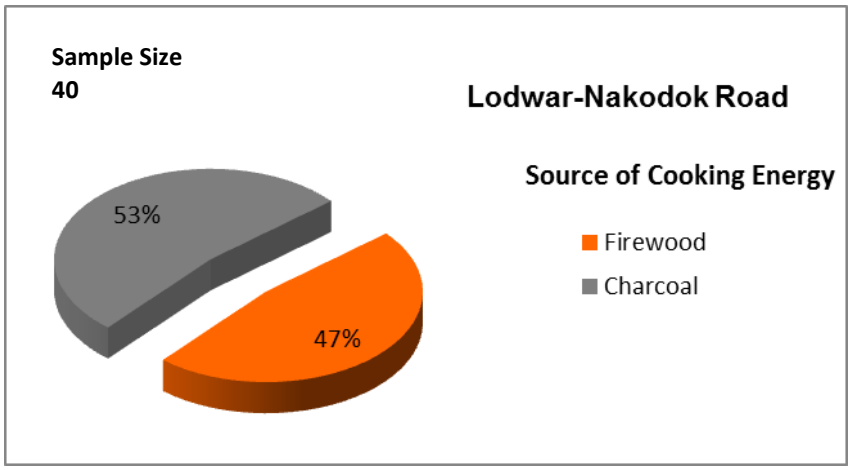


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.6 Source of Energy for Cooking

Respondents from Lodwar-Nakodok Road corridor exclusively use two sources of energy for cooking (Charcoal 53%.and Firewood 47%). This is a worrying trend when considering conservation of forest resources. See **Figure 21.** Firewood does not only deplete forest resources, it significantly contributes to air pollution resulting in Upper Respiratory Tract Infection (URTI) which is also reported as one of the most prevalent OPD diseases at almost every health facility in the project area.. Sensitisation of the project area community should be carried out to educate them on the impacts of absolute reliance on natural vegetation for cooking energy (destruction of forest resources and health effects) Use of clean energy sources like gas and charcoal briquettes) should be promoted.

Figure 21: Cooking Energy for Lodwar-Nakodok Road Corridor Community

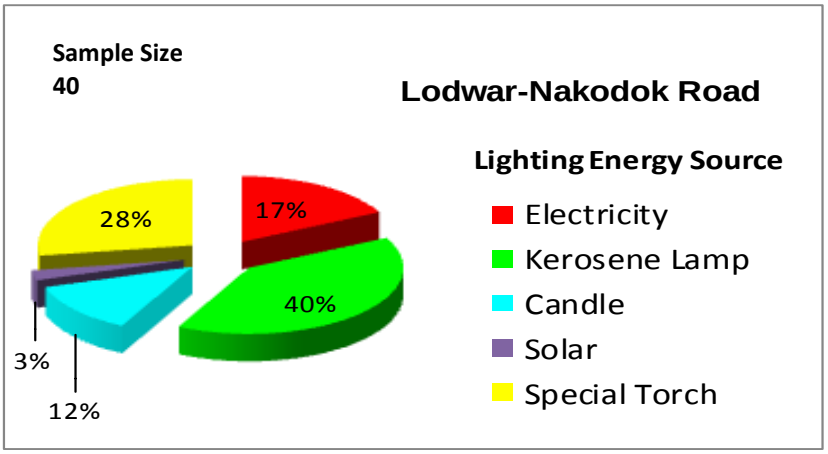


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.7 Source of Energy for Lighting

Majority of the project area respondents use Kerosene Lamp (40%). The special torch follows with 28% usage and electricity 17% and candles at 12%. As shown in shown in **Figure 22** (n=40). Use of kerosene lamps is unsafe health-wise and may contribute to respiratory and eye related diseases due to smoke emission.

Figure 22: Energy Source for Lighting at the Lodwar-Nakodok Road Corridor

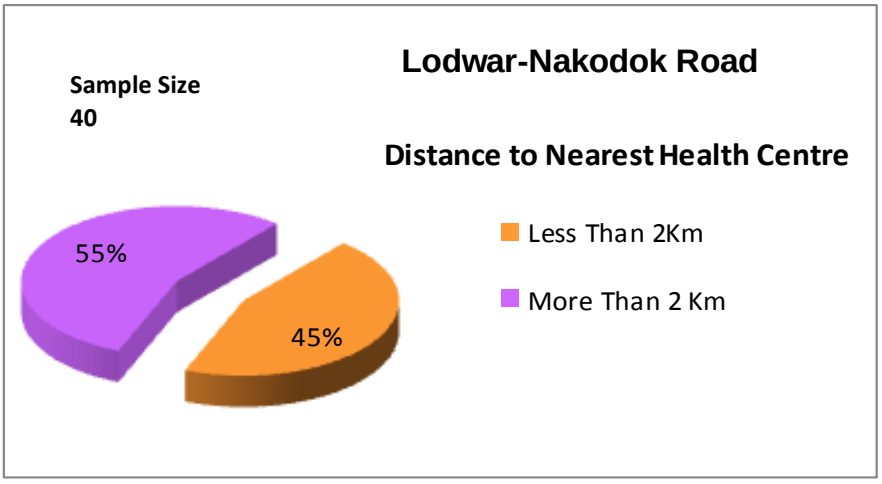


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.8 Distance to Health Centre/Dispensary

In the Lodwar-Nakodok Road corridor, respondents with access to a medical facility that are less than 2km (45%) are less than those who access a health center more than 2km (55%) (n=40). See **Figure 23.** This confirms that health facilities (dispensaries/Health Centres and hospitals are not within easy reach for majority of the community members along the Lodwar-Nakodok Road corridor. Majority of the health facilities are located at major centres.

Figure 23: Distance to nearest Health Centre for respondents

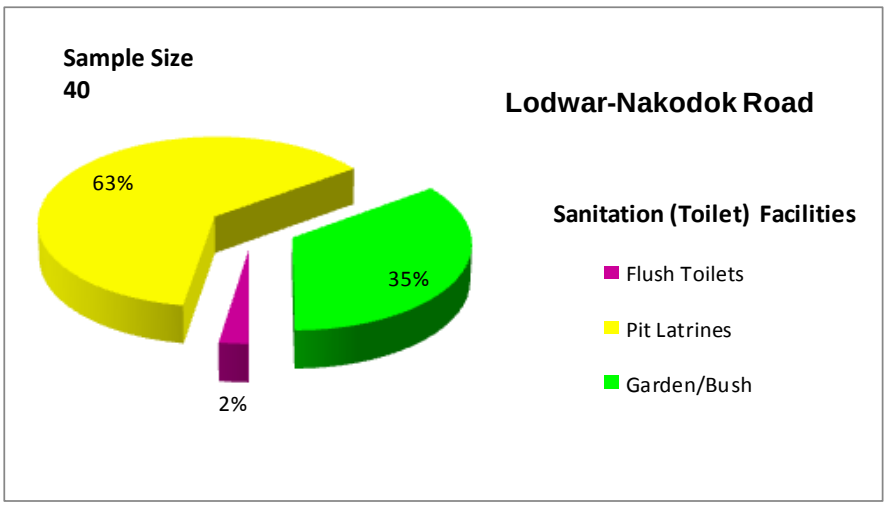


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.9 Sanitation Facilities at the Lodwar-Nakodok Road

About 63% of the respondents along the Lodwar-Nakodok Road corridor use pit latrines. About 35% do not have any developed sanitary facility (use the bush) to answer the call of nature. A very small percentage (2%) has flush toilet facilities See **Figure 9**. When considering that a significant population (32%) use water from wells for drinking and given that groundwater is relatively shallow, there is cause for concern on health and sanitation of the community since the wells are located where community is residing.

Figure 24: Sanitation Facilities at the Lodwar-Nakodok Road Corridor

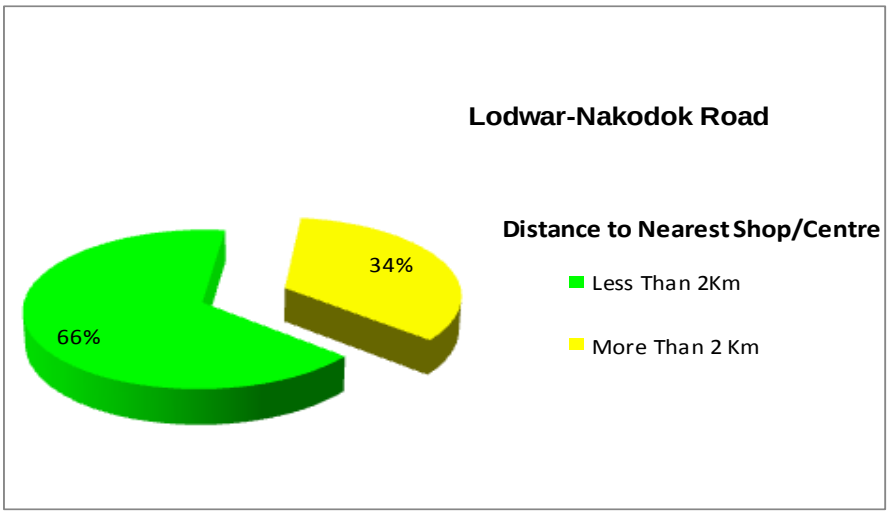


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.10 Distance to the Nearest Market Centre

The respondents in the project area have access to a market or shop that is less than 2km away (66). See **Figure 25.** This suggests that project area community is able to access shops or markets for essential supplies.

Figure 25: Distance to Nearest Market Centre

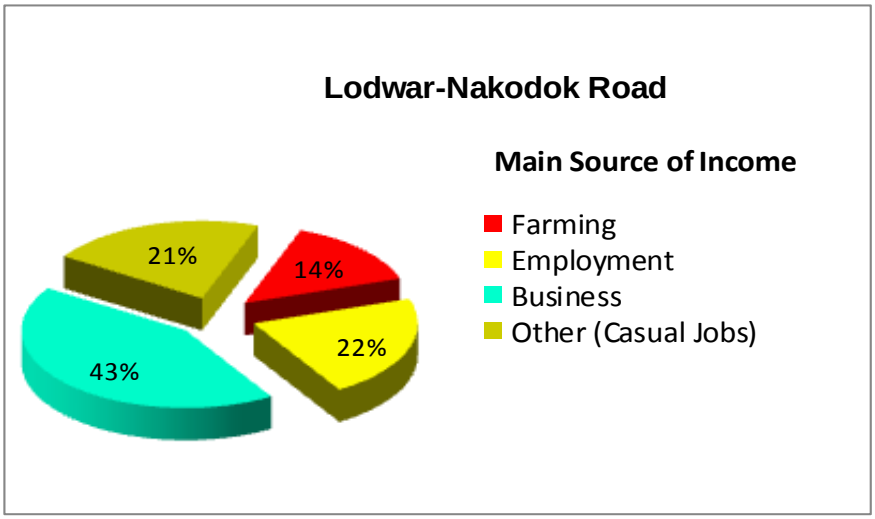


***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

6.3.11 Source of Income for Lodwar-Nakodok Road Corridor Respondents

Respondents practicing business including livestock trade were the majority (43%) followed by those in employment (22%). Those carrying out casual jobs form 21% of the income generating activities and those carrying out farming a meager 14% as shown in **Figure 26.**

Figure 26: Sources of Income for Lodwar-Nakodok Road Corridor



***Source: Panafcon Ltd** – ESIA Study Socio-economic Survey – Lodwar-Nakodok Road 2014*

7 PUBLIC PARTICIPATION AND CONSULTATION

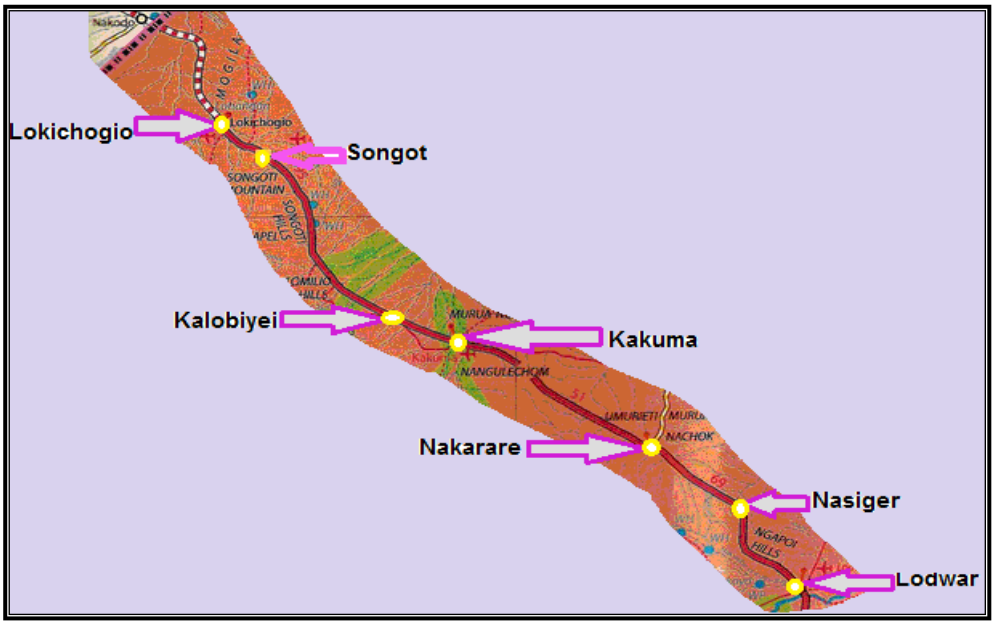
Public consultation meetings were held for the proposed Lodwar – Lokichogio - Nakodok (A1) Road in order to capture the concerns associated with the project from all stakeholders. The stakeholders who were targeted were members of the local community, local leaders, and officers from the Turkana County Government, officers of the National Government, business owners, religious leaders, NGOs and transporters, among others. There was an earlier mobilization meeting whose purpose was to introduce the ESIA team to the area, inform the local communities about the proposed road project and identify key stakeholders for interviews and public consultation meetings. Public consultation meetings were used to explain to stakeholders the benefits of the proposed road project, potential adverse impacts, measures to mitigate negative impacts, and arrangements to compensate project affected persons. Stakeholders where thereafter given the opportunity to give their views, opinions and suggestions on the most appropriate considerations during the construction and operation of the road.

7.1 Approach to Stakeholder Consultations

Stakeholder consultations occurred at two levels.

- The first level involved in-depth interviews and discussions with institutional stakeholders, such as the provincial administration, County Government, United Nations Agencies (UNHCR and IOM), Government departmental heads and Civil Society, NGOs and CBOs representatives. The interviews were intended to share information on the road project with them, and solicit their opinions and recommendations.
- The second level involved public meetings with the general public, particularly the local communities, their leaders, pastoralists, farmers, transporters and the business community to discuss the proposed road project and obtain their opinion and recommendations about the project. A total seven meetings were held between 2nd and 5th December 2014 at designated venues along the proposed road corridor.

Figure 27: Towns/Centres where PCMs were held along Lodwar– Nakodok Road



Source: *ESIA Study Lodwar-Nakodok Road 2013*

The Public Consultation Meetings (PCMs) were convened at various locations that were used in the 2013 ESIA Study. The target groups for the Public Consultation Meetings were:

- Project area community
- Local Administration
- Business community within the project area
- CBOs and NGOs
- Government Agencies
- Local leaders

Table 21: ESIA Public Consultation Meeting (PCM) Venues and Dates

#	Location	PCM Venue	Day	Date	Time	No. of Participants
1.	Lodwar Township	Mikeka Grounds/LodwarTown	Tuesday	02/12/2014	10.30am	30
2.	Nasiger	Nasiger Lagga/River	Tuesday	02/12/2014	02.00pm	213
3.	Nakalale	Makutano Gold Market	Wednesday	03/12/2014	09.30am	105
4.	Kakuma	Kakuma Town – Baraza Park	Wednesday	03/12/2014	02.30pm	75
5.	Kalobeyei	Baraza Park, Kalobeiyei	Thursday	04/12/2014	09.30am	177
6.	Songot	Chiefs Office, Songot	Thursday	04/12/2014	02.00pm	125
7.	Lokichogio	Anglican Church Grounds - Lokichogio	Friday	05/12/2014	10.00am	142

***Source: Panafcon Ltd** – ESIA Study – Public Consultations – Lodwar-Nakodok Road 2014*

Consultations with stakeholders were carried out among the people living and carrying out their daily livelihood activities within the environs of the Lodwar-Lokichogio-Nakodok Road. The aim of the consultations was to ensure that interests and concerns of all stakeholders are identified and incorporated in the project development, construction and operation (rehabilitation of the Lodwar-Nakodok). The consultations and the PCMs that were convened from Tuesday December 2 - Friday December 5, 2014 enabled interested and affected parties to contribute their concerns (views, opinions and suggestions on the project). These views and suggestions can reveal environmental issues that were not captured earlier. Findings of stakeholder analysis are very important in predicting impacts and the development of mitigations and EMP.

The study employed three main methods of consultations to get the data presented in this report. These are:

- Meetings and discussions with Key Stakeholders;
- Questionnaire administration and interviews;
- Convening of Public Consultation Meetings within the project area.

Key informants included County Leaders and representatives from various Government Departments, CBOs and NGOs. The rest of this report identifies the critical issues emerging from the proposed rehabilitation of Lodwar-Nakodok Road.

7.2 Purpose of Stakeholder Consultation

The main purpose of carrying out stakeholder consultation was to obtain views, concerns and opinions of the project area community and other interested parties regarding the project so as to incorporate their contribution into the project development to safeguard

the environment, the interest of key stakeholders particularly the local community, project area leadership and agencies directly or indirectly affected by the project.

Stakeholder consultation was conducted to take the opportunity to elaborate the essence of the project, to inform the stakeholders of any potential negative impacts and to elaborate on the positive aspects so that informed decision is made by the stakeholder regarding the project.

The Public Consultation Meeting (PCM) was aimed at achieving the following specific objectives:

- Collection of additional baseline data/ information on the project area community;
- Conduct further stakeholder and community consultations and sensitization;
- Provide the project area community with an opportunity to directly interact with the project developer through the ESIA Consultants and ask questions, raise issues and concerns pertaining to the proposed project and contribute to the identification of project impacts, mitigation measures and project alternatives.

7.3 Stakeholder analysis

A number of stakeholders were involved in activities that were impacted directly or indirectly by the existing road. They were therefore likely to be affected in some way by the upgrading of the road. The table below identifies some of the stakeholders with their roles in activities that depend on the Lodwar – Lokichogio – Nadapal Road.

Table 22: Stakeholders in activities that rely on Lodwar - Nadapal Road

#	Stakeholder	Role
1.	ALRMP 11	Capacity building and construction of roads water and sanitation structures
2.	Community Development Trust Fund (CDTF)	Construction of schools, dispensaries and health centre, water and irrigation structures
3.	Constituency Development Fund	Construction of roads and capacity building
4.	District Development Office	Co-ordination of HIV/AIDS programmes
5.	District Education Board	Coordination of education activities in the district
6.	District Health Stakeholders forum	Coordinate Health activities in the district
7.	GOK	Provision of policy Guidelines, regulation and facilitation in capacity building and training
8.	KEMSA	Supply of drugs to health institutions.
9.	Kenya Power and Lighting Company	Maintain the existing power lines, extend power supply to new consumers and implement rural electrification programme.
10.	Kenya Red Cross	Distribution of relief foods and of medical supplies during emergencies and construction of latrines
11.	Kenya Wildlife Service	Opening and maintaining roads within the game reserves; construction of water structures
12.	Kerio Valley Development Authority.	Capacity building, construction and rehabilitation of roads and air strips.
13.	KPLC	Provision of electricity connectivity to national grid.
14.	Local Authority Transfer Fund	Construction and rehabilitation of roads and air strips, housing construction.
15.	Local community	Provision of the market for goods and services
16.	National aids Control Council	Fund HIV and AIDS activities in the County
17.	PBK, and KARI	Provision of research and marketing of crops and Livestock products
18.	Police, Judiciary, Prisons and Probation	Ensuring that the offenders who go to prison or are put under probation are helped to come out of their life of crime and are trained to become useful members of the society.

19.	Private Sector	Support community initiatives
20.	Provincial Administration	Coordinating government business in the County and ensuring adequate is security
21.	SIDA (NALEP)	Capacity building for farmers
22.	UNICEF	Support to girl child education, health services, construction of education facilities and nutrition supplements; construction, rehabilitation and equipping of schools and provision of bursary funds; support health services, construction of sanitation facilities, capacity building, nutritional support
23.	World Food Programme	Provision of food for the school feeding programme; Provision of food for the supplementary feeding programme.

7.4 Stakeholders Consulted During ESIA Study

The Study Team held discussions and interviews with key stakeholders. These included:

Primary Stakeholders

- Project area community
- Businesses within the road corridor

Secondary Stakeholders

- Ministry of Interior and Coordination of National Government:
  - Project area Chiefs and Assistant Chiefs
  - Project Area Village Elders;
- Officers from the following Health Institutions
  - Lodwar County and Referral Hospital
  - Naiyanae Ankalalio Dispensary - It is to be officially opened in 2015
  - Lomil Dispensary
  - Oropoi Dispensary - Located around 8km from the road
  - AIC Natira Dispensary
  - Aposta Health Facility
  - Lopiding Sub - District Hospital - Located around 4km from the road in Lokichoggio;
- Religious Groups;
- Business Community;

7.5 Modalities for stakeholder consultation

Each category of stakeholder required a different approach/mode of consultation.

7.5.1 Consultation with Project Area Community

The project area communities were consulted through administration of two questionnaires specifically designed for this purpose. The socio-economic questionnaire was administered on households/individuals within the proposed project area while feedback forms were administered to the Public Consultation Meeting (PCMs) participants. These were done for purposes of obtaining baseline socio-economic and environmental data of the project area community and to capture their views, opinions and concerns regarding the environmental aspects of the proposed project. The feedback forms and socio-economic questionnaires have been provided in **Annex 5 and Annex 7** of this report respectively.

7.5.2 Consultations with Secondary Stakeholders

In this category, cross sections of stakeholders were met; discussions held using key informant interview guide and later stakeholder questionnaires were administered to obtain information regarding the proposed project and the community's perception. This category included local administration, civil servants, local government officials and service providers in the water and health sectors. The main aim of the consultation was to:

- Hold discussions with Key Stakeholders on the project and its components;
- Sensitize them on the potential project impacts;
- Enlighten them on the proposed mitigation measures;
- Obtain views & concerns regarding the project;
- Identify and discuss project alternatives;
- Get proposals on project safeguards to the environment and local communities;
- Collect preliminary baseline data/info on project area and community;

Consultations took place in respective offices and in the field where this was possible.

Discussions started with the Consultant team explaining the project to the target officers. Thereafter, the respective officers (s) were asked to identify their environmental concerns on the same. Stakeholder questionnaires were thereafter given out for the officer to fill in. Duly filled in stakeholder questionnaires are in **Annex 4.**

7.5.3 Public Consultation Meetings (PCMs) Announcement and Agenda

The meetings were facilitated by the Chiefs and Assistant Chiefs of the areas where the each meeting was being convened.

PCM Invitations

Invitations for Members of the Public to attend the meetings were relayed through various media as follows:

- Chiefs Offices - Announcements made in English, Kiswahili and local language;

The PCM Agenda

The Agenda of the PCM convened on Friday October 31, 2014 from 10.00 am – 01.00pm was as follows:

1. *Arrival of Guests/Participants*
2. *Opening prayer by one of the participants*
3. *Introduction of the participants*
4. *Purpose of conducting the ESIA and the Consultation Meeting.*
5. *Various project components, benefits and possible impacts/mitigation measures.*
6. *Comments/Questions on the Proposed Project by Participants (Q & A).*
7. *Filling of the ESIA Questionnaires/Feedback Forms.*
8. *Closing Prayer.*

The attendance of the PCM was good and the community showed a lot of interest and support for the project

Minutes of the discussions at the PCM were recorded and form part of this ESIA Project Report. During the PCM, the proposed project was elaborated to the participants through a presentation that was conducted in Kiswahili to ensure participants understood all the issues related to the project. An interactive questions and answers session took place during the PCM immediately after the presentation on the proposed project. Participants finally filled in feedback forms/questionnaires. The questionnaires have been included in **Annex 5** Minutes of Public Consultation Meeting and attendance register are provided in **Annex 3**.

Plate 12: PCM in Progress at Nasiger Lagga/River

Plate 13: PCM in progress at Kakuma Baraza Park

Plate 14: PCM in pogress at Nakutano Gold

Plate 15: PCM in progress at Mikeka Grounds in Lodwar Township

Plate 16: PCM in progress at Kalobiyei

Plate 17: PCM in progress at Songot Chief's Office

Plate 18: PCM in progress at ACK Grounds in Lokichogio

7.6 Feedback from stakeholder interviews

Acceptance of the Project

Generally, the project is accepted by all the stakeholders and those attending the meeting since the rehabilitation of the road will improve movement and enhance economic development of the region.

7.6.1 Provincial Administration

The local administration provided the following feedback:

- The road project is long overdue and would benefit the people of Turkana County immensely. The road should be designed and budgeted with a security component as the area is at level 4 in terms of security. It is therefore commonly known as the zone of loose guns. The main security issues in the area include cattle rustling and thuggery in major towns. There are, however, minimal incidences of burglary and car thefts.
- Due to illiteracy and low level of education among locals, there will be need to use local leaders in awareness creation.
- The local population resist foreigners coming to do casual jobs and therefore they should be given first priority in employment during road construction. Conflict over employment opportunities is foreseeable if locals are discriminated against during recruitment for jobs
- Land ownership would create conflicts during valuation and compensation. This can be addressed through provincial administration and clan structures.
- Affected property should be valued at market rate and paid for promptly to avoid apathy while affected water points such as pans or boreholes should be replaced.
- The demolition / high cost of compensation of encroached buildings within Kakuma Town could be avoided if a by-pass of the town was created.
- The road should be marked clearly with signs at animal and human crossing points. The community will need to be educated on the need to observe road signs.

7.6.2 Feedback from County Government

- Most people in Turkana County do not have land ownership documents; very few have allotment letters. The pastoralists move around in such of pasture, but the elders of the villages know who owns each piece of land.
- So many properties along the road will be destroyed in town areas such as Lodwar, Kakuma, Makutano Gold and Lokichogio, so the road corridor should be reduced to 40 m instead of 60 m.
- Bridges should be constructed instead of drifts crossing the laggas
- Persons coming to work in Turkana should be sensitive to the culture and customs of the Turkana.
- There are different types of structures along the road even huts; all of them should be compensated for

7.6.3 District Heads of Departments

- The road will lead to growth of towns including Kainuk considering that these are now growing without adequate infrastructure
- Economic benefits will also include agriculture around the Turkwel gorge area
- The existing road is not all that bad, but requires recarpeting
- Attention should be paid to laggas (seasonal streams) where when it rains; transport is impaired at several points. Avoid drifts and construct bridges across these lagas notably Kalobeyei

7.6.4 Security, Immigration and Customs

- The construction of the road will make the boarder point busier. Currently, transporters complain of the poor state of road and insecurity because vehicles travel at low speed. The insecurity problem will be solved as speed increases making it difficult for bandits to attack vehicles.
- The many trans-border people who will benefit by using the improved road will include students seeking education opportunities in Kenya, professionals going to South Sudan and refugees

7.6.5 Refugee agencies

- Many of the refugees are from areas they have never seen tarmac neither do they know the rules on road use and do not understand the meaning of road signs. It will be necessary to educate them of road signs

7.7 Feedback from public consultation meetings

The following concerns, comments and recommendations were given by members of the public during public consultation meetings.

Fears and concerns

There were fears that

- Compensation will be delayed leaving many PAPs to spend in the cold and have no livelihoods and thereby leaving them poorer.
- Similarly, many raised concerns that they may lose land due to lack of appropriate documents or delayed payments resulting from court cases where there are disputes.

- There were also fears that some business structures though allocated and approved by the County councils are on the 20/25m road reserve and may warrant demolition without compensation.
- There were also fears that the promise of compensation cannot be trusted as many had watched on the national TV buildings being demolished and the owners complaining of inadequate or non -compensation,
- What will happen to graves that we leave behind as we get resettled?
- What will the criteria for employment during road construction?

Recommendations

- The Provincial Administration and the clan leadership should be incorporated in the process of identifying who rightfully owns the land
- Compensation should be given before relocation
- Locals should be given a chance to do casual jobs such as clearing the grass and land during road construction.
- The road design should ensure that the huge volumes of storm water are accommodated adequately in the culverts, bridges and drainage channels that will be constructed.
- A psychological counselling programme should be incorporated into the road project to address the Project Affected Persons (especially the aged and other vulnerable persons)
- The road should address the lagga behind Makutano Gold market to ensure that the embankment against water flowing along the lagga is not disturbed and cause overflow to the shops
- The dangerous extensive quarry behind Makutano Gold market, created by extraction of materials during past road construction efforts, should be addressed either through backfilling or designing it as a water pan and fencing it off.
- Quarries excavated during material extraction should not be refilled after use, but instead improved by fencing to serve as water collection pans for the community. Further, these should be designed in a way that they are not deep but wide so as to avoid dawning of animals and people. These sites should be left as water pans where the pastoralists will depend on for water supply in future.
- The road should have a HIV/AIDS programme with VCTs centres spread all along the road corridor
- In order to avoid heavy compensation and loss of livelihoods at Kakuma and Lokichogio where there are many affected structures constructed without proper planning, it will be important to consider providing a bypass
- The road construction and all associated activities should be undertaken transparently
- Valuation should be based on current market value
- The road design should designate specific points where people and/or livestock cross the road and install signboards and other features (bumps to prevent/reduce accidents. Such crossing points should not be too far apart to protect the public from long distances walking with their animals.

Hotspots that require speed bumps and/or signboards are:

a) Songot Location: Nakururu near Lotelej, Songot Market, Teremukwu near Songot Secondary School, Teremukwu near Lominat, and Lokichogio
b) Kakuma Location: Komdei, Lokichar near Naterebei.
c) Kakuma bridge, Nakoyo, Nokilekips and Naustorm

7.8 Anticipated impacts as perceived by members of the public

Positive impacts

From a general perspective, the anticipated positive impacts in order of importance include:

a) Jobs/employment
b) Increased revenue
c) Improved security
d) Increased trade
e) Business and market expansions
f) Improved access to education and health facilities
g) Improved transport and communication network
h) High standard of living
i) Enhanced development of the area traversed by the road

The following specific positive impacts are anticipated from the proposed project:

- Reduced fuel prices with a variance of 7% between Kitale and Lodwar/Lokichogio
- Reduction in cost of motor vehicle operation and maintenance. The bus owners estimated to be spending KShs 300,000 per month on repairs for each bus. This will also reduce shortages of PSV and commercial vehicles passenger transport between.
- Business activities on road reserves will be economically revamped
- Lower cost of commodities e.g. in Lokichogio

The road project is expected to reverse the following constraints in the Livestock sector:

- Insecurity caused by castle rustling and disputes over grazing resources
- Drought
- Encroachment of Prosopis sp
- High Cost feeds
- Impassable roads
- Poor livestock husbandry practices
- Low quality of livestock breed
- Inadequate livestock and livestock product markets

Potential negative impacts as perceived by members of the public

The population along the project corridor anticipate various negative impacts from the road project, such as:

- Relocation and displacement of some people,
- Increase in population (immigration of workers) and long term increase in population. The incoming population will include workers who will be constructing the road, business people, drivers, entrepreneurs and traders
- Increase in the spread of diseases, especially HIV/AIDS and STIS and increase in prostitution
- Strained social facilities as a result of arrival of foreigners
- Increased accidents due to speeding; livestock could be prone to accidents following road construction
- Increased drug abuse
- Conflicts over land ownership and allocation since the value of land will rise

Table23 presents an analysis of some of the Key Stakeholder Questionnaires and PCM Feedback Forms. The Key Stakeholders and Feedback Forms filled in by PCM respondents are placed in **Annex 5.**

Table 23: Analysis of Stakeholder and PCM Participant's Feedback

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
1.	Barnabas E. Eloiloi	OOP - Chief Nakalale	N/A	0715008479	Local Leader	• Aware of the project • Project will bring development • There will be quick transportation • Communication will be good	• Implement project to foster development • Place road signs • Control speed of vehicles • GoK should continue improving roads • Project should proceed
2.	Vida Y. Rutto	Aphia Plus Imaruha	22443325	0721380045	Stakeholder	• Aware of the project • Good Road to access Lokichogio easily • Organisation has activities in Lokichogio •	• Minimise dust during construction • Erect speed bumps in centres and where animals cross • Have proper signages • .
3.	Lochuch Eshinyen Christopher	OOP – Ast Chief Lodwar Township	12910335	0729411104	Local Leader	• Aware about the project • Project will be and South Sudan • Movement of people and goods will speed up • Health problems from dust and smoke • There will be increase in noise • Air pollution will from dust and smoke • Machines may weaken foundations of existing houses • Project will enable people to push their development agenda forward	• Project should proceed • Pay compensation to affected persons • Offer at Construct bridges instead of drifts • Project should proceed with affected persons relocation assistance
4.	Cosmas Nakapa Esoguru	OOP – Chief Kakuma Location	-	0720916213	Local Leader	• Aware about the project • Project will ease transportation of goods and services • It will enable quicker movement • Project will bring development and growth of businesses	• Project should proceed • Damage to trees and other vegetation • Environmental degradation • Project affected persons should be fully informed that it is a road project
5.	Emmanuel Lopongo	OOP – Chief of Kalobiyei Location	0147361	0724272924	Local Leader	• Aware about the project • Project will bring development • There will be better infrastructure • More businesses will come up	• Project should proceed • Destruction of houses and other structures • The cutting down of trees

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
						• of goods and services • It will enable quicker movement • Project will bring development and growth of businesses • Employment will improve	
6.	Daniel Losil Kakure	OOP – Chief Lokichogio Location	-	0700783998	Local Leader	• Aware about the project • Project will create development • It will open new areas for development • Trade between Kenya and South Sudan • Project is delaying too much • There may be poor remuneration/compensation of affected people	• Project should proceed • Include zebra crossings • Put up bumps to control speeding in urban centres • Include flyovers and bridges • Include parking areas along the highway • Include lights along the highway
7.	Meshack Lokalei Loter	OOP – Chief Songot Location	-	0712700362	Local Leader	• Aware about the project • Project will create employment • Enhance trade • There will be quicker communication • It will boost the economy of the region • There will be increase in diseases due to population increase • There will be destruction of affected buildings • Project will enhance good relationship between Kenya and South Sudan	• Proper plans for compensation should be put in place
8.	Hon. Immanuel Imana	County Government	-	0723059969	County Leader	• Aware about the project • Sign post destroyed by locals due to lack of awareness • Former road did not fully identify environmental effects	• Project should proceed • Carry out sensitization and awareness creation • Turkana 's high temperature affects tyres/safety •
9.	Kenya Forest Service	Ecosystem Conservation – Turkana County	-	0721307235	GoK - Lead Agency	• Not aware about the project before now • Project will increase business opportunities	• Project should proceed • Purchase tree seedlings for planting where some have been cut down. • Bear in mind class of the road

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
						• Project will enhance service delivery including sensitization of communities on environmental conservation, planting of trees, sale of seedlings • Trees will be cut down especially where there are diversions • There will be poverty alleviation	• The class of the road should be that of Heavy commercial vehicles since such vehicles will frequent the route.
10.	Mus Tioko Bwire	Helpage	-	0720660791	NGO	• Aware about the project • Project will enhance movement of people and goods • It will boost economy of the region • It will spur growth and development • Project will pollute environment	• Project should proceed • Involve community in ESIA to identify mitigation measures •
11.	Charles M. Igiha	Min of Interior	11282204	0727151692	County Leader	• Aware about project • Project will spur development • There will be increased accidents due to speed • There will be loss of vegetation due to road deviations • New centres will emerge • Security will be enhanced	• Project should proceed • Sprinkle water to reduce dust
12.	Daudi Wilfred	Min of Interior	11439754	0724837058	County Leader	• Aware about project • Project will open up the area • Project will improve mobility • There will morality • HIV/AIDs and STI infections will increase. • There will be increased developments on road reserve areas • There will be improved security	• Project should proceed
13.	Hellen Kwendo	International Rescue Committee	27761784	0722448312	NGO	• Not aware about the project before now • Road safety and security will be enhanced • The project is good/beneficial	• Project should proceed • Project construction should be speeded up so benefits can coming in.

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
						• Project will reduce the cost of goods in Lodwar and beyond •	
14.	Jackson Misale	Ministry of Health - Medical Superintendent, Lopiding Hospital Lokichgio	-	0729827418	Health Services to Community	• Aware about project • Project will facilitate easy movement • Improve accessibility • Project will cause displacement	• Project should proceed • Put in place appropriate safety measures
15.	Lodwar Water and Sanitation Company Ltd (LOWASCO)	Water and Sewerage Services		0720387061	Service Provision (Water and Sewerage)	• Aware about the project • Project will open up region • There will be improved tourism and industry development • There is lack of information regarding progress of the project • There will be excavations to facilitate construction	• Project should proceed • Fill up any excavations properly • Plant trees to replace cut ones and more • Take care of water and electricity lines when excavating • Make provisions for water and other services in the project
16.	Bernard Odinoh	National Government Administration	13877895	0721216099	Administration	• Aware about the project • Project will reduce cost of living • Project has the potential to cause pollution	• Project should proceed • Sprinkle water to reduce dust
17	Tioko Logiron	Executive, Infrastructure and Housing – Turkana County Government	-	-	County Government	• Aware about the project • The project will bring several benefits • It will destroy trees • There has been low consultations in the past •	• Project should proceed • Consultations and Public participation should be enhanced • Project should be extended to the entry to the County (Kainuk)
18.	David Eloket Lokuss lokidongi	Turkana County Government		0721174968	Turkana County Government	• Aware about the project • Project will open up linkage and living standards in the region. • Project will cause demolition of property • There will be destruction of trees	• Project should proceed • Project should be implemented in an environmentally friendly manner.
19.	World Vision	World Vision Kenya (Lodwar)	-	0724521603	Provides Support to Communities	• Project will open closed areas for easy communication • Easy transportation of goods and services • Project may have some impacts but the advantages outweigh disadvantages	• The project should continue • Involve the community in all the phases of the project

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
						• The environment effect will be cutting of trees	
20.	Julius Chila Ekutan	Resident	20071015	0710616971	PAP	• Aware of the project • PAPs should be paid first before project implementation • Project will affect grazing land • Project will create employment • Business will increase	• My Family is affected by the project • PAPs to be paid
21.	Evans Ekae	Assistant Chief	-	0713800211	Resident	• Aware of the project • The project will contribute to business development in the area • Project will be good for development and transformation • The project will impact environment	• Project should continue • Compensate affected people affected
22.	Michael Mwea Lobor	Resident	5726764	0712162974	Stakeholder	• Aware of the project • Project will impact environment • There will be demolition of buildings	• Project should proceed • Compensation should be paid • Carry out community sensitisation
23..	Jackson Morukitieng Eremon	Resident	0320077	N/A	Stakeholder-Resident	• Aware about the project • Project will affect community • May cause transport delays during construction	• Include firefighting equipment in the proposed project • Construct a fly over/ foot bridge for pedestrian use • Put in place measures to prevent dust, noise and road accidents from the proposed project • Employ locals • Consider having a health facility catering to the spread of HIV/AIDs in the area

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
24.	Gabriel Ebulon Lokoroi	Businesswoman	4322686	0722335530	Stakeholder-Businesswoman	• Aware about the project • Project will improve business • Business between Kenya and South Sudan • Project will cause air pollution causing diseases	• Project should continue • Sprinkle water to reduce dust • Put in place road signs to avoid accidents • Develop proper road deviations.
25.	Esther Kachinga	Vice Secretary NAPOS	12585385	0724906415	Stakeholder-Resident	• Ware about the project • There will be demolition of houses • Business will improve • There will be job creation	• Project should proceed. • Announce to all project area community the planned dates for construction so that those affected by the project can prepare. • People should not be evicted in a hurry. Ample time should be provided.
26..	Florence Ekaran	Resident	2608407	0701245629	Stakeholder-Resident	• Aware about the project • Project will affect those close to the road and displace some without land • Floods affect transportation hence improved road is needed • Project will improve transportation • The project will affect environment	• Project should proceed
27.	John Eregae	Resident	4735794	0728574989	Stakeholder-Resident	• Aware about the project • Trees will be felled • There will be soil erosion • Transport will be quick • There will be destruction of resources where the road passes • Jobs will be created	• Project should proceed • People should keep away from the roadside during construction (Safety) • Project area community should be given jobs

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
28.	Gabriel Lobolia Edapal	Resident	32044946	0720354968	Stakeholder-Resident	• Aware about project • Project will improve transportation • Project will cause displacement of people	• Project should proceed • Project affected persons should be compensated • Provide adequate security during project implementation • Government to consider compensation without insisting on documentation so long as ownership can be confirmed using other ways.
29.	Emejen Lodakach	Resident	27767821	0708112387	Stakeholder-Resident	• Aware about the project • There will be educed accidents • Carry out sensitization of communities on project facts and impacts	• Project should proceed • Educate project area community on safe use of roads
30.	John Lochikiru Lomor	Resident	26313202	0725278119	Stakeholder-Resident	• Aware about the project • People will be displaced • Accidents will reduce •	• Project should proceed • Educate community on road use and road safety
31.	Alfred Kapoko Kamat	Resident	0143033	0728390037	Stakeholder-Resident	• Aware about the project • There will be relocation of some of family property • Project will improve transportation • Project will generate noise during construction	• Project should proceed • Sensitise the public (Community) on project facts and impacts • There should liaison with local rod committees • Hand over water boreholes to community after completion of construction
32.	Julius Edung Apuron	Resident	21587719	0708112387	Stakeholder-Resident	• Aware about the project • There will be displacement of people • There will be destruction of trees • Jobs will be created by project	• Project should proceed • Compensate and resettle affected persons • Inform community on project impacts

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
33.	Naikohan Priscillah	Resident	26529137	0719894849	Stakeholder-Resident	• Aware about the project • There will be displacement of persons • The project should reduce rod accidents • Displaced persons will impact resettlement site by cutting down vegetation to put up new dwellings	• Project should proceed • Carry out compensation and resettlement of displaced persons
34.	Lochas Johnstone Napao	Resident	32713932	0714833605	Stakeholder-Resident	• Road project will affect my family • Road will enhance employment • There will displacement of persons • Project will cause loss of vegetation	• Project should proceed • Sensitise people on safe
34.	Edipo Paul Emoru	Resident	27767110	0723410002	Stakeholder-Resident	• Aware bout project • Project will displace people • Transportation of goods and services will improve	• Project should proceed • Sensitise project area community on environmental conservation • Construct road well to last longer
35.	Mercy Natiira Lobuin	Resident	23686475	0714274113	Stakeholder-Resident	• Aware about the project • Increased noise levels during construction • Improved transportation • Fear that the contractor may carry out poor construction of the road • Put up clear signage and road markings to reduce accidents	• Project should proceed • Sensitise community on road safety and potential impacts • Carry out construction of the road using high standards to avoid reconstruction again. • Compensate the affected families
36.	Epak John Ekai	Resident	32023418	0712694837	Stakeholder-Resident	• Learning about the project for the first time • Improved transportation of people and services • There is lack of adequate	• Project should proceed. • Construct bridges and do away with drifts •

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
						bridges	
37.	Cosmas N. Lorot	Resident	10986551	0727380625	Stakeholder-Resident	• Aware about project • There will be reduced cost of bus fare to Lodwar and beyond • The road will bring about development	• Project should proceed
38.	Akwee Aregae Papa	Resident	10123171	0713888002	Stakeholder-Resident	• Aware about the project • The project will generate excess dust • There will be improved transportation •	• Project should proceed • Compensate affected families
39.	Lokarach Patrick Lokaale	Resident	237821232	0722776007	Stakeholder-Resident	• Aware about project • People will be displaced by project •	• Project should proceed
40.	Lojad Samuel Lokiding	Resident	32158990	0714	Stakeholder-Resident	• Aware about the project • Project will ease transportation • Demolition of structures and displacement of people	• Project should proceed.
41.	Lokai Wilfred Lokuno	Resident	29783410	0712109384	Stakeholder-Resident	• Aware about the project • Project is going to cause displacement • Transportation will be quick and cost will reduce	• Project should proceed • Project implementor should introduce road bumps to reduce speed of vehicles at centres • Road signage should be done • Road bridges should be upgraded and drifts removed.
42.	Likeny Lotukoi Lokodakume	Resident	20339322	0726943268	Stakeholder-Resident	• Aware of the project • Project will result in demolition of houses • There will be elevated	• Project to proceed • Contractor to put in place road bumps and clear signage

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
						noise during construction • Road will enhance development • Trade and development will be enhanced	
43.	Esinyen Emmanuel Ebenyo	Resident	20333878	0700492634	Stakeholder-Resident	• Aware about the project • Transportation will be eased and cost will come down • Due to speed vehicles will be causing accidents • There will be jobs created	• Project should proceed • Compensation should be paid to affected households and assisted to resettle
44.	Lutai Aruton Kokoi	Resident	26833801	0718210984	Stakeholder-Resident	• Aware about the project • Project will bring development • and environmental conservation	• Project should proceed • Include clear road signs and speed bumps to check speed of vehicles at centres • Sensitise/educate community on road safety and environmental conservation
45.	Lokeun Sylvia Kapua	Resident	25101224	0714120812	Stakeholder-Resident	• Aware about the project • Project will affected homesteads • The project will foster development in the area • Project will cause displacement and relocation	• Project should proceed • Compensate affected households and offer resettlement assistance
46.	David Kapua Lobach	Resident	10152523	0725224643	Stakeholder-Resident	• Aware about the project • Project will cause displacement of people • Transport to be cheaper •	• Project should proceed • Construct speed bumps to check vehicle speeds at centres • Ensure construction is done to high standards to avoid rapid deterioration of the road
47..	Symon Lochul Namuya	Resident	13315540	0727644708	Stakeholder-Resident	• Aware about the project • There will be impact from people with different	• Project should proceed • Sensitise project area community on the project and its impacts

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
						cultures coming together • Project will bring development	
48.	Julius Etabo Akula	Resident	24910266	0710662740	Stakeholder-Resident	• Aware about the project • Transportation cost will come down • . Development and businesses will improve	• Project should proceed • Understanding between community and project implementors should be enhanced • Construct bump at every centre to check speed of vehicles
49.	Akadai Mathew Morungole	Resident	29736221	0705932089	Stakeholder-Resident	• Aware about the project • Transport cost will reduce • Project will impact environment • The project will enhance development	• Project should proceed • Project implementers should construct speed bumps to control vehicle speeds
50.	Sabina Arukudi Sigerit	Resident	13648204	0718199490	Stakeholder-Resident	• Aware bout the project • Project will cause displacement of people • Project will impact environment • Project will enhance development	• Project should proceed • Include road bumps and signage
51.	Edung Alexander Natoo	Resident	47962408	0701671459	Stakeholder-Resident	• Aware about the project • There will be displacement of people • Job opportunities will be created • Transportation cost and time will be reduced.	• Project should proceed • Sensitise community on importance of the project and its impacts
52.	Habiba Hussein Issa	Resident	22703481	0722541775	Stakeholder-Resident	• Aware about the project • Project will improve business and development •	• Project should proceed • Sensitise community on the project and its impacts and benefits • Compensate PAPS and offer resettlement assistance to affected persons

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
53.	Roae Ekai	Resident	26505649	0712085636	Stakeholder-Resident	• Aware about the project • The project will enhance business	• Project should proceed • Compensate affected persons
54.	David Ereng Emaru	Resident	29786341	0701124083	Stakeholder-Resident	• Aware about the project • Many people will be displaced • Project will bring development • Transportation of people, goods and services will improve immensely •	• Project should proceed • Compensate households affected by the road project.
55.	Joseph Aletea Lochulo	Resident	0145041	07131586	Stakeholder-Resident	• Aware about the project • There will be displacement of people including myself • Businesses and development of the area will be enhanced	• Project should proceed • Compensate affected persons and offer resettlement assistance. • Sensitise community on project benefits and impacts
56.	Francis Eruth	Resident	32853369	0723870021	Stakeholder-Resident	• Aware about the project • Road will improve business	• Project should proceed • Construct speed bumps in every centre
57.	Gabriel Opsait	Resident	21505611	0710741755	Stakeholder-Businessman	• Aware of the project • Project will affect,/displace people • Project will bring about development of the area and improved businesses	• Project should proceed • Construct speed bumps and put clear road signages
58.	James Katitho	Resident	12908819	0704813037	Stakeholder-Resident	• Aware of the project • Project will improve businesses	• Project should proceed
59.	Peter Ekai Adipo	Resident	23867294	0725477599	Stakeholder-Resident	• Aware of the project • Project will cause displacement of families • Transportation will improve	• Project should proceed speed bumps and put in place clear road signs • Sensitise the community on the project, its benefits and potential

#	Stakeholder Name	Department or Organization	ID No.	Telephone	Involvement or Role in Project	Stakeholder Interest, Goals, and Concerns	Follow-up Actions and Communication
							impacts
60.	Anne Njeri	Resident	26231863	0705124121	Stakeholder-Resident	• Aware about the project • Project will cause displacement of households • There will be improved transportation • Businesses will thrive • There will be improved development in the project area	• Project should proceed • Compensate affected households • Provide jobs to affected persons
61.	Maru Emejen Lotur	Resident	27912133	0704245496	Stakeholder-Resident	• Aware of the project • The project will generate dust and smoke causing pollution and affecting the community.	• Project should proceed • Construct speed bumps to control speed at centres along the project road.
62.	Susan Namuge Eyan	Resident	225697751	0703964305	Stakeholder-Resident	• Project should proceed	

Source: Panafcon Ltd *– ESIA Field Survey Activity – Lodwar-Nakodok Road 2014*

Key:

A	-	High Priority
B	-	Medium Priority
C	-	Low Priority
N/A	-	Not Applicable

8 ANALYSIS OF PROJECT ALTERNATIVES

This section of the report presents analyses of route options, pavement options and drift alignment options.

8.1 Analysis of route alternatives

Four alternatives have been considered under routes options for the proposed Lodwar – Lokichogio – Nadapal (A1) Road. These route options include:

a) No upgrading of the existing road ('no action' option)
b) Upgrading the existing road without any changes in route alignment
c) The proposed route option
d) Proposed route option with changes in alignment

8.1.1 Option 1: No upgrading of the existing road ('no action' option)

This option considers improvement and upgrading of the road to have negative impacts on both the environment and the local community. Thus, instead of advocating for measures to mitigate such impacts, the option considers the project largely unnecessary. Although those who hold this view in the project area are extremely few, they are primarily those who own large herds of livestock and have difficulty crossing the road with their livestock in search of pasture and water. Their perspective is, however, understandable since the existing road lacks speed bumps and road signs relevant to the land use of the area (livestock production). Thus, motorists end up driving at extremely dangerous speeds to the horror of local herdsmen. Nonetheless, this option is not the best because the adverse impacts of this project can be adequately mitigated. Moreover, failure to upgrade the road will deny both the project area and the East African region highly significant benefits.

8.1.2 Option 2: Upgrading the existing road without any changes in route alignment

This option is highly favoured by property owners and businessmen who are likely to be affected by the proposed road either as a result of loss of property or loss of business due to demolition of buildings along the road corridor or shift of business activities to the new road corridor. The option is preferred by a fairly some fraction of the population in the project area. However, it has two major disadvantages: (i) upgrading only the existing road implies that traffic will be diverted to a temporary earth road for the entire road corridor – besides exposing motorists to high maintenance costs, this is also likely to enhance some environmental and social impacts of the project; and (ii) the new temporary road will affect a set of property owners and business owners. This option may be favourable to the Contractor, but it enhances environmental and social impacts of the project.

8.1.3 Option 3: The proposed route option

The proposed route for the new road project guarantees a better road in terms of engineering design than the existing road. Although, it appears to share the same corridor with the existing road in most sections, its corridor differs from the existing one in a few places. Interestingly, the few changes in route alignment present extremely serious social impacts that may either delay the road project or cause its abandonment. The proposed route traverses two cemeteries in Lodwar and Kakuma. Given that the situation will certainly trigger conflict with local communities, which may result in law suits and delay in the road project, this route option is not the best.

8.1.4 Option 4: Proposed route option with changes in alignment

This route option proposes changes in route alignment to the proposed route in the two sections with cemeteries in Lodwar and Kakuma. Since there is ample open space between the existing road corridor and the cemetery in Lodwar, and also in the area opposite the cemetery (next to the existing road) in Kakuma, it advisable to purchase these parcels of land with a view to rerouting the new road corridor. Moreover, it would be cheaper to purchase open land (right next to the existing road) to construct the new road, than to purchase land for a new cemetery given that approval of an application to exhume and rebury several dead bodies may not materialize. Thus, this is considered the best route option for the proposed road project.

8.1.5 Analysis of pavement design options

Two Pavement Designs alternatives with 20 year design life were developed with comparative cost on Construction & Maintenance. The pavement designs are in conformity with current standards of part III & Standard Specification for Roads & Bridges.

The pavement design alternatives considered are with Asphalt Concrete wearing course, DBM base and GCS subbase or cement / lime improved subbase. The cost and implications during service period is generally considered the most important criterion in the selection process. Recommendations regarding the type of pavement are made based on the Life Cycle Cost Analysis, construction method and socio-economic factors.

The pavement design is also validated using other pavement design manuals namely, the AASHTO Pavement Design Guideline and the ORN 31. The recommendation of the final pavement is made based on factors such as economy, environmental considerations, and implications during service and practicality during construction.

As per Standard Pavement Structure 12 of the Road Design Manual III, 275mm GCS Subbase, 150mm DBM base and 50 mm “superpave” Asphalt Concrete, single seal surface dressing using 10/14mm Class I chippings on carriageway & 6/10 on shoulder is recommended. The GCS subbase adopted will facilitate the inter pavement drainage and will act as a crack relief layer.

The most appropriate method for design of pavement based on existing pavement type, pavement condition and other parameters is by Structural Number method as cracks are major mode of distress. The SN method is based on empirical correlation between tested material properties and expected pavement performance. Alt 1, the “Base Case” refers to maintaining the project road to good standard viz, zero capital investment on the project road.

Alt 2 refers to reconstructing the project road which results into major capital investment. Economic viability of the investment will be confirmed if:

- IRR is greater than the discount rate
- NPV value is positive.
- B/C ration is greater than 1

Preconstruction maintenance standards are applied to alt 1. Post construction maintenance standards are applied to alt 2. Analysis by project is adopted. Base year is 2016. It is assumed that benefits shall accrue to the investment after 100% completion; hence, analysis period is 2016 – 2035.

For a project to be justified, the Net Present Values should be positive and the Economic Internal Rates of Return should be greater than the discount rate, in this case; 12%. The discount rate of 12% is applied because it is widely used for most World Bank funded projects. In some cases, the "value added approach" is used to justify projects in which case, the economic indicators parameters may be overruled.

The project is viable on the basis of HDM-4 analysis alone based on First Year Rate of Return (FYRR). Similarly, results of the sensitivity test done by adopting low traffic growth rates show that the investment would be economically viable. However, the sensitivity test for a 20% cost overrun reduces the project economic rate of return (EIRR) to 11.9%, while 12.0% is normally considered the minimum level required. This situation emphasises the need to manage the construction cost in this project to ensure that it will stay economically viable. Any cost overrun should be minimised as much as possible. If possible, the cost increase should not exceed 15%.

However, the benefits to the Kenyan economy as a whole and the local economy will be substantially higher, although no exact figure can be provided of these additional benefits. The project road improvement and the LAPSSET project will significantly transform Kenya's economy.

Although this economic evaluation does only include benefits to Kenya, the benefits to South Sudan will be equally important by providing access to sea and important trading partners.

8.2 Drift realignment and bypass options

The existing project road geometry generally meets the required standards except at all drift locations and within town areas. Realignments to the existing alignment has been necessary in some places so that the appropriate geometric design standards can be achieved, but these have been minimized to conform, where possible, with the objective of remaining within the existing road reserve.

In Kakuma, the existing geometry is good and a major bridge exists immediately after the town centre. Furthermore, as the town is spread on both sides of the existing road any potential bypass alignment will be very long and cannot be justified in economic terms. The major constraint for improvement along the existing alignment is that it poses only very narrow right of way of about 25 to 30m. However, provision of service road is necessary to segregate the local traffic from the through traffic and it could be accommodated within the available right of way. Considerable pedestrian movement is noticed in this area including along the bridge and hence provision of foot path along the town area as well as on either side of the bridge is proposed as part of the project road improvement.

Figure 28: An aerial view of Kakuma Town

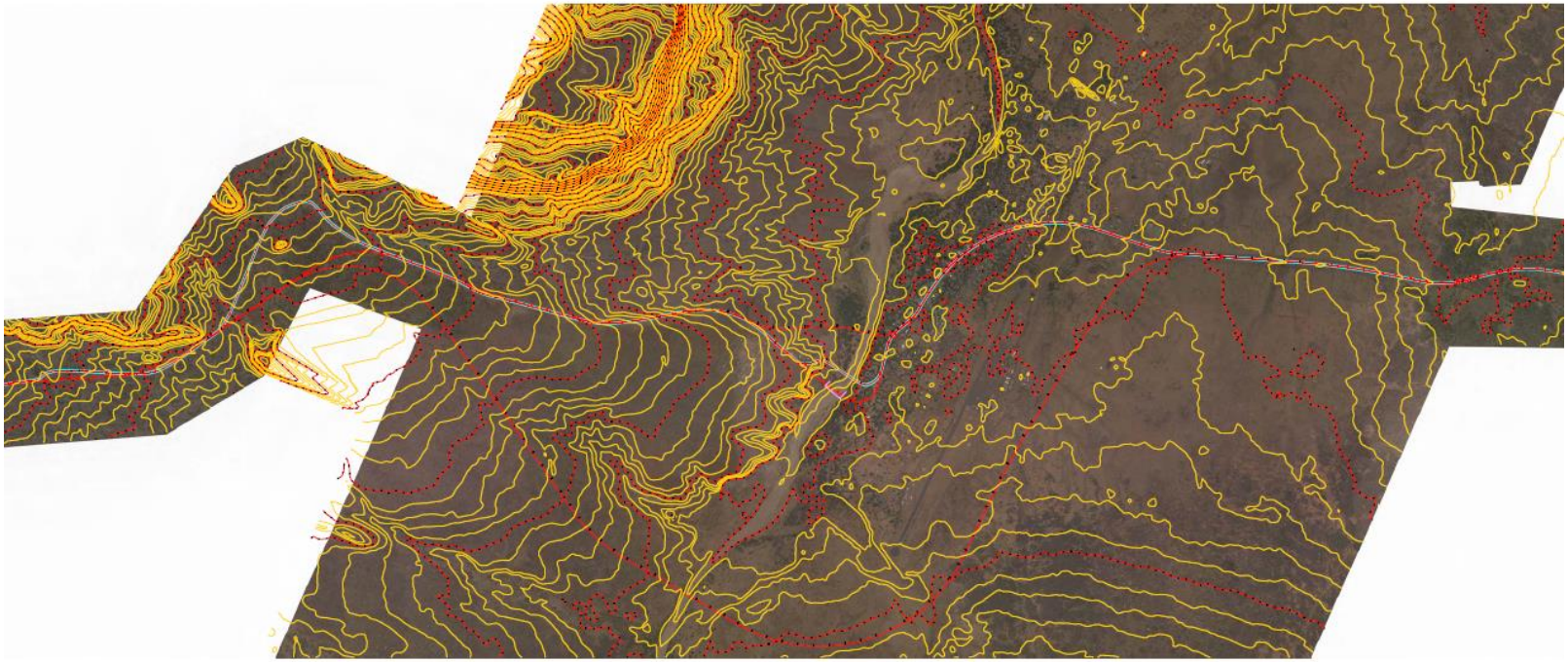
Three alignment options are considered for Lokichogio area. These are (a) along the existing alignment with river crossing on the right side of the drift (b) bypass alignment on the right hand side (Alignment E) and (c) along the existing alignment with river crossing on the left hand side of the drift (Alignment F)

In Lokichogio, a river running on the left side of the alignment and a fully developed and built up area extending to the river bank prevents the possibility of a bypass alignment located in between the river and the existing alignment. Mountainous terrain beyond the river makes any viable alignment along the left side of the Lokichogio area impossible. Lokichogio airstrip is on the right side and hence any alignment on the right side will impact further expansion of the runway. However, based on the terrain analysis it is found that expansion of the runway on the western side is impossible due to the presence of hilly terrain. The present length of the runway is about 1.9km.

The terrain condition on the right side is suitable for high speed connectivity and hence there exists an option for a bypass alignment which initially runs parallel to the runway on the southern side and then veers towards the western end of the runway, crossing the river before re-joining the original alignment.

The other options are the improvements of the existing alignment. The major constraint along this alignment is the presence of a drift with sub-standard geometry immediately after the town area. As this alignment passes through an urban area a design speed of 50kmph is considered appropriate and two alignment options which generally follow the existing alignment are examined. The width of river to be crossed on alignment option along the left hand side of the drift is less compared to the right hand side and hence left hand side alignment is preferred**. Figure 29** shows the various alignment options at Lokichogio area.

Figure 29: An aerial view of Lokichogio Town



In addition to the town areas, the project road has a number of existing drift crossings. The existing geometry of the drift approaches are designed for lower standards to caution drivers about the possible danger ahead and thus the approaches to the drift is an S curve. Realignments are carried out on all the drift location for the provision high level bridge with appropriate approach geometry meeting the design standards. Additional alignments are also proposed on five drift locations. A typical realignment of the drift location at Km 8+920 is depicted in the Table below.

Table 20: Details of realignment at Drift Locations

S No	Chainage (km)	Terrain type	No of sub-standard curves in existing alignment	Additional alternative alignment
Drift 1	1+615	Flat	1	
Drift 2	8+920	Flat	4	
Drift 3	15+750	Flat	3	Alternative A
Drift 4	34+865	Flat	4	
Drift 5	37+630	Flat	0	Alternative B
Drift 6	94+000	Flat	6	
Drift 7	97+645	Flat	4	
Drift 8	100+865	Flat	0	Alternative C
Drift 9	112+400	Rolling	4	Alternative D
Drift 9	122+830	Flat	5	
Drift 10	126+785	Flat	6	
Failed Drift 11	150+675	Flat	6	
Drift 12	157+330	Flat	4	
Drift 13	161+965	Flat	1	
Drift 14	165+925	Flat	6	
Drift 15	170+850	Flat	6	
Drift 16	184+000	Flat	3	
Drift 17	214+875	Rolling	4	Alternative E & F
Drift 18	220+255	Rolling	2	
Drift 19	228+950	Rolling	2	
Drift 20	229+900	Rolling	0	

Alternative A:
As the Drift 2 (in above table) is located in flat terrain, an additional alignment option (Alternative A) is examined with a design speed of 100km/h. However the first alternative with 70km/h design speed is recommended considering the maximum utilization of existing alignment.

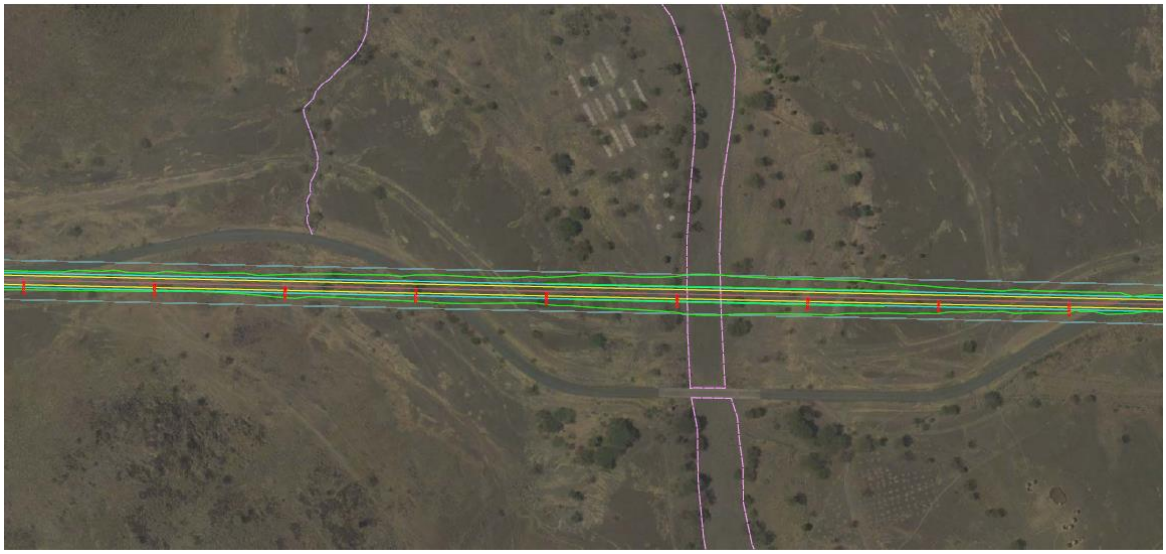
Alternative B:
This alternative is proposed on Drift 5 where existing geometry is good and the existing drift is vented. The first alternative is proposed along the vented drift as the existing geometry is good. However this alignment is not suitable for single span steel bridge and hence Alternative B with straight alignment at the drift location is recommended. With alternative B cost of traffic diversion can also be avoided.

Alternative C:
At Drift 8, vented culvert is existing and also existing geometry is good. Hence first alternative is proposed along the existing alignment. However to avoid temporary traffic diversion during construction, Alternative C which is proposed parallel to the original alignment is recommended.

Alternative D:
Drift 9 is located on a rolling terrain and hence vertical alignment is also having considerable impact on the selection of alignment. The first alternative which is shorter is cutting a small hillock and hence Alternative D which is passing through more gentle contour is recommended.

Alternatives E & F:
Alternatives E and F are for Lokhichogio area and are already explained in lokhichogio realignment section. As the Alternative E which is designed for 100km/h design speed is considered better than the other alternatives on Lokichogio area

Figure 30: Typical realignment at drift 2 km 8+920



9 POTENTIAL IMPACTS AND MITIGATION MEASURES

The construction and operation of the proposed Lodwar – Lokichogio – Nakodok (A1) Road will have both positive and negative environmental and social impacts. This section of this ESIA report identifies positive and adverse impacts of the proposed road project, and recommends measures to mitigate the identified negative impacts..

9.1 Potential Positive Impacts

Improved road connectivity between Kenya and South Sudan, and by extension northern Uganda and southern Ethiopia, will not only open these countries goods to export markets, it will also strengthen Kenya's position are the regional economic hub. Moreover, Kenya's goods will easily access markets in South Sudan, northern Uganda and southern Ethiopia. In addition, the situation will open up northern Kenya, particularly Turkana County, to investment and economic opportunities. The road will also create the much needed infrastructure to aid the development a railway and pipeline link to South Sudan, which are expected to bring massive economic benefits to Kenya and the East African region.. Some of these benefits and their justification are outlined in the **Table 24** below:

Table 24: Potential Positive Impacts and the Justification

#	Potential Positive Impact	Justification
1.	Improvement of Poor Infrastructure Turkana County (Lodwar-Lokichogio-Nakodok Road)	The poor status of the Lodwar-Lokichogio-Nakodok (A1) Road is a challenge to truck drivers and causing damage to the vehicles that ply that route. The excess smoke and dust being generated along this road is a health hazard to the community along the road. Rehabilitated road will significantly reduce dust and smoke emissions resulting in better health The rehabilitation of this road will ease movement of goods and services and thus generate movement of more cargo by road and correspondingly increase economic growth not just for Turkana County alone or Kenya but also for the neighbouring countries that rely on this route for their goods from Port of Mombasa.
2	Enhanced economic growth due to improved road connectivity	Improved road connectivity between Kenya and South Sudan, and by extension northern Uganda and southern Ethiopia, will not only open these countries goods to export markets, it will also strengthen Kenya's position are the regional economic hub.
3.	Installation of Automated Systems to Improve Efficiency	Almost the systems currently being used at the station are manual and therefore very slow in service delivery. This causes a lot delay and congestion along the highway. It is also subject to manipulation.
4.	Creation of Jobs and Employment Opportunities During Construction	The proposed The project will provide direct and indirect employment opportunities. For instance, skilled and unskilled workers will be employed by the project during its construction. In addition, there will be opportunities for establishing shops / kiosks and other small-scale businesses to provide some of the immediate needs of project staff. A lot more employment opportunities will arise from investment and economic opportunities attributable to improved road connectivity. Some of the employment opportunities will arise from improvement in commerce and trade, new jobs in the transport industry, improved tourism and adventure safaris, better market access for livestock and livestock products, market access for on-going mining activities and irrigated agriculture.
5.	There will be enhanced productivity, reduced travel times and less stress to road users.	Travel time to destinations will be greatly reduced. This will be a relief to many motorists who have to travel from Lodwar to Lokichogio.
6.	Reduced transport costs for transport companies and other motorists that would want to access south Sudan through Turkana. Like	Truck drivers and other motorists will take a much shorter time to reach their destination. This will result in less fuel consumption which will not only be a saving to the transporters and other motorist but also a saving to the country on foreign exchange since fuel has to be imported into the country.

#	Potential Positive Impact	Justification
	commercial vehicles and tankers delivering fuel.	
7.	Economic and social value addition to the project's local area of influence	There exists a close relationship between transport infrastructure and primary production (agriculture, animal husbandry, fishing, forestry and mining). Without transport access, much of primary production is not feasible. Availability of transport infrastructure attracts not only traders and transporters, but agricultural, animal husbandry and other extension services. Equally important, improved access does also impact educational, health and other social services, which are essential for social and economic development
8.	Appreciation of Property Value	There will Road network in Turkana County. Development therefore creating influx of would be investors resulting in high demand for property within the project area.
9.	Improved living standards for the station staff and the community	There will be a general improvement on the living standards of the project area community due to increased incomes from employment and increased business activities
10.	Opportunity to improve road drainage design	Local communities expressed concerns during public meetings about the existing road drainage design. They claimed that some existing culverts have created new laggas, while drifts constructed across existing laggas have led to loss of human lives and death of animals. Thus, the upgrading of the proposed road offers an opportunity to improve the existing drainage design for the benefit of the environment and local communities through the construction of bridges, better-designed culverts, cut-off drains and side drains to improve drainage.
11.	Suggestions to enhance the positive impacts	Suggestions to enhance the positive impacts Most of the aforementioned positive impacts are socio-economic in nature. Enhancing their impacts will require a strategic approach. Some of the strategies required are multi-sectoral and are therefore beyond the scope of the Ministry of Roads and KeNHA. Some of the strategies include: • Strengthening of institutions that will support trade and commerce in the wider project area, such as Kenya Revenue Authority in Lodwar. • Promoting tourism in the area, including educational and research expeditions, through the Kenya Tourist Board and private tour operators. • Encouraging the Contractor(s) who will carry out construction works to source non-skilled labour from the project area. • Fully integrating the proposed road project within on-going infrastructure projects, such as LAPSSET, in order to maximize economic benefits. • Consider providing economic incentives to investors in the area, and promoting development of sectors such as agriculture, mining, oil exploration tourism and livestock. • Having long-term plans on provision of water and electricity as part of the overall infrastructure package. • Regular maintenance of the improve road
12.	Solid and Liquid Waste Generation during Construction	Solid and Liquid Waste Generation during Construction
13.	Site Area Infrastructure	The project is going to enhance development of project area infrastructure that is going to improve livelihood of the project area residents

***Source: Panafcon Ltd** – ESIA Field Survey Activity – Lodwar-Nakodok Road 2014*

9.1.1 Enhanced economic growth due to improved road connectivity

Improved road connectivity between Kenya and South Sudan, and by extension northern Uganda and southern Ethiopia, will not only open these countries goods to export markets, it will also strengthen Kenya's position are the regional economic hub. Moreover, Kenya's goods will easily access markets in South Sudan, northern Uganda and southern Ethiopia.

In addition, the situation will open up northern Kenya, particularly Turkana County, to investment and economic opportunities.

The road will also create the much needed infrastructure to aid the development a railway and pipeline link to South Sudan, which are expected to bring massive economic benefits to Kenya and the East African region.

9.1.2 Employment opportunities

The project will provide direct and indirect employment opportunities. For instance, skilled and unskilled workers will be employed by the project during its construction. In addition, there will be opportunities for establishing shops / kiosks and other small-scale businesses to provide some of the immediate needs of project staff. A lot more employment opportunities will arise from investment and economic opportunities attributable to improved road connectivity.

Some of the employment opportunities will arise from improvement in commerce and trade, new jobs in the transport industry, improved tourism and adventure safaris, better market access for livestock and livestock products, market access for on-going mining activities and irrigated agriculture.

9.1.3 Economic and social value addition to the project's local area of influence

There exists a close relationship between transport infrastructure and primary production (agriculture, animal husbandry, fishing, forestry and mining). Without transport access, much of primary production is not feasible. Availability of transport infrastructure attracts not only traders and transporters, but agricultural, animal husbandry and other extension services. Equally important, improved access does also impact educational, health and other social services, which are essential for social and economic development.

At present, the cultivated irrigated agricultural area in Northern Turkana is only about 800 ha. Livestock production is much more common, but productivity is low due to lack of veterinary services. Fishing in Lake Turkana has today a very low value due to poor condition of existing roads and lack of cold storage facilities. Thus, improved transport network will add value to both economic and social situation in Turkana County and northern Kenya.

9.1.4 Societal well-being

The provision of a more efficient transport system will integrate the entire region into the national economy and improve their stands of living. For instance, the duration of travel will be shortened, while the cost of travel will be reduced. Prices of consumer goods will reduce, since transportation costs and the monopoly by a few traders will be broken. Banditry that is associated with inaccessibility and remoteness of northern will reduce significantly as a result of shorter response time by security forces.

9.1.5 Improvement in gender parity

It is envisaged that the upgrading of the road will improve availability and accessibility to social amenities, such as schools. Thus, women will have access to improved education facilities thereby enabling women to compete on an equal footing with men.
The upgraded road may also facilitate balancing of the workload between women and men considering that men may be motivated to take over some of the tasks that are currently performed by women, particularly those economic incentives. Such workload includes

taking produce to the market on bicycles, and carrying water using trucks and animal traction.

9.1.6 Training and transfer of skills

During road construction, locals whose will be employed by the project will have an opportunity to learn an array of skills that relate to road construction. These skills would assist them to obtain employment opportunities in road projects in other parts of the country.

9.1.7 Improved response to emergencies and humanitarian aid

Turkana County and adjoining areas are prone to drought and famine, including massive death of livestock. Provision of relief food and other forms of humanitarian aid is therefore common. The improved road is expected to aid in rapid response to such emergencies which will in turn save human lives and livestock.

9.1.8 Opportunity to improve road drainage design

Local communities expressed concerns during public meetings about the existing road drainage design. They claimed that some existing culverts have created new laggas, while drifts constructed across existing laggas have led to loss of human lives and death of animals. Thus, the upgrading of the proposed road offers an opportunity to improve the existing drainage design for the benefit of the environment and local communities through the construction of bridges, better-designed culverts, cut-off drains and side drains to improve drainage.

9.1.9 Reduction of dust pollution from the unpaved Road

A section of the existing road, particularly between Lokichogio and Nadapal is an earth road. Thus, there is a lot of dust pollution that is generated when vehicles use it in its present state. The section between Lodwar and Kakuma is also largely worn out. The dust that is generated is a health hazard to both human and livestock. The upgrading of the proposed road is expected to eliminate the existing problem of dust pollution.

Suggestions to enhance the positive impacts

Most of the aforementioned positive impacts are socio-economic in nature. Enhancing their impacts will require a strategic approach. Some of the strategies required are multi-sectoral and are therefore beyond the scope of the Ministry of Roads and KeNHA. Some of the strategies include:

- Strengthening of institutions that will support trade and commerce in the wider project area, such as Kenya Revenue Authority in Lodwar.
- Promoting tourism in the area, including educational and research expeditions, through the Kenya Tourist Board and private tour operators.
- Encouraging the Contractor(s) who will carry out construction works to source non-skilled labour from the project area.
- Fully integrating the proposed road project within on-going infrastructure projects, such as LAPSSET, in order to maximize economic benefits.
- Consider providing economic incentives to investors in the area, and promoting development of sectors such as agriculture, mining, oil exploration tourism and livestock.
- Having long-term plans on provision of water and electricity as part of the overall infrastructure package.

- Regular maintenance of the improved road

9.2 Project Negative Impacts

The proposed road project is expected also to have adverse impacts on the physical, biological and social-economic environment during its construction and operation.

9.2.1 Pre-Construction Impacts

There are potential impacts that will occur prior to actual construction. These may include the following:

- Lack of project support due to Project Area Community and Stakeholders having inadequate project facts and information;
- Clearing of site vegetation (impact on flora);
- Potential project impact (disturbance) on Fauna during site preparations;
- Site excavation works (soil erosion);
- Generation of dust and smoke during pre-construction activities;
- Generation of excess noise from vehicles and other equipment being used for site preparation activities prior to construction;
- Project pre-construction wastes (material and domestic solid and liquid waste).

9.2.2 Negative impacts to the biological environment

9.2.2.1 Impact on flora

The potential impact on flora is considered low and is both short and long-term. The most important aspect of the project that may impact on vegetation is the need for cooking energy by construction workers as opposed to vegetation clearing during road construction.

Construction workers may be tempted to cut down trees for firewood within the neighbourhood of the construction camp. The predominantly arid environment is not conducive for plant growth because tree growth is extremely slow. The critical impact, therefore relates to the inability of the area to naturally regenerate after harvesting the mature trees in landscape.

On the other hand, the construction workers by themselves may not harvest trees, but locals may see an opportunity for income generation by selling firewood and/or charcoal to them. Charcoal may be preferable to the workers since it is easier to use indoors. Estimates by ACTS (2005) indicate that in the woodlands of arid environments, it takes about 1 ha of trees to produce 1 ton of charcoal. Given the sparse tree population in the natural woodlands of the project area, the overall impact is likely to be even higher than these estimates. If we base our estimates on consumption of wood products in the form of charcoal, the following scenario emerges:

Table 25: Estimated vegetation loss attributable to workers' energy demand

Total number of employees at the camp	Consumption rate of charcoal	Total consumption per year	Total estimated woodland lost per year (based on 1 ha per ton of charcoal)	Estimated lost woodland over a 3 year construction period (Ha)
50	2 Kg/day	35600 Kg	36	108 ha
100		71200 Kg	71	210
200		142400 Kg	142	396
500		356,000	360	1,080
1000		712,000	720	2,160

These figures are conservative since they are based on relatively more dense woodlands. However, a scenario where over 2,000 ha of tree cover is lost in the fragile environments of Turkana is substantial if this clearance is localized to areas around the camp sites only. A more realistic situation is that both firewood and charcoal could originate from diverse sources within the expansive hinterland of the road, and there is also likelihood that there will be several smaller camps along the road as well as one larger main camp. Thus, tree felling may be spread within about 5 – 10 km radius of any given camp making its potential impact moderate in most cases, but the impact can be high if tree felling concentrated around camps sites.

The vegetation cover in the project area is very low and this is even lower along the road corridor due to frequent disturbances. Nonetheless, there is substantial tree cover along the sections through Lodwar, Kakuma and Lokichogio towns. Construction of the road will be accompanied by clearance of vegetation along the roadside, clearance for construction of access roads and other civil works. The impact of the project on vegetation is thus very specific to the site of construction activities and is therefore localized.

Additional vegetation clearance in quarry sites, borrow pits, and camp sites will also contribute to overall vegetation loss. However, the diversity of natural vegetation in the project area is low, suggesting that vegetation clearance will not cause loss of rare species, species of medicinal and of major commercial value.

Plate 19: Sacks of charcoal on sale along the Lodwar – Lokichogio Road

Moreover, road improvement is expected to lead to urbanization and immigration to the project area due to opportunities that shall come with a better transport network. Increase in human population will lead to increase in demand on cooking energy.

It is not easy to estimate demand during operation phase, but this demand is certainly expected to increase.

Another potential long term impact relates to the advancement of the invasive weed, *Prosopis juliflora*. Prosopis is a very prolific seeder whose seeds are dispersed through the gut of livestock with a preference to invade freshly disturbed sites. The paved road will act as an impervious layer channelling run-off to the roadside which will readily support the proliferation of *Prosopis* on the roadside as already evidenced along the paved section in the immediate environs of Kakuma. Such proliferation will spread and pose visibility challenges to motorists. The impact of *Prosopis* will be rampant at all disturbed sites, roadsides and borrow areas.

9.2.2.2 Impact on fauna

Wildlife diversity and population in the project area is rather low compared to similar environments across Kenya and South Sudan. This is partly because over the years, wildlife has been killed for a variety of reasons including bush meat. In addition, wildlife habitats have been degraded through the felling of trees for charcoal and firewood, particularly to the demand from refugee camps. However, there is still wildlife that disperse into the project area, some from as far as South Turkana Nature Reserve. The project has the potential to affect wildlife as follows:

Table 26: Potential negative impacts on fauna

#	Type of impact	Nature of impact	Most vulnerable species
1.	Construction workers may provide a ready market for game meat. The workers may, by themselves, not be involved in hunting game for food, but the local community may entice them with cheap game meat. This could potentially affect the wildlife through reduction in their population.	Indirect impact. Within 5 km radius of construction camp.	Wildlife such as antelopes, gazelles and avian species, notably guinea fowls
2.	Direct impact through blasting at quarries, noise and vibration occasioned by machinery and construction workers can affect their feeding habits and even migration patterns. Some animals can be more aggressive in the face of such sudden noise and vibration.	Direct but sporadic impact. Within 2 km of quarry sites	All species
3.	Cutting down sanctuary trees (trees above 5 m height with well developed canopy) along the road to pave way for construction. These trees act as perching and nesting sites for a wide range of bird species. They also provide shade for mammals especially ungulates.	Direct impact and specific to where large trees would be felled.	Birds, especially weaver birds, ungulates.
4.	Death of wildlife occasioned by construction vehicles and speeding traffic	Direct, especially in the evenings and early morning. Likely to be very low	Various species
5.	Accidental spills of oil, petroleum products, solvents, bitumen, etc.	Direct impact	Birds, wild dogs, ruminants

9.2.3 Negative impacts to the physical environment

9.2.3.1 Soil erosion

The project area receives low rainfall, which is erratic in most cases. Ordinarily, therefore, soil erosion is not a regular occurrence in the project area. However, occasional torrential rains or flash floods do carry a lot of soil downstream, and this can cause severe soil erosion especially where vegetation cover is poor, as is the case in most of the project area.

The excavation of soil during road construction is likely to generate a lot of loose soil that may result in soil erosion by both water and wind. The impact is expected to be higher during the operational phase when the road acts as a barrier to flush floods occasioning concentrated water flow and enhancing scouring of the road embankment and side drains. Most

In addition, construction activities may cause soil erosion in the following ways:

- Heavy vehicles used during construction activities compact soil, resulting in the reduction of their infiltration capacities, thus facilitating surface flow and possible gully formation.
- The concentration of flows at inlets of culverts may cause increase in flow volume leading to soil erosion at the outlet. The local community has already complained that some of the culverts are responsible for the formation of laggas. Side drains in areas with steep slopes have a similar effect.
- Clearing of vegetation, especially *Prosopis sp*, along the roadside during construction will cause a reduction of the vegetation cover within the RoW. This will expose soil to erosion.

Soil erosion arising from road construction related activity could be both a short and long-term impact depending on whether measures are put in place to arrest it. The rate of soil erosion tends to increase with time. Therefore initially soil erosion will have a small magnitude effect, but once gully erosion has been initiated then the impact will have a progressively larger effect.

Impact on hydrology

Plate 20: An eroded road embankment along the Lodwar - Kalokol Road

The project area has no permanent rivers. The seasonal rivers emerge during the long rains and dry up during the dry season. Lack of permanent rivers is due to unpredictable rainfall pattern as already described in the baseline. These conditions imply that drainage is a seasonal phenomenon. Sometimes the project area experiences extremely intense rainfall over a short period of time, thereby causing heavy run-off and flooding. It would be extremely expensive to design and build drainage structures along the road to cater for all such unpredictable but sporadic extreme weather conditions.

The conventional structures used to drain water are culverts, side drains, miter drains and bridges. Most culverts concentrate flows at their inlets and outlets resulting in localized increased rates of flow, and consequently potential for scouring, especially at the outlets. Such soil erosion could endanger the road itself, and be a hazard to traffic as illustrated in the preceding section. In addition, the water disposed from such concentrated flows could enhance erosion and gully formation.

9.2.3.2 Impact on air quality

Air quality is defined by ambient air concentration of specific pollutants determined to be of concern with respect to the health and welfare of the general public (in this case both human and livestock).

Construction activities associated with the project are expected to have short-term and minor adverse impacts on local air quality, which should be reversible. Such impacts would be primarily caused by increased emissions of carbon monoxide, hydrocarbons, and nitrous oxides from construction traffic.

Vehicle travel along unpaved road surfaces, especially along diversions and excavation of bare ground surfaces would create short-term dust emissions. In addition to the short-term dust emissions, project construction activities would generate tailpipe emissions from mobile heavy equipment and increased vehicular traffic. In a regional context, the daily equipment emissions associated with project construction, even during maximum-intensity work periods, would be relatively minor. However, longer term effects on air quality may occur as a result of significantly increased traffic in the area. Increase in road traffic would result in increased daily emissions of carbon monoxide, hydrocarbons, and nitrous oxide. The adverse effect on regional air quality could thus be substantial when the projected increase if traffic materializes.

Considering the prevailing conditions in the project area, dust pollution is potentially the most important source of pollution. The project site is dominated by a hot, dry and windy environment which exacerbates generation and blowing away of dust beyond the project site. Nevertheless, pollution attributable to dust could be significant within Lodwar, Kakuma and Lokichogio Towns and adjoining settlements. Concentrated construction activities across these towns could lead to sustained generation of dust, as opposed to sporadic generation of dust by vehicular transport. This sustained high level of dust could impact negatively on the people who spend considerable time within the area adjacent to the road, such as shopkeepers.

Whereas the public can withstand dust as a trade-off for better infrastructure, the workers may not have the luxury of such a trade-off. Construction workers at the road construction sites, quarries and borrow pits will be exposed to high dust levels under hot and dry environmental conditions for many hours each day. This impact, if not well mitigated could have very serious health implications on the workers.

9.2.3.3 Soil contamination

Accidental spillage of oil, petroleum products and bitumen (amongst other hazardous chemicals) in and around machinery and plant yards, base camps and areas of concentration activities, may infiltrate into soils and cause soil contamination. During the rainy season, such contaminants can find their way in both surface and ground water resources through flash floods. This impact is only likely during the construction phase of the project and it is expected to be minor and highly localized. However, during the operational phase, it is likely that vehicles may spill oil and petroleum products along the road, which may contaminate the soil. This latter impact is however considered insignificant.

If the machinery yard, workshops and labour camps are not properly protected, wild animals, including birds could be poisoned if they drink contaminated water within the yards caused by accidental spillage of oil, petroleum products, solvents and similar category of materials.

9.2.3.4 Impact on water resources

Water for construction will be mainly obtained from boreholes, which will be constructed along the road. However, water is an extremely precious resource in this area and issues relating to access to water often lead to conflicts between local communities. Thus, sites where boreholes are to be constructed should be carefully selected to avoid community conflicts during decommissioning and handing over of the boreholes to local communities. For instance, accessing a water resource that is located at the boundary between two communities or clans may lead to clashes during periods of resource scarcity.

Moreover, establishing a permanent water source in environmentally sensitive sites may lead to habitat degradation as a result of overgrazing around the site. Without rest periods that temporary water sources provide, forage condition may deteriorate around the locations of wells or boreholes. The situation may lead to the creation of cattle trails and overuse of the surrounding areas. These trails encourage rill erosion, which later can transform into gully erosion in the event of heavy rains. Sheet erosion may also occur around water points, due to animals loosening the ground surface as they rest before and after taking water. The potential impacts of the provision of water for construction purposes are therefore indirect.

9.2.4 Impact on human environment

9.2.4.1 Noise and ground vibrations

Activities associated with road construction will cause a temporary increase in noise levels in the vicinity of the construction sites. This should be of short duration, however, and should not produce any long-term adverse effects within the region. This impact can be of concern only at construction sites within the larger urban environments of Lodwar, Kakuma and Lokichogio. The other urban environments are very small with very low population. Nonetheless, many of these small centres have schools and health facilities which are rather sensitive receptors to noise. These sensitive receptors could be affected in the long-term when truck traffic increases over time.
Where explosives will be used, especially at quarries, there will be serious noise and vibrations in the vicinity of the site. Certain degrees of explosion can be destructive to structures particularly houses. Fortunately most of the potential material sites are located in land far removed from human settlements and activities. In any case, impacts associated with explosions are sporadic and short term.

The operation and maintenance phases of the project will be accompanied by significant increases in traffic, much of which will be composed of heavy and medium goods vehicles, which will in turn increase noise levels significantly along the road. Furthermore, noise associated with vehicular traffic is largely unavoidable.

9.2.4.2 Visual intrusion (landscape disfigurement)

Quarries and burrow pits, are limited cut slopes that are anticipated in road construction. However, material stockpiles when exposed to the public, often lead to visual intrusion. The landscape within the project area consists mainly of monotonous plains dominated by shrub, dry woodland and volcanic rocks. The plains are continually interrupted by upland areas off-site of the road.

On the whole, there are few scenic sites along the road corridor other than some wild animals, large herds of camels and livestock and picturesque ranges such as Mogilla ranges.

If the construction contracts specify that material sites/borrow areas and quarries are to be landscaped after use to blend with the landscape as far as is reasonably possible, visual intrusion associated with these activities would be swamped by the expansive landscape, hence impact would be minor.

Quite often, broken down machinery, structures and other facilities are left on the camp site at decommissioning. This could create visual intrusion. The impact will depend wholly on the decommissioning standards set out in the contract details

9.2.4.3 Waste management

A wide variety of waste will be generated during road construction. This includes debris, domestic and human waste, timber, stone, rock, metal, paper and plastic. The quantity of waste will be substantial and will be a health hazard and also cause visual intrusion. Furthermore, there is potential for contamination of soils and watercourses as a result of improper disposal of liquid and solid waste from construction activities and construction camps.

Within the project area, the local communities are in dire need of water containers ranging from small cans to large containers used to ferry and store a variety of construction materials ranging from bitumen to paint. Some of these used containers invariably have residual chemicals that could be poisonous to humans and other life forms if used to ferry cooking (humans) and drinking water for both domestic and wild animals.

9.2.4.4 Enhanced urbanization

Long distances between existing urban centres of Lodwar, Kakuma and Lokichogio imply that small centres along the proposed road will grow and develop into more important rest points for motorists, tourists and passengers in transit to and from Southern Sudan. In tandem with the increased importance of the centres as rest stops for truckers will be an increase in population within these centres. The increase in urban population will in turn exert increased demand on natural resources especially firewood for cooking. Increased sedentarization of nomads is also expected within the vicinities of these centres in years to come.

9.2.4.5 Public health

Potential public health and safety issues will be both directly and indirectly associated with the activities of the project. The direct impacts include effects of dust, noise and fumes from machinery and construction traffic, as well as noise and fumes from the expected increase in truck traffic along the road.

Construction workers will be most pre-disposed to these direct impacts, during the construction phase. As discussed in other sections, pollution, noise and vibration during both construction and operation could have comparatively higher impacts on health in urban centres (Lodwar, Kakuma and Lokichogio) than in rural areas.

The indirect impacts of the project on health and safety are associated primarily with human behaviour, and this includes the potential for transmission of HIV-AIDS. Another impact, though insignificant, is related to the creation of mosquito breeding grounds.

9.2.4.6 Road safety

Improved roadway complete with paved surface will undoubtedly encourage more vehicular traffic and higher average speeds. There will be increased possibility for accidents between vehicles, and with non-motorized road users such as cyclists, pedestrians and livestock and wildlife. This was highlighted as one of the concerns by the local community during public consultations.

Paved road surfaces will allow vehicles to travel at faster speeds. Although the improved road will be wider in certain areas, thus making it safer to travel at higher speeds, there are still likely to be more collisions between vehicles and with, pedestrians, and livestock (and wildlife).

Local people in the area have lived so long without good roads that there is a lack of awareness of the dangers of the roadways and fast moving vehicles. Due to poor road conditions over the years, people, animals and particularly children are unaware of the danger of a fast approaching vehicle and may cross the road in front of it. This impact is likely to be serious during daytime hours when traffic is heavier and when drivers are able to move faster. Because of insecurity and the road condition, there is currently little traffic from sunset to sunrise, the most active time for most wildlife. However, as security and road conditions improve, there will be increased chances for vehicle-wildlife collisions. These impacts are considered low during construction but medium in the long-term.

Plate 21: Camels crossing a section of the Lodwar – Lokichogio – Nadapal Road

9.2.4.7 HIV-AIDS infections

During public consultations, participants identified extra-marital sexual relations as a possible negative impact of the project during the construction phase. Assuming that some construction workers would be recruited from other parts of the country, there is a high possibility that some of them will have sexual relations with locals and in the process lead to new HIV infections in the project area. The implication is that due to low population density in the project area, any new infections will increase the overall infection percentage substantially. Prevention of new HIV-AIDS infections is, therefore, an important public health issue that the project should address.

In addition, improvement in the financial status among locals who will be employed by the roads project may also lead a situation where some of them may begin to seek extra sexual partners, which may lead to new incidences of HIV infections.

9.2.4.8 Malaria infections

Mosquitoes are vectors of the deadly malaria disease and are common in warm tropical regions. Mosquitoes need stagnant water and warm temperatures to breed. The project site is vulnerable to rapid population explosion of mosquitoes during the rainy season due to pools of stagnant water that are likely to collect in construction sites.

Construction activities may create water-holding ditches and containers left lying around, creating breeding grounds for mosquitoes. Whereas such carelessness on the part of the contractor may, in theory, lead to an increase in mosquitoes, our assessment indicates that

this is not likely to be the case in the wet season. The wet season is characterized by such a high population of mosquitoes that a small increase would be insignificant. The dry season may be different, but only if the pools of water are large enough to last a long time. However, this is highly unlikely considering the ambient conditions that prevail in the dry season. Potential impact associated with increases in malaria is therefore considered low to insignificant.

Resettlement and compensation of affected persons

A compensation and Resettlement Action Plan (RAP) is being prepared with mitigation measures on land and property acquisition to ensure that project affected persons are adequately compensated for their property or loss business. Any potential impact that could be associated with compensation and relocation can be considered well mitigated; assuming the Resettlement Action Plan will be adhered to by the proponent. The RAP will be publicly disclosed and implemented prior to beginning of civil works on the site.

9.3 Sites that require special consideration

9.3.1 Graves and cemeteries within the road corridor

During public consultation meetings, the local community pointed out that the Turkana community has special attachment to their deceased relatives. Thus, they would prefer to have graves and cemeteries spared during road construction. Whereas, the road alignment may not change in order to avoid isolated graves that may be located within the road corridor, it may be more expensive to demolish cemeteries than to seek alternative alignment away from cemeteries located within the road corridor in Lodwar and Kakuma towns. Considering that the cost of land is still relatively lower in most of Turkana County, the opportunity cost associated with compensating individual land owners would be significantly lower than that of acquiring land for new cemeteries and holding reburial ceremonies.

9.3.2 Drifts across laggas

One of the challenges of road transport in Turkana County, and by extension most of northern Kenya, is that vehicles have to stop and wait for flush floods to subside across drifts during the rainy season. This often lasts between a few to several hours. In the past, many vehicles have been swept and human lives lost as vehicles cross flooded drifts. Some of the most dangerous sections include Kalawase drift in Lodwar, Nasiger drift in Nasiger, and Lokochogio drift in Lokochogio. Given that the proposed road will be a major link road connecting Juba in South Sudan to Mombasa and Lamu ports, such stoppages would results in major economic losses. It is advisable therefore to have bridges and not drifts in these sections.

9.3.3 Riverine vegetation

The proposed road corridor traverses only seasonal rivers and streams, but the vegetation along the seasonal rivers comprises the largest trees and the greatest vegetation in the landscape. The trees are of crucial environment significance because of their role in holding soil together to prevent laggas from expanding. The trees are also used by Turkana men as shade, while women collect their pods to feed livestock. The removal of trees located on the road corridor is expected to loosen soil, thereby leading to the expansion of laggas. The situation is therefore likely to negatively impact the environment and the local community.

9.3.4 Quarries

Quarrying is one of the areas that can lead to substantial impacts on the environment. Provisional hardstone material sites have been identified, but it is noted that other new sites may be identified by the contractor(s). Some of the negative impacts that are associated with the quarries and broad guidelines for managing them include:

- Loss of vegetation in quarry sites and in areas along new access roads
- Exposure of workers to risks of scattering rocks, dust and deafening noise during blasting
- Accidents arising from abandoned pits and quarries

9.4 Potential Impact Matrix

A summary of the main potential impacts of the proposed project as deduced from key stakeholder views and preliminary assessment during the ESIA has been prepared and presented in **Table 27**. The matrix describes whether the impact is positive or negative, direct or indirect, temporary or permanent, major or minor and the stage of the project development the impacts occur (construction, operation or decommissioning). The impacts have been broadly categorized into social environment, natural environment and environmental pollution.

Table 27: Potential Impact Matrix

Category	#	Potential Environmental & Social Impact	Positive/ Negative	Direct/ Indirect	Temporary/ Permanent	Major/ Minor	Occurrence		
							Construction	Operation	Decommissioning
Social Environment	1.	Rehabilitation of Lodwar-Nakodok Road	Positive	Direct	Permanent	Major	√	√	x
	2.	Generation of direct & indirect employment and income	Positive	Both	Both	Major	√	√	√
	3.	Contribution to Government Revenue	Positive	Direct	Permanent	Major	√	√	x
	4.	Generation of Dust and Smoke	Negative	Direct	Temporary	Major	√	x	x
	5.	Improved Road Safety due to improved safety measures	Positive	Direct	Both	Major	x	√	x
	5.	Insecurity	Negative	Direct	Temporary	Major	√	√	x
	7.	Corporate Social Responsibility (CSR)	Positive	Indirect	Temporary	Minor	√	√	√
	8.	Risk of fire	Negative	Direct	Permanent	Minor	√	√	x
	9.	Physical body hazards	Negative	Direct	Temporary	Major	√	√	√
	10.	Loss of land use	Negative	Direct	Permanent	Major	√	√	√
	11.	Temporary risk to road safety area during transportation of construction materials	Negative	Indirect	Permanent	Minor	√	x	√
	12.	Occupation Safety (working at heights)	Negative	Direct	Permanent	Major	√	√	√
	13.	Health risk associated with Air and Water Borne diseases (Malaria, Bilharzia etc.)	Negative	Direct	Permanent	Major	√	√	
	14.	Increase in HIV/Aids infections and related illnesses	Negative	Direct	Permanent	Major	√	x	√
	15.	Decrease in in HIV/AIDS Infections	Positive	Direct	Permanent	Major	x	√	x
	16.	Faster Weigh Bridge services	Positive	Direct	Permanent	Major	x	√	x
	17.	Reduced Travel Times for Truck Drivers	Positive	Direct	Permanent	Major	x	√	x
	18.	Loss of Farm Lands	Negative	Direct	Permanent	minor	√	√	√
	19.	Community misconceptions	Negative	Indirect	Temporary	Minor	√	√	x
	20.	Increase in social vices	Negative	Indirect	Both	Minor	√	√	x
	21	Increased property value and security as a result of improved road	Positive	Direct	Permanent	Major	√	√	x
	22.	Increased socio-economic activities at the project area	Positive	Direct	Both	Major	√	√	x
	23	Improved living standards and poverty	Positive	Direct	Permanent	Major			

Category	#	Potential Environmental & Social Impact	Positive/ Negative	Direct/ Indirect	Temporary/ Permanent	Major/ Minor	Occurrence		
							Construction	Operation	Decommissioning
		reduction due to increased incomes							
Natural Environment	1.	Improvement of the site area biodiversity	Positive	Indirect	Permanent	Minor	√	√	√
	2.	Vegetation Clearing at the road corridor	Negative	Direct	Permanent	Minor	√	√	x
	3.	Soil erosion caused by excavation	Negative	Direct	Permanent	Major	√	x	x
	4.	Surface run off and siltation of streams and River valleys	Negative	Direct	Permanent	Major	√	x	x
	5.	Topographical Features	Negative	Direct	Permanent	Minor	√	√	x
	6.	Cutting down of trees for wood fuel for cooking	Negative	Direct	Permanent	Major	√	√	x
	7.	Disturbance of existing wildlife (fauna) species	Negative	Direct	Temporary	Minor	√	x	x
	8.	Decommissioning Activity	Negative	Direct	Temporary	Minor	x	x	√
Environmental Pollution	1.	Water pollution	Negative	Direct	Permanent	Minor	√	√	x
	2.	Air pollution (dust, fuel emissions)	Negative	Direct	Permanent	Major	√	√	x
	3.	Generation of Solid Waste	Negative	Direct	Permanent	Minor	√	√	√
	4.	Soil Contamination	Negative	Direct	Temporary	Major	√	√	x
	5.	Noise and Vibration	Negative	Direct	Temporary	Major	√	x	√

***Source: Panafcon Ltd** – ESIA Field Survey Activity – Lodwar-Nakodok Road 2014*

9.5 Mitigation Measures

The impact mitigation measures that are presented in this report are intended to avoid, reduce, remedy and offset potential environmental and social impacts of this project, where applicable. Avoidance applies in situations where modifications can be made in the alignment of the road project in order to evade potential impacts on sensitive sites, such as cemeteries. Reduction applies in situations where certain aspects of the project, such as access roads to quarry sites, cannot be avoided but can be minimized in order to reduce potential environmental impacts to manageable levels. Actions to remedy adverse impacts apply in situations where potential impacts, such as fuel, oil and chemical spills, are not anticipated, but measures are put in place to clean-up and restore the environment in the event that such impacts occur. Measures to offset potential impacts apply in situations where the impact cannot be avoided and also cannot be adequately mitigated and therefore may have to be offset through compensation. Offset measures include compensation for human resettlement and social amenities such as churches, mosques or health centres.

9.5.1 Pre-Construction Activities Mitigation

Before construction commences, there is going to be pre-construction activities that are going to take place to prepare the site for the construction works. These activities include:

1. Obtaining approval of project designs from local authorities and appropriate lead agencies
   - Local Council Office in Lodwar (County Headquarters),
   - Ministry of Public Works,
   - Ministry of Public Health; and
   - Physical Planning Department
2. Conducting of Information Education and Communication (IEC) amongst the community and the project staff;
3. Implementation of selective clearing of vegetation making sure that only the vegetation that must be cut down is removed;
4. Conserving as much of the natural vegetation as possible;
5. Collection of all the excavated soil during site preparation and ensuring appropriate temporary storage before disposal. This is to be done to ensure control of soil wash off that can cause siltation of rivers, streams and canals;
6. Implementation of dust control measures by sprinkling of water. Use of serviceable equipment and vehicles to control smoke emission;
7. Ensuring availability of waste bins for collection of pre-construction waste;
8. Providing sanitary facilities for pre-construction activities.

9.5.2 Mitigating potential impact on soil

Since the proposed road is already in existence and will only be improved and upgraded except for a few sites where the alignment may change, most impacts associated with soil erosion have already been seen and noted. Moreover, the impact of soil erosion (attributable to road construction) has had a greater impact on the existing road than on the environment. The impact will be mitigated by:

a) Optimizing the potential of new drainage structures to minimize soil erosion by realigning approaches to drifts and bridges
b) Reducing the impact of soil erosion on the road by constructing erosion protection works, such as gabions
c) Stabilizing the soil along the roadside and in the road reserve

d) Having side-slopes at a gentle angle in order to allow vegetation to grow
e) Constructing scour checks alongside drains on steep slopes

The risk of soil contamination by spillages from inappropriate handling of fuel, oil, bitumen and chemicals can be significantly reduced by:
a) Using well-maintained construction vehicles and machinery
b) Servicing construction vehicles and machinery in a designated area, and disposing of the hazardous waste through a NEMA-registered waste disposal agent

9.5.3 Mitigating potential impact on hydrology

Since the road already exists, some of the effects of changes in hydrology as a result of its presence have been noted. Whereas there are many adequate drainage structures along the road, some drainage structures may be inadequate, or in poor condition, and may require re-designing and repositioning. The design of the upgraded road is expected to mitigate this impact by:
a) Realigning some of the existing drifts to improve drainage
b) Re-designing and repositioning some new drainage structures e.g. culverts
c) Constructing bridges in areas where existing drifts are inadequate

9.5.4 Mitigating potential impact on air quality

The effect of dust on air quality will be limited to the time and area of construction activities only. This should be mitigated by:
a) Spraying water along road diversions to reduce dust emission
b) Use of dust protection measures by project staff, such as wearing dust masks.
c) Limiting the movement of vehicles and machinery to moderate speed in order to reduce the amount of dust being generated
d) Warning people in the neighbourhood of possible generation of dust beyond normal levels
e) Maintaining construction vehicles and machinery regularly to reduce exhaust emissions

9.5.5 Mitigating potential impact on water resources

Mitigation measures against contaminating water resources include:
a) Prohibiting discharge of effluents, oil, petroleum products, bitumen and hazardous chemical onto the ground, particularly in areas close to surface and groundwater resources
b) Observing appropriate effluent, fuel, chemical and oil handling procedures
c) Where applicable, construction vehicles and machinery should be serviced in certified garages
d) Construction activities should be located away from stream / river channels to minimize the risk of impacts on surface water
e) If construction is in progress during the rainy season, temporary catch basins or sediment traps should be prepared to prevent sediment and other wastes from getting into water bodies
f) Developing project-owned surface and groundwater resources e.g. water pans and boreholes to avoid water use conflicts with local communities

g) Obtaining government approval and abstraction permits from Water Resources Management Authority (WRMA) and a license from NEMA before drilling boreholes
h) Carrying out adequate consultations before settling on a location for a borehole or water pan

In order to avoid degrading the environment and also minimize community conflicts over access to water resources, it is advisable to use the criteria presented below while locating project owned permanent water sources, which may eventually be handed over the community at decommissioning:

Table 28: Criteria for selecting water sources to be handed to community

#	Site condition	Suitability
1	Wet season grazing area	Suitable
2	At least 15 km from boundary between two or more communities with history of hostility	Suitable
3	Area with sparse wildlife population	Suitable
4	Area of moderate to good range conditions	Suitable
5	Distance to major road > 500 m	Suitable
6	Near urban areas	Suitable
7	Near current permanent water sources	Unsuitable
8	Wildlife migration corridor	Unsuitable
9	Near community boundary	Unsuitable
10	Area with saline soils, hence salty or brackish water	Unsuitable
11	Within 15 – 30 km radius of another pan	Unsuitable
12	Sites already under heavy grazing	Unsuitable
13	Convergence zone for animals from different regions, except for stock routes	Unsuitable
14	Directly on laggas	Unsuitable

Some of the factors to consider before handing over water sources to the local community include:

- Boreholes that are very close to existing permanent water source are suitable. They will improve water supply at an already existing water source, hence no new negative impacts will be associated with it.
- Boreholes that are within or close to urban centres are suitable. The borehole will provide additional water supply to the urban centre
- The boreholes should be at least 20 km apart in order to spread the risk of overgrazing over a wider area.

9.5.6 Mitigating potential impact on flora

The impact of vegetation clearance for road construction is likely to be minor, but the following impact mitigation measures are necessary:

a) Vegetation should only be cleared only where it interferes with road construction or where present a hazard to traffic. In such instances, both the local community construction workers could be allowed to use cleared vegetation for firewood
b) Construction workers should be encouraged to use alternative sources of cooking fuel
c) In areas where soils are compacted as a result of road construction e.g. along temporary access roads, soil should be loosened through ripping, after completion of the works, to enable infiltration of water and growth of plants

9.5.7 Mitigating potential impact on fauna

Mitigation measures against impacts on fauna include:

a) A code of conduct should put in place to ensure that construction do not consume game meat from the area, whether supplied by the locals or killed by themselves.
b) Awareness should be created among the local community and construction workers on laws that relate to wildlife conservation, and the importance of wildlife as a natural heritage
c) Used chemical, other wastes and their containers should be kept way from wildlife and livestock to avoid exposing them to possible poisoning
d) Construction vehicles and machinery should be driven at moderate speed to avoid disturbing wildlife in their habitats, particularly in access roads to quarries and camp sites
e) The project should minimize on the number of access roads in order to avoid affecting a significant proportion of wildlife habitats, food sources and forage for livestock through destruction of vegetation and soil compaction
f) Speed bumps and road signs should be erected in sections of the road that are commonly crossed by livestock and wildlife. The same should apply in sections near schools, hospitals and other social amenities.
g) Given their experience with the existing road, the local community should be encouraged to suggest sections of the road where speed bumps and road signs may be necessary

9.5.8 Mitigating potential impact of noise and ground vibrations

As far as possible, attempts should be made to minimize impact of noise and ground vibrations by:

a) Restricting noisy construction activities to day time
b) Informing the local population in advance about the likelihood of noise pollution from construction activities.
c) Using heavy vehicles in densely populated areas, such as Lodwar, Kakuma and Lokichogio, only during the day
d) Special care should be taken when construction is taking place near sensitive receptors such as schools and hospitals
e) Efforts should be made to limit noise levels to acceptable standards by using well-maintained vehicles and machinery,
f) Construction workers should be supplied with noise mufflers, where applicable

9.5.9 Mitigating potential impact on physical cultural resources

The road alignment may not change in order to avoid isolated graves that may be located within the road corridor, it may be more expensive to demolish cemeteries than to seek alternative alignment away from cemeteries located within the road corridor in Lodwar and Kakuma towns. Considering that the cost of land is still relatively lower in most of Turkana County, the opportunity cost associated with compensating individual land owners would be significantly lower than that of acquiring land for new cemeteries and holding reburial ceremonies.

If the Contractor discovers archeological sites, historical sites, remains, and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall:

- Stop the construction activities in the area of the chance find;

- Delineate the discovered site or area;
- Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the Ministry in charge of managing cultural heritage and related resources in the country (Ministry of Sports, Culture and the Arts) take over;

- Notify the supervisory Project Environmental Officer and Project Engineer who in turn will notify the responsible local authorities and the Ministry of Sports, Culture and the Arts immediately (within 24 hours or less);

Responsible local authorities and the Ministry of Sports, Culture and the Arts would then be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This would require a preliminary evaluation of the findings to be performed by the archaeologists assigned by the government. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage, namely the aesthetic, historic, scientific or research, social and economic values.

Decisions on how to handle the finding shall be taken by the responsible authorities and the Ministry of Sports, Culture and the Arts. This could include changes in the layout (such as when finding irremovable remains of cultural or archeological importance) conservation, preservation, restoration and salvage.

Implementation for the authority decision concerning the management of the finding shall be communicated in writing by relevant local authorities.

Construction work may resume only after permission is given from the responsible local authorities or the responsible ministry concerning safeguard of the heritage.

9.5.10 Mitigating potential impact visual intrusion

A good road would normally be perceived as an important development. However, the effect of the road on the environment may qualify as an unnecessary intrusion. Some of the measures to mitigate against such perception include:

a) Disposing of waste arising from the road project, both along the road and in abandoned camp sites, in an environmentally sound manner
b) Rehabilitating quarries and borrow pits to make them look as much as possible like the natural landscape

9.5.11 Mitigating potential impact of waste

Measures to mitigate potential impacts of improper handling of waste include:

a) Storing both construction and domestic waste (from workers' camp sites) in the specially designated places
b) Communicating and agreeing upon waste disposal mechanisms before construction activities commence
c) Prohibiting discharge of any non-treated drain water and other forms of waste to water resources
d) Using inert waste, such as concrete from bridge reconstruction or excavated soil, as fill materials e.g. to fill quarries and borrow pits.
e) Inspecting waste storage areas and facilities in construction sites/camps periodically to ensure proper handling of waste.
f) Encouraging reuse and recycling wherever possible to minimize residual waste.
g) Having a waste handling protocol in place e.g. storing waste away from public view, provisions dealing with accidental spills of toxic, hazardous, and harmful construction materials, such as caustic and acidic substances, oil, waste oil, diesel and bitumen
h) Displaying work instructions and waste disposal procedures for handling and disposal of containers of used oil, lubricants, paint, and other toxic substances.

9.5.12 Mitigating potential impact of urbanization

a) Proactive planning by the County Government
b) Providing roadside amenities, such as road stations, preferably as a component of this road construction project to avoid un-planned parking of trucks
c) Initiating arid lands afforestation projects using drought tolerant indigenous tree species to provide fuel wood

9.5.13 Mitigating potential impact on public health

a) Inform road construction workers about diseases that are prevalent in the project area, and how they can minimize their exposure to such diseases.
b) Conduct regular awareness campaigns on HIV-AIDS
c) Conduct a yearly audit of occupational health and safety within all construction premises and sites as required by law

9.5.14 Mitigating potential impact on road safety

a) The contractor shall develop a health and safety policy and procedures, and educate all workers on the same
b) Access roads for haulage trucks, used during road construction, should not be located near schools, hospitals and residential areas
c) Inform shop owners and other commercial businesses located next to the road at least two weeks before use of heavy equipment near their premises
d) Install appropriate reflectorized signs at road diversions
e) Erect speed bumps to reduce speed in relevant sections of the road

9.5.15 Mitigating potential impact of HIV-AIDS infections

a) Hold regular HIV-AIDS awareness campaigns
b) Avail condoms to construction workers and the local community

c) The Contractor should provide workers with sufficient accommodation to enable married employees to stay with their spouses
d) The Contractors should hire a permanent nurse or clinical officer to attend to medical emergencies and assist in awareness campaigns among the workers
e) Health service providers should be regularly consulted to determine any changes in disease patterns which may be associated with road construction.
f) KeNHA should hold regular discussions with health professionals on health implications of on-going road construction work

9.5.16 Mitigating potential impact of Malaria infections

a) Avoid creating mosquito breeding grounds near human settlement and construction camps
b) Encourage construction workers to sleep under mosquito nets

9.5.17 Mitigating on resettlement Impact of affected persons

a) Hold stakeholders' meetings to information the local community about the likelihood disturbance and resettlement prior to project implementation
b) Carry out an assessment PAPs
c) Value affected property and loss of business
d) Implement RAP provisions and put in place a strong conflict resolution mechanism

9.5.18 Mitigating of impact on graves and cemeteries within the road corridor

a) Inform the local community during the stakeholders' meeting that the project is likely to affect graves located within the road corridor
b) For single, isolated graves, compensate affected families and cater for reburial expenses
c) Avoid community cemeteries and identify an alternative alignment for the road

Mitigating potential impact on drifts across laggas

a) Where applicable, construct soil stabilization structures to check the expansion of laggas just before they cross the road
b) Construct bridges instead of drifts across major laggas in order to reduce incidences of waiting for water to subside when it rains

9.5.19 Mitigating potential impact on Riverine vegetation

a) Rehabilitate areas where riverine vegetation has been cleared for road construction by stabilizing the soil using gabions.
b) Compensate the community for loss of shade and feed for their livestock as a result of tree felling in riverine vegetation. This could be done through corporate social responsibility, which may target a social amenity such as water pan.

9.5.20 Mitigating potential impact of quarry activities

a) The contractor will be expected to obtain a formal license

b) Topsoil material resulting from stripping or associated operations should be stockpiled in raised areas so as to avoid being washed away by any flush floods
c) The environmental rehabilitation measures needed (after completion of certain works) should be enforced through provisions in the contract agreement(s) for the construction work
d) Blasting should take place at pre-arranged designated times and the affected public, within approximately 1 km radius, duly informed. Appropriate warning signs on the road will also need to be erected
e) Keep workers a minimum 350 m away from the blast spot to avoid scattering stones. If possible, machinery and other facilities should also be kept at least 200 m from the blast site. These distances will, however, depend upon the charge power
f) Workers should return to the working zone 10-15 minutes after the explosion
g) The storehouses of explosives should not be kept on the sites; instead they should be delivered to the site when required, from special storehouses managed by the contractor.
h) Only qualified personnel should be allowed to handle explosives.
i) Fence off the entire quarry to prevent the public, livestock and wildlife from accidentally falling over the cliff.
j) Development should be oriented so that grading and other site preparation is kept to an absolute minimum. Natural features, landforms, and native vegetation, such as shrubs and occasional trees, should be preserved to the maximum extent feasible.
k) Any adjacent water facilities, or structures such as water pans, should be protected.
l) Due to scarcity of water and hot windy conditions in the project area, sprinkling of water as a way of reducing dust may not be a sustainable measure to mitigate the potential dust pollution, which will particularly affect the workers. Whereas it is highly recommend that dust suppressants be used, it may not be very effective, hence it is advisable that the workers be provided with dust masks while in the quarry area.
m) An attendant should be stationed at the entrance at all times, when the quarry is open, to control entry to the site. The entrance gate should be locked when the quarry is not in operation.
n) Quarrying operations should be conducted in a neat and orderly manner, free from junk, trash, or unnecessary debris.
o) Convert borrow sites to water pans to be used by the local community upon completing construction work in a particular area.

9.6 Post-closure recommendations

(i) Quarry waste should be should be segregated from topsoil and used to reclaim borrow pits. Where possible, quarry waste should be used to landscape the area to conform to the surrounding topography
(ii) Topsoil should be spread on hard rock surfaces to allow natural colonization by vegetation over time. It is not realistic, under the prevailing eco-climatic conditions in Turkana, to broadcast seeds or plant trees in such areas.
(iii) In order enhance the potential for successful reclamation, additional topsoil may be imported to a degraded site to increase chances of vegetation establishment and growth.

(iv) The contractor should reinstate the entire area so as to blend with the surrounding landscape as much as is reasonably possible.

(v) The selection criterion for water sources that could be handed back to the community at decommissioning, should ensure that the immediate vegetation around the water source is not degraded, and avoid conflicts between communities are also avoided.

10 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

Environmental and Social Management Plan (ESMP) is a management tool that is used to monitor and evaluate the compliance of project activities to measures outlined in the ESIA report to ensure that adverse environmental and social impacts are offset or maintained within acceptable levels. Although an ESMP deals with the mitigation of identified potential negative impacts of a proposed project, it is also useful in monitoring and mitigating those impacts that were not anticipated during the preparation of the ESIA report. For instance, this ESMP has been developed based existing project knowledge and information available to date. However, some of the project's final details, such as proposed locations of construction camps, actual locations of borrow sites that will be used by the Contractor and disposal areas for construction debris, are unknown at the present time. Nonetheless, the project implementing agencies are expected to update the ESMP where applicable in order to address emerging issues in accordance with relevant legal and regulatory framework. Thus, the Supervising Consultant may periodically revise the ESMP in consultation with the Contractor, and subject to the approval from KeNHA and the National Environment Management Authority. Revisions may be made to accommodate changes in work, weather and site conditions. It is envisaged that the ESMP will be made available to all Project Staff.

This section of the ESIA report provides the objectives of the ESMP, institutional arrangements and responsibilities of parties involved in its implementation, a summary of the ESMP in tabular format and an ESMP monitoring and evaluation plan.

10.1 Objectives of the ESMP

The objectives of the ESMP include:

a) To monitor the implementation of mitigation measures against potential adverse impacts of construction and operation phases of the project to ensure that they conform and comply with relevant environmental and social policies, guidelines and legislation
b) To assess for emerging non-anticipated adverse environmental and social impacts and implement relevant mitigation measures to maintain them within acceptable levels
c) o maintain best practice in environmental health and safety during project construction and operation
d) To address capacity building needs within KeNHA and the Ministry of Transport and Infrastructure, where necessary.

10.2 Responsibilities for environmental management

In order to ensure effective implementation of the ESMP, it will be necessary to identify and define the responsibilities and functions of different agencies that will be involved in the implementation of this project. The following agencies will be involved on the implementation of this ESMP:

KeNHA: As the proponent, KeNHA shall have the primary responsibility of ensuring the implementation of the ESMP and environmental and social protection measures that will be necessary in the course of project implementation. The primary responsibility is considered

as commitment to good environmental practice as set out in the ESMP. KeNHA is expected to engage a contractor and other institutions to implement the activities of the ESMP.
The proponent will also conduct regular internal monitoring of the project to audit the implementation of environmental mitigation measures contained in the ESMP and the project's construction contract clauses. It will also monitor the implementation of land acquisition and compensation arrangements as outlined in the RAP Report.

Ministry of Transport and Infrastructure: Road safety and accident prevention is the responsibility of the Ministry of Transport and Infrastructure. The Ministry shall:

a) Carry out regularly monitoring of the state of road safety
b) Assess road safety and improvement needs
c) Enforce measures to reduce road accidents, such as mandatory use of seat belts, compulsory driver training and testing, prohibition and punishment of driving under the influence of drugs or alcohol, traffic safety education for children and testing and inspection of vehicles in accordance with national vehicle safety standards.

National Environmental Management Authority (NEMA): NEMA shall exercise general supervision and co-ordination over all matters relating to the environment and be the principal instrument of Government in the implementation of all policies relating to the environment to ensure that all proposed mitigation measures are implemented.

The Resident Engineer and Environmental and Social Officer: The Resident Engineer (RE) shall be appointed by KeNHA or the Supervising Consultant and will be required to oversee the construction activities performed by the Contractor, in compliance with the ESMP. The RE should have an Environmental and Social Officer (ESO) in his team to co-ordinate all aspects of the environment during project implementation. The ESO shall:

a) Oversee the construction activities performed by the Contractor, in compliance with the ESMP
b) Update environmental aspects (not covered in the ESIA / ESMP) during project implementation
c) Auditing environmental and safety aspects of construction activities
d) Participate in the selection of camp sites, borrow pits, quarries and other environmentally sensitive construction sites
e) Recommend solutions for specific environmental and social aspects
f) Facilitate the creation of Community Liaison Groups and monitor the compliance of the social clauses of the contract, particularly enlisting of locals in construction work
g) Oversee strategies for sensitising the local population on health and safety issues
h) Participate in consultations meetings held at key stages of the project with the local community and interested parties
i) Liaise with respective Environmental Authorities on the status of compliance with the ESMP by the Contractor
j) Prepare quarterly environmental and social progress / audit reports on the status of implementation of the project

The Civil Works Contractor: The Civil Works Contractor shall be appointed by KeNHA and will be required to comply with the requirements of the ESIA/ ESMP and the Standard Specifications for road works in Kenya. Key responsibilities of the Contractor include road construction, environmental protection and waste disposal, borrow pit and quarry acquisition and exploitation, landscaping, grassing and general rehabilitation of the project sites upon completion of construction activities.

County Government: The relevant departmental officers in the County Government will be called upon, where necessary, during project implementation to provide the necessary permits and advisory services to project implementers. Some of the areas for which the officers will be required include:

a) Approving locations for establishing work camps
b) Relocation of project affected persons
c) Liaising with NGOs in the project area to assist in sensitization campaigns on HIV/ AIDS and public health to the project workforce and the local community
d) Issuing permits for tree felling, vegetation clearing, exploitation of quarries and borrow sites, whenever necessary
e) Identifying appropriate sites for disposal of construction debris
f) Issuing permits or relevant documentation for health and safety monitoring in accordance with local health and safety legislation and / or ILO standards

Table 29: Environmental and Social Management Plan

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
Design Phase						
1.	Lodwar-Nakodok Road	Landscape visual impact	– Design of infrastructure that conforms with the project site features (topography and aesthetics)	• KeNHA • Architect	Site infrastructure design blending with host environment	Approx. 1,000,000/=
2.	Lodwar-Nakodok Road P Sanitation Facilities	Soil and water contamination	– Design appropriate containments for oils/other construction chemicals and sanitary waste from the contractor's camp.	• KeNHA • Architect	Availability of sanitary facility and paved containments in the design	Approx. 500,000/=
3.	Lodwar-Nakodok Road Vegetation Cover	Removal of existing Vegetation	– Design of appropriate construction that provides for incorporation of existing trees	• KeNHA • Architect	Site infrastructure incorporating existing trees	Approx. 300,000/=
Pre-Construction Phase						
1.	Project Facts Sensitisation and Awareness Creation	Potential lack of support from project area community	– Timely dissemination of project facts to community and stakeholders through Barazas and designated meetings. – Convening of meetings with Community and Stakeholders to carry out sensitization and disseminate project facts *This is in line with:* ♦ *Environmental Management and Coordination Act (EMCA), 1999* ♦ *OP 4.01 Environmental Assessment* ♦ *OP 4.12 Involuntary Resettlement*	• KeNHA • PR Firm	Feedback information and forms from project area community	Approx. 1, 500,000/=
2.	Clearing of Lodwar-Nakodok Road Corridor site vegetation	Vegetation damage, and invasion by exotic species	• Except to the extent necessary for establishing the construction site and carrying out the construction works, vegetation shall not be removed, damaged or disturbed nor should any unauthorized planting of vegetation take place; • The clearance of the site for construction purposes shall be kept to a minimum. The use of existing un-vegetated or disturbed areas for the Contractor's Camp, stockpiling of materials etc. shall be encouraged; • Areas to be cleared should be agreed and demarcated before the start of the clearing operations; • Clearing and removal of vegetation, especially at borrow sites must be carried out in such a way that damage to adjacent areas is prevented or minimized; • All vegetation encroaching into the road reserve must be cleared	• KeNHA • Contractor	Existing trees incorporated in the improved Road Design	Approx. 600,000/=

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
			to give room for visibility; • Areas with dense indigenous vegetation are not to be disturbed unless required for construction purposes, nor shall new access routes be cut through such areas; • Trees should be trimmed rather than removed wherever possible; • The Contractor should plant indigenous and native trees along the project road in Lodwar, Kakuma and Lokichogio. • The use of fuel wood by construction workers should be discouraged. Workers should be encouraged to use clean energy sources. *This is in line with:* ♦ *Environmental Management and Coordination Act (EMCA), 1999* ♦ *OP 4.01 Environmental Assessment*			
3.	Clearing of Lodwar-Nakodok Road Corridor site vegetation	Generation of Solid Waste	− Only trees that have to be cut down should be cut − Contractor to provide strategically located solid waste collection container (skip); − Collect together all generated waste from site clearing; − Transport and dispose all waste away from site; − Liaise with local authority on suitable dumping site for spoils; *This is in line with:* ♦ *Environmental Management and Coordination Act (EMCA), 1999,* ♦ *Water Act 2002 and Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	Records of existing trees and other exotic vegetation retained at the along the road corridor	Approx. 200,000/= for the selective vegetation clearance
4.	Clearing of Lodwar-Nakodok Road Corridor site vegetation	Noise pollution (excess noise and vibration)	− Use of noise reduction/ hearing protection devices when working with noisy equipment; − Use of serviceable chain saws (low noise emission); − Instruct machinery operators to avoid raving of engines; − Carry out site preparation activities during the day; *This is in line with* ♦ *Environmental Management and Coordination Act (EMCA), 1999;* ♦ *Environmental Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009* ♦ *OSHA Act, 2007.* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	• Records of machine and vehicle maintenance • Availability and use of Ear Muffs	Approx. 200,000/= for provision of noise pollution

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
5.	Clearing of Lodwar-Nakodok Road Corridor site vegetation	Sanitary and other Domestic Waste	– Provide site clearing workers with solid waste collection bins for their use; – Ensure site has toilet facilities; – Sensitise workers on site cleanliness and hygiene *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999* ♦ *Water Act, 2002* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act, Cap 242*	• KeNHA • Contractor	• Presence of waste bins and Toilets for use by workers	Approx. 300,000/= for provision of Sanitary and waste collection facilities.
6.	Lodwar to Nakodok Road Corridor	Displacement of Persons along the road corridor	– Implementation of Resettlement Action Plan ▪ Compensation of PAPs ▪ Preparation and Implementation of a Resettlement Plan ▪ Assistance to PAPs to put up their houses ▪ Relocation of PAPs to New Site *This is in line with:* ♦ *Environmental Management and Coordination Act (EMCA), 1999* ♦ *OP 4.01 Environmental Assessment* ♦ *OP 4.12 Involuntary Resettlement*	• KeNHA • Resettlement Expert • KeNHA Resettlement Unit (KRU)	• Resettled PAPs Report	As Per RAP Report
7.	Lodwar to Nakodok Road Corridor Demolition of Structures including PAP Houses	Health and Safety of Workers and PAPs who may want to recover some materials	• Use of construction site barrier tapes to isolate the site(working) area to bar intruders from accessing the area in case of a dropping object; • Appropriate head, hand and foot protection (PPE) during the manual clearing of vegetation and construction activities; • Adopting ergonomic work flow designs that fit physical tasks to employees and not vice versa. Maintain a work productivity; • Construction site visitors require appropriate safety Gear. *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Environment Management and Coordination Act (EMCA), 1999* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act Cap 242* ♦ *OP 4.12 Involuntary Resettlement*	• KeNHA • Contractor	• Resettled PAPs Report	Estimate as per RAP Report

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
8	Construction material sourcing	Pollution Risk, Health and Safety Risk of fro	• To rehabilitate quarry and borrow sites after completion of construction. • The Contractor will be responsible for ensuring that appropriate authorisation and licences to use the proposed borrows pits and quarries has been obtained before commencing activities; • Carry out inspection of each of the site's soil stability before excavation; • All borrow pits sites shall be clearly indicated on a plan and approved by the RE; • Borrow pits and quarries shall be located more than 20 meters from watercourses to minimise storm water runoff into watercourse; • The Contractor shall give 14 days' notice to nearby communities of his intention to begin excavation in the borrow pits or quarries; • Prepare health and safety plan before any work on the quarries is commenced; • Cordon off the quarry and borrow areas to keep livestock and children off; • The Contractor shall rehabilitate and decommission all borrow pits and quarries • Stockpile top soil on site and use during rehabilitation of the borrow site and quarries; • Plant suitable saplings where it is deemed feasible; • In case of blasting: i. The Contractor will obtain a current and valid authorization from the Department of Mines and Geology prior to any blasting activity. ii. A qualified and registered blaster shall supervise all blasting and rock-splitting operations; iii. The contractor shall develop a safety policy on site. • Upon completion of works, the borrow areas should be graded and backfilled with top soil that formed the overburden. The sites should be re-vegetated preferably with local species of plants	Contractor / Supervising Engineer / KeNHA	Construction	Sh. 3,000,000 for rehabilitating material sites

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
9.	General materials Handling and Storage	Potential release of pollutants or clattering project area site	To ensure proper handling and storage of materials • All materials shall be stored within the Contractor's camp • Stockpile areas shall be approved by the RE; • All imported fill, soil and/or sand materials shall be free of weeds, litter and contaminants. Sources of imported materials shall be listed and approved by the RE; • The Contractor shall ensure that delivery drivers are informed of all procedures and restrictions (including 'No go' areas) required; • Any electrical or petrol driven pumps shall be equipped and positioned so as not to cause any danger of ignition of the stored product; • Collection containers (e.g. drip trays) shall be placed under all dispensing mechanisms for hydrocarbons or hazardous liquid substances to ensure contamination from any leaks is reduced; • Regular checks shall be conducted by the Contractor on the dispensing mechanisms for all above ground storage tanks to ensure faulty equipment is identified and replaced in timely manner; • Only empty and externally clean tanks may be stored on bare ground. All empty and externally dirty tanks shall be sealed and stored on an area where the ground has been protected. *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999* ♦ *Water Act, 2002* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act, Cap 242* ♦ Occupational Safety and Health Act (OSHA) 2007	• KeNHA Supervising Engineer • Contractor	Appropriately organized storage taking care of potential impact of each material and its risk level.	Best Engineering practices
Construction Phase						
1	Lodwar-Nakodok Road Construction Activities	Generation of used oils and other hazardous substances	• All maintenance of equipment and vehicles shall be performed in the workshop. • If it is necessary to do maintenance on site, but outside of the workshop area, the Contractor shall obtain the approval of the RE prior to commencing activities; • The Contractor shall ensure that there is no contamination of the soil, vegetation or surface water. • The workshop shall be kept tidy at all times and shall have the following as a minimum:	• KeNHA • Supervising Engineer	• Quarry and borrow pit site reports •	Sh. 3,000,000 for rehabilitating material sites

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
			• An impermeable floor either constructed of concrete or suitable plastic fabric • The floor shall be bunded and sloped towards an oil trap or sump. • Drip trays shall be used to collect the waste oil and lubricants. • The drip trays shall be inspected and emptied daily; • Drip trays shall be closely monitored during wet weather			
2	Soil Excavation at the Lodwar-Nakodok Road Corridor	Soil Erosion	− Soil from the site is to be used for backfilling excavated areas while excess soil is disposed of off-site; − Soils are not to be left exposed to wind/water; − Soil erosion is to be reduced and river valley protection enhanced. *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999* ♦ *Water Act, 2002* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	• *Ground cover in constructed areas* • *Quality of surface water at the site and in the neighbouring rivers/canals*	Part of Construction Obligation
3.	Soil Excavation at the Lodwar-Nakodok Road Corridor	Air Pollution (dust, fuel and smoke emissions)	− Control speed of construction vehicles and Prohibit idling of vehicles; − Water is to be sprayed during the construction phase on dusty areas to reduce dust emission; − Regular maintenance of vehicle & equipment to reduce smoke; − Provision of dust masks for use in dusty conditions; − Use of serviceable vehicles/machinery to avoid excessive smoke; *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment;* ♦ *Public Health Act, Cap 242*	• KeNHA • Contractor	Records of machine and vehicle maintenance Availability and use of Noise Masks	Approx. 250,000/= for air pollution prevention
4.	Soil Excavation at the Lodwar-Nakodok Road Corridor	Excess noise and vibration	− Use of noise reduction/ hearing protection devices when working with noisy equipment or noisy environment; − Use serviceable equipment with low noise emission; − Instruct truck/machinery operators to avoid raving engines; *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999* ♦ *Noise and Excessive Vibration Pollution) (Control) Regulations, 2009* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	• Records of machine and vehicle maintenance • Availability and use of Ear Muffs	Approx. 200,000/= for provision of noise pollution

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
6.	Construction of the Lodwar-Nakodok Road Infrastructure	Generation of Solid Waste	− Provide communal solid waste collection containers (skip) for the collection and storage prior to appropriate disposal; − Local Authority/NEMA to provide waste dumping site; − Engage a NEMA Registered Waste Collection Firm; − Excavation activities to be done preferably during the dry season to avoid soil erosion and siltation of streams; − Construction site soil to be used to backfill excavated sites; *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999,* ♦ *Waste Management Regulations, 2006* ♦ *Water Act 2002* ♦ *Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor • NEMA Registered Waste Collection and Disposal Firm	Clean, Organized, Neat Road Site Presence of waste collection receptacles	Approx. 500,000/= for waste containers 50,000/= per month for waste collection and disposal during construction
5.	Soil Excavation at the Lodwar-Nakodok Road Corridor	Generation of Liquid Waste – used oil and other Chemicals (Hazardous Waste)	− Construct a paved containment for storage of oils and other liquid chemicals being used in the construction of the road; − Provide containers for storage of used oils from vehicles /machines/equipment being used at the construction site; − Engage a NEMA Registered Firm for the collection, transportation and appropriate disposal of used oil; *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999,* ♦ *Waste Management Regulations, 2006* ♦ *Water Act 2002* ♦ *Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor • NEMA Registered Used Oil Collection and Disposal Firm	• Presence of a paved area for storage of oils and other chemicals • Presence of used oil containers.	Approx. 400,000/= for paved containment and used oil containers. 20,000/= per month for collection and disposal of used oil.
6.	Soil Excavation at the Lodwar-Nakodok Road Corridor	Impacts on Physical Cultural Resources	− If objects of cultural heritage (e.g. graves, cemeteries, sacred trees, etc.) are discovered the contractor must stop work and contact relevant authorities. The Contractor also must use the Chance Finds Procedures (Section 9.5.9). *This is in line with:* ♦ *Land Act, 2012* ♦ *OP 4.11 Physical Cultural Resources*	• Contractor • National Museums of Kenya • KeNHA • Min. of Sports, Culture and Arts	• Records of locations of objects of cultural heritage. • Grievance record logs.	Included into BoQ.

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
7.	Soil Excavation at the Lodwar-Nakodok Road Corridor	Risk of fire	– Provide firefighting equipment at the construction site area; – Contractor staff to be sensitized on firefighting equipment use; – No burning of materials is to be permitted at the site. *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Public Health Act, Cap 242* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	• Performance records • Presence of Fire Extinguishers at construction site	Approx. 250,000/= for fire extinguishers
8.	Soil Excavation at the Lodwar-Nakodok Road Corridor	Potential Pollution of Surface and Groundwater	• No domestic waste is to be disposed of at the project area; – Provision of used oil containers at a central point; • Use of waste bins/proper waste management; • Pave parking area for trucks and direct drainage to containment; *This is in line with:* ♦ *Environment Management and Coordination Act (EMCA), 1999,* ♦ *Water Act, 2002* ♦ *Public Health Act Cap 242* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	• Water Quality • Presence of Waste Bins	Approx. 50,000/= for communal waste containers
9.	Lodwar-Nakodok Road Construction Activities	Safety of Workers and other visitors to construction site	• Use of construction site barrier tapes to isolate the site(working) area to bar intruders from accessing the area in case of a dropping object; • Appropriate head, hand and foot protection (PPE) during the manual clearing of vegetation and construction activities; • Adopting ergonomic work flow designs that fit physical tasks to employees and not vice versa. Maintain work productivity; • Construction site visitors require appropriate safety Gear. *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Environment Management and Coordination Act (EMCA), 1999* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act Cap 242*	• KeNHA • Contractor	• Workers have Safety Gear • Medical records • Emergency contacts for Hospital and Police available	Approx. 300,000/= for safety gear

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
10.	Lodwar-Nakodok Road Construction Activities	Temporary road use risk to local population	• Notification on the intension to move large equipment by road; • Observe strict code of conduct by the transporters; *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Public Roads and Roads of Access Act Cap 399* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	*Availability of transportation Programme*	Routine construction obligation
11.	Lodwar-Nakodok Road Construction Activities	Deviation road use impacts	• Avoid settlement areas when identifying road deviations; • Prepare a programme of spraying the road deviations and construction areas with water to suppress dust; • Provide alternative road for a resident on the north west of the Site whose road will be interfered with by the project. *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *Public Roads and Roads of Access Act Cap 399* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	• *A final selected deviation route with minimal impact* • *Presence of a water spraying programme*	Routine construction obligation
12.	Lodwar-Nakodok Road Construction Activities	Working at heights	• Testing of structures for integrity prior to undertaking work; • Implementation of fall protection including induction on climbing techniques and use of fall protection measures, • Use of harnesses and scaffolds for working at heights; • Inspection, maintenance, and replacement of fall protection equipment ; • Use of helmets and other protective devices that are going to mitigate against scratches, bruises; lacerations and head injuries due to dropping objects[• Provide first aid facilities at the site; *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment* ♦ *Public Health Act Cap 242*	• KeNHA • Contractor	• Medical Records and Training records • Availability and use of proper PPE • Availability of Fall Protection Equipment at the Construction Site	Approx. 400,000/= for special safety equipment

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
12.	Lodwar-Nakodok Road Construction Activities	Health issues of construction workers and Community	– Sensitise workers and community on sexually transmitted diseases especially STIs and HIV/AIDS which is spread through socialization and unprotected sex; – Sensitize workers on use of protection facilities like mosquito nets appropriate gear when working in waterlogged areas to avoid Bilharzia; – Provide workers and community with condoms. – Facilitate the development of a Health facility at the project area together with Ministry of Public Health and interested Donor Agencies. *This is in line with:* ♦ *Public Health Act Cap 242* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor • Ministry of Public Health • NGOs and Donor Agencies • Local Administration	Pamphlets on Health Matters Records of disease incidences/prevalence	1,000,000/= for sensitization and provision Of condoms. Health facility cost to be determined
13.	Lodwar-Nakodok Road Construction Activities	Community misconceptions	• Awareness creation amongst the Community on project facts; • Community issues to be responded to promptly; • Project progress reports and monitoring reports to be prepared and recommendations implemented;	• KeNHA • Local administration • Local Leaders	• Records of Meetings with Community • Records of community issues recorded and responses.	Approx. 100,000/= for convening meetings
14.	Lodwar-Nakodok Road Construction Activities	Increase in social vices/ Security Concerns	• Conduct Information Education and Communication; (IEC) amongst the community and the project staff; • Hold meetings between Contractor Staff and Community; • Have regular police patrols at the beginning of project development; • Collect information on persons coming into the project area to settle during project implementation.	• KeNHA/Ministry of Education • Local Police • Local Administration • Local Leaders	Meeting reports Police records on project area security	Approx. 300,000/= for convening meetings
15.	Lodwar-Nakodok Road Construction Activities	Surface run off and sedimentation from construction activities	– Construction of effective drainages and culverts; – Plant soil binding grasses and other native plants *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999* ♦ *Water Act, 2002*	• KeNHA • Contractor	Surface runoff water impact protection facilities in the project area	Construction Obligation

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
			♦ *OP 4.01 Environmental Assessment*			
16.	Lodwar-Nakodok Road Construction Activities	Sanitary facilities for construction workers	• Installation of appropriate sanitary facilities; • Installation of appropriate sewage works (septic tanks and soak pits since the area does not have sewage network; • Having a monitoring programme for the septic tanks to ensure no overflow takes place *This is in line with:* ♦ *Environment Management & Coordination Act (EMCA), 1999,* ♦ *Waste Management Regulations, 2006* ♦ *Public Health Act Cap 242* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor	Presence of Toilet Facilities for Workers and Visitors to the Construction Site.	Construction Obligation
17.	Lodwar-Nakodok Road Construction Activities	Lack of sufficient water for Construction activities and workers	• Obtain construction water from the site after applying for abstraction licence • Consider sinking of borehole to provide water for construction Carry out hydrogeological studies to identify suitable location of Borehole • Carry out ESIA for Borehole before drilling and equipping can commence. *This is in line with:* ♦ *Public Health Act Cap 242* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor • Hydrogeologist and • EIA Expert	Presence of a reliable source of water for Road construction activities (Borehole)	5,000.000/= for sinking a borehole and equipping it (pump & storage tank
18.	Lodwar-Nakodok Road Construction Activities	Safety of pedestrians crossing the Highway at the	• Sensitise workers and community on road safety; • . *This is in line with:* ♦ *Public Health Act Cap 242* ♦ *Occupational Safety and Health Act (OSHA) 2007* ♦ *OP 4.01 Environmental Assessment*	• KeNHA • Contractor • Traffic Police	Availability of sensitization/safety awareness Report	500,000/= for sensitization and awareness creation

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
19.	Lodwar-Nakodok Road Construction Activities	Interruption of businesses and sources of income for hawkers and vendors selling foodstuff and other merchandise	• Identify and sensitise affected members on alternative arrangements for them to continue selling their merchandise to truck drivers and other motorists • Avail job opportunities to the affected persons and other community members; *This is in line with:* ♦ *Public Health Act Cap 242* ♦ *Occupational Safety and Health Act (OSHA) 2007*	• KeNHA • Contractor • Local Administration • Project Area Police	Availability of an alternative site for hawkers and vendors to sell their merchandise List of job opportunities availed to project area community members	Construction Activity Obligation
20.	Lodwar-Nakodok Road Construction Activities	Lack of proper place to sell foodstuff to Workers and including machine operators	• Provision of a designated area to be used by community members to sell foodstuff, groceries and other merchandise to workers and visitor to the site.	• KeNHA • Contractor	Presence of kiosks for groceries and restaurant services	Construction Obligation
21.	Lodwar-Nakodok Road Construction Activities	Dangers of having Child Labour issues arising	• Contractor to be strictly advised not to engage any underage persons(under 18 years of age) to perform any form of work at the Lodwar-Nakodok Road corridor during construction • Contractor will be required to comply with the Employment Act, 2007 *This is in line with* ♦ *Employment Act, 2007*	• KeNHA • Contractor	List of workers that does not contain underage persons	Construction Obligation
22.	Lodwar-Nakodok Road Construction Activities	Lack of Facility for use by Project Area Community	• KeNHA and Contractor to consider building a good workshop site that can later be handed over to the project area community to be used as a Social Hall or Community Centre. The centre can be used for purposes including promotion of indoor games like table tennis, pool where community youth can spend time instead of engaging in drugs & other vices.	• KeNHA • Contractor	Presence of a community facility that will enhance bonding	Construction Budget for CSR
23	Health Facility at the project area	Some section of the road is far from health facilities posing a risk when emergency medical attention	• KeNHA to facilitate liaison with relevant agencies to organise a mobile health facility for use by workers and other project area needy cases since they always run to the Contractors camp.	• KeNHA • Ministry of Public Health • NGOs & Donors	Presence of a Functional Health Centre at the project area.	To be determined according to requirements of Health Centre

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
		is require				
Operational Phase						
1.	Lodwar-Nakodok Road Operation Phase Activities	Maintenance of the Road Working at heights	• Use of barrier tapes to isolate the maintenance areas; • Provide harnesses and scaffolds for working at heights; • Inspect, maintain and replace fall protection equipment; • Use of helmets and other protective devices to mitigate against scratches, bruises; lacerations and head injuries due to dropping objects; • Provide first aid facilities at the site; *This is in line with* *Occupational Safety and Health Act (OSHA) 2007* *OP 4.01 Environmental Assessment*	• KeNHA • Contractor during Project Liability Period (PLP)	• Use of Proper PPE and Equipment • Handouts on safety	Approx. 50,000/=
2.	Lodwar-Nakodok Road Operation Phase Activities	Community misconceptions	• Awareness creation amongst the community on the project facts • Ensure community issues/questions are responded to promptly • Preparation of project progress and monitoring reports and recommendations implemented • Hold meetings with project area community.	• KeNHA • Local Administration • Local Police • Local leaders	• Awareness creation programme • List of community issues with the appropriate responses • Progress Reports	Approx. 1,000,000/= in the first year for meetings 100,000/= per year in the following years
3.	Lighting Energy Source Impacts during operation	Pollution of air from kerosene lamp causing URTI	• Provision of electricity network connection for the community; • Use of electricity for lighting; • Significant reduction of air pollution at the project area hence reduction in URTI prevalence.	• KeNHA • Ministry of Public Health	• Presence of Electricity Network • Reduced reliance on wood fuel for cooking and kerosene lamp for lighting • Reduced URTI prevalence	To be determined
4.	Lodwar-Nakodok Road Operation Phase Activities	Health issues of the Community	– Sensitise community on sexually transmitted diseases especially STIs and HIV/AIDS which is spread through socialisation and unprotected sex; – Sensitize workers on use of protection facilities like	• KeNHA • Ministry of Public Health • Local	Presence of a HIV Programme at selected Health Centres Records of disease	1,000,000/= for sensitization and provision

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
			mosquito nets appropriate gear when working in waterlogged areas to avoid Bilharzia; - Provide workers and community with condoms. - Encourage Workers, Truck Drivers and Community to go for HIV Testing and Counseling in order to live a productive life; *This is in line with:* ♦ *Public Health Act Cap 242* ♦ *Occupational Safety and Health Act (OSHA) 2007*	Administration	incidences/prevalence (URTI, HIV/AIDS, Water Borne Diseases etc.	Of condoms. Cost of running Health facility to be determined on need basis.
5.	Lodwar-Nakodok Road Operation Phase Activities	Safety of pedestrians crossing the Project Road	• Sensitise project area community on road safety issues and importance of the footbridge; • Provide adequate on the footbridge to avoid mugging of pedestrians using it when it is dark; *This is in line with:* ♦ *Public Health Act Cap 242* ♦ *Occupational Safety and Health Act (OSHA) 2007*	• KeNHA • Traffic Police	Presence of a footbridge	100,000/= for sensitisation
11.	Lodwar-Nakodok Road Operation Phase Activities	Monitoring and Evaluation of the effectiveness of project Mitigations	• Implementation of monitoring road during operation and success of proposed mitigations - Health Trends (URTI, Malaria, STIs and HIV/AIDS); - Livelihood and socio-economic status of project area community; - Community perception on the road project; - Any new emerging issues, threats and benefits of the new road	• KeNHA • Administration	Quarterly Reports on performance	Routine Operation of the road
Decommissioning Phase						
1.	Decommissionin g of Contractors Camp	Air Pollution (dust, smoke, fuel emissions)	- Control of demolition vehicle speeds; - Prohibition of idling of vehicles; - Water is to be sprayed on building undergoing demolition during decommissioning o reduce dust emission; - Regular maintenance of vehicles and equipment; - Provision of dust masks for use in dusty conditions. - Use of serviceable vehicles and machinery to avoid	• KeNHA • Decommissioning Contractor	Decommissioning Records	Approx. 150,000/= for nose protection equipment (dust masks)

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
			excessive smoke emission *These is in line with:* ♦ *Environmental Management and Coordination Act, 1999* ♦ *Occupational Safety and Health Act (OSHA) 2007*			
2.	Decommissioning of Contractors Camp	Noise pollution	– Noise reduction/ hearing protection devices when working with noisy equipment; – Use of serviceable equipment with low noise emission; – Instruction to truck/machinery operators to avoid raving engines; – Use of noise protection (ear muff) during demolition; *This is in line with:* ♦ *Environmental Management and Coordination Act, 1999.* ♦ *Occupational Safety and Health Act (OSHA) 2007.*	• KeNHA • Decommissioning Contractor	Decommissioning Records	Approx. 200,000/= for noise pollution mitigation
3.	Decommissioning of Contractors Camp	Potential Injury to Workers	• Use of appropriate head, hand and feet protection (PPE) during demolition of structures • Adopting ergonomic work flow designs that fit physical tasks to employees and not vice versa while maintaining a balance with productivity; *This is in line with:* ♦ *Occupational Safety and Health Act (OSHA) 2007*	• KeNHA • Decommissioning Contractor	Availability of appropriate gear/Records Use of Proper PPE	Approx. 200,000/= for PPE and other safety equipment
4.	Decommissioning of Contractors Camp	Working at heights	• Use construction site barrier tapes to isolate the site area to guard site visitors from accidents/injuries & dropping objects; • Implement a fall protection program that includes training in climbing techniques and use of fall protection measures, Provide Harnesses; • Use of helmets and other protective devices is going to mitigate against scratches, bruises; lacerations and head injuries due to dropping objects, • Provide first aid facilities at the site *This is in line with:*	• KeNHA • Decommissioning Contractor	Availability of appropriate Safety Gear/Records Proper use of PPE	Approx. 100,000/= for PPE and other safety equipment

#	Activity	Negative Impact	Mitigation Measure	Responsibility	Performance Indictors	Cost (KES)
			♦ *Occupational Safety and Health Act (OSHA) 2007*			
5	Decommissioning of Contractors Camp	Site area rehabilitation and restoration	• Remove all demolished waste material; • Repair and restore project area site • Plant trees and other appropriate vegetation	• KeNHA • Site Restoration Contractor	Well restored site	To be determined

Source: *Panafcon Ltd – ESIA Field Survey Activity – Lodwar-Nakodok Road 2014*

10.2.1 Sound Environmental and Social Monitoring

Environmental and Social Monitoring is an important process in project management. The monitoring programme is intended to reveal changes and trends brought about by the presence and operations of the project. Such information is going to be useful in the formulation of sustainable project management and operation strategies.

The basic activity for the sound-monitoring of Lodwar-Nakodok Road is to include at least the following parameters:

- Collection and analysis of relevant environmental and social data of the site including:
  - Evaluation of the site vegetation cover that is to be cleared to pave way for construction of the Rod
  - Evaluation of the type and quantity of solid waste generated at the construction site
  - Inspection of the materials being used;
  - Evaluation of the construction practices;
  - Monitoring of the site maintenance activities to ensure proper vegetation control methods are applied to prevent invasion by exotic species;
  - Evaluation of noise generation and duration during construction activities;
  - The amount of water consumed during the construction of a section of the road;
  - Seasonal variation of the presence of disease vectors (mosquitoes);
  - Quality of life of the project area community;
  - Monitor sources of energy for cooking and lighting;
  - Change in health trends of the project area community;
- Identification of unexpected environmental and social impacts;
- Formulation of counter-measures to mitigate unexpected negative impacts and comparing them with actual impacts as identified during the assessment.

10.2.2 Internal Environmental Monitoring

In order to sustain a healthy environment and the site receives minimal negative impact, the project management needs to undertake internal monitoring of environmental parameters as a routine practice. Monitoring will involve measurements, observations, evaluations, assessment and reporting on the following variables once the road ASIA is completed and becomes operational. It is therefore useful for KeNHA to institute Internal Environmental Monitoring since this will assist in improving site operations of the site. Environmental protection components may include:

1. The Contractor is to ensure that at any time during construction he has one staff member being capable of administering first aid to a person prior to the injured person being transferred to a medical institution for treatment;
2. Seasonal variation of disease vectors (e.g. mosquitoes, since this is going to assist KeNHA and the Contractor to advice staff on potential dangers of getting diseases including Malaria and Respiratory Infection and the appropriate precautions;
3. Evaluation of firefighting equipment status by having the relevant maintenance team to check them regularly and test their functionality;
4. Monitoring of STIs and Sexually Transmitted diseases including HIV/AIDS and its prevalence in the project area;
5. Provision of appropriate and polite notice posters within the construction site area guiding the staff on various aspects of environmental protection including:
   - No throwing of litter apart from the designated areas to ensure that the site is protected from pollution;

- Early reporting to the Contractor management any unusual health feelings (e.g. some persons may not know the symptoms of malaria until they are very sick).

6. Monitoring of solid waste generation and handling trends and sanitary waste generation trends so as to provide data and information for putting in place solid waste collection and sewage exhaustion plan.

The above information is vital for the smooth running of the facility and therefore KeNHA is encouraged to ensure that the contractor and monitoring staff are able to monitor all activities and keep records for review by KeNHA and other Authorities.

A monitoring Plan is provided in **Table 30**

Table 30: Lodwar-Nakodok Road Monitoring Plan

#	Environmental Component	Activity	Standard/ Reference	Location	Frequency	Implementation	Supervision
Pre-Construction Phase							
1.	Project Design	Provision of Solid and Liquid Waste	NEMA Guidelines	Lodwar-Nakodok Road	Quarterly until Design is ready	• KeNHA • Design Consultant	• KeNHA • Supervision Consultant
2.	Vegetation cover	Monitor clearing to ensure consistent with ESMP	ESMP	Lodwar-Nakodok Road	As required during site preparation	Contractor	Supervision Consultant
Construction Phase							
1.	Noise levels	Noise levels on dB (A) scale from excavation and construction areas not to exceed the Maximum Noise Level Permitted (Leq) in dB(A) of 75	NEMA guidelines	Noise level meter kept at a distance of 30m from source	When noisy construction activities are in progress. Or as directed by Supervision Consultant	Contractor	Supervision Consultant
2.	Air Pollution	Dust and Smoke Emission	NEMA guidelines	Construction area at Lodwar-Nakodok Road Site	As required by the Supervision Consultant	Contractor	Supervision Consultant
3.	Soil Erosion	Turbidity in River , River and Stream water	NEMA Guidelines ESMP	At Construction area of Lodwar-Nakodok Road	During and after the rainy seasons	Contractor	Supervision Consultant
4.	Accidents	Accident reports, community consultations	ESMP	At Construction area of Lodwar-Nakodok Road	Monthly	Contractor	• KeNHA • Supervision Consultant
5.	Health	URTI, HIV/AIDS, Malaria and Water borne disease prevalence	ESMP	At Construction area of Lodwar-Nakodok Road	Monthly	• Contractor •	• KeNHA • Supervision Consultant
6.	Construction waste	• Quantity and Type of solid waste generated by construction activities. • Waste Segregation	NEMA guidelines	Designated Waste Collection points at the Lodwar-Nakodok Road Site	Monthly	Contractor	KeNHA

#	Environmental Component	Activity	Standard/ Reference	Location	Frequency	Implementation	Supervision
7.	Sanitary waste	Contractor toilet facilities operation/performance	NEMA guidelines	Lodwar-Nakodok Road Corridor	Monthly	Contractor	Supervision Consultant
8.	Project Area Population	Change in Project Area Population	ESMP	Lodwar-Nakodok Road Corridor	Quarterly	• KeNHA • Local Authority	Supervision Consultant
Operation Phase							
1.	Solid Waste	• Quantity and Type of solid waste generated by Contractor. • Segregation	NEMA guidelines	Designated Waste Collection points at the site	Monthly	Waste Collection Firm Registered with NEMA	KeNHA
2.	Health	• Changes in health trends • Presence of Mosquitoes, snails • Records of Malaria and Water borne disease occurrence • HIV/AIDS cases/prevalence	ESMP	Lodwar-Nakodok Road Corridor	Monthly	• Hospital •	• KeNHA • Ministry of Public Health
3.	Sanitary waste	toilet facilities operation and performance	NEMA guidelines	Lodwar-Nakodok Road Corridor	Monthly	KeNHA	Supervision Consultant
4.	Lodwar-Nakodok Road performance	• Length of the Traffic Jams, day of the week and the times of occurrence	ESMP	Lodwar-Nakodok Road Corridor	Monthly	• KeNHA • Ministry of Roads	Supervision Consultant
5.	Socio-economic status of Project Area Community	• Records of Community income generation/livelihood	ESMP	Lodwar-Nakodok Road Corridor	Quarterly	• KeNHA	Supervision Consultant
6.	Pedestrian Accidents at the Project Site	• Records of accidents occurring near project area • Statistical Trends of Accidents		Lodwar-Nakodok Road Corridor	Monthly	KeNHA	Supervision Consultant

Source: *Panafcon Ltd – ESIA Field Survey Activity – Lodwr-Nakodok Road 2014*

10.2.3 External Audits

KeNHA should engage a line with NEMA requirements. NEMA has the overall responsibility for issuing approval for the Project and ensuring that their environmental guidelines are followed during Project implementation (construction and operation). Its role therefore is to review environmental monitoring and environmental compliance documentation submitted by the implementing authorities and they would not normally be directly involved in monitoring the Project unless some specific major environmental issue arises.
KeNHA through the Consultant is therefore required to provide NEMA with a report on environmental compliance during implementation phase as part of their annual progress reports and annual environmental audit reports.

10.3 Environment and Social Management Plan Recommendations

In order to ensure a healthy and safe environment at the project area, Environmental and Social Management has to be instituted through an Environmental and Social Management Plan and Monitoring.

This involves the collection and analysis of relevant environmental and social data of the resettlement site and its immediate surroundings. KeNHA is to do the following:

- Environmental protection has to be implemented at all levels of project implementation (Pre-Construction, Construction, Operation and Decommissioning) as proposed in the Environmental and Social Management Plan (ESMP);
- KeNHA is to facilitate rehabilitation of any degraded environment especially during construction and after the construction activities;
- The degraded environment especially excavated areas are prone to soil erosion and require to be rehabilitated *in-situ* (as the construction progresses) to avoid soil being washed into the water courses. Some of the excavated soil is to be used for backfilling;
- Noise and dust emissions are to be controlled during construction through spraying of water where necessary. Trucks and other vehicles are to maintain low speeds at the project site;
- The vehicles and machines/equipment used at the site are to be regularly serviced to avoid excessive smoke emission;
- Site vegetation clearing is to be done selectively using appropriate clearing techniques (e.g. hand clearing as opposed to mechanized clearing);
- Use of human labour instead of heavy machinery is to be promoted in order to provide jobs to the local community;
- Planting of trees and grass during construction and operation of the facility is to be encouraged to enhance environmental restoration.
- Project area community whose businesses will be interrupted should be identified and provided with alternative arrangements on how they can continue carrying out their socio-economic activities to avoid the project impacting on their lives negatively.

10.4 Waste Management Recommendations

Solid waste generated during the project lifespan (during construction and operation) require appropriate collection, storage and disposal. This waste is to be managed in an environmentally sound manner. The following is to be done:

- The contractor is to construct a paved area with containment where oils and other chemicals are to be stored;

- The site construction materials and solid wastes are to be gathered together at designated areas using appropriate/waste bins (bins with lids) and collected for appropriate disposal following NEMA and Local Authority regulations.

- The contractor staff and any casual workers are to be sensitized on waste management (collection and disposal) particularly hazardous substances like oils and other chemicals generated at the site.

- Used oils recovered from vehicles and construction machines/equipment are to be collected in special containers for appropriate disposal.

- The contractor is to provide mobile toilets for the site staff during the entire construction period. The toilets are to be maintained and waste disposed of following NEMA and Local Authority regulations on human waste collection, handling and disposal.

- NEMA approved waste collection and disposal firms are to be engaged to be collecting wastes (solid wastes and used oils) for disposal.

11 CONCLUSIONS AND RECOMMENDATIONS

11.1 Conclusions

Arising from the analysis by the Consultant, the proposed project is unlikely to generate irreversible or permanent negative impacts. The project area community and key stakeholders support the project and would like that it is implemented as soon as possible so that they can start enjoying its benefits.

The ESIA has identified potential negative environmental and social impacts that are likely to arise and proposed appropriate mitigation measures that require implementation. The impacts include temporary; permanent, short term, long term and cumulative impacts.

11.2 Recommendations

The following recommendations have been arrived at after carrying out the ESIA Study. Key environmental issues associated with the irrigation project have been identified and recommendations made. The project area community and local leaders were consulted and Public Consultation Meetings (PCMs) convened where issues and concerns were raised by the participants. These questions and concerns were responded to and minutes of the same are appended in this ESIA Report in **Annex 3.**

It is recommended that the proposed project be approved provided that the proposed recommendations are followed.

11.2.1 Project Approval Recommendation

The following recommendations are proposed:

a) Stakeholder Recommendations

Key Stakeholders who have been consulted through oral interviews and the Public Consultation Meeting held at the project site area on November 5, 2014 gave the following recommendations on rehabilitation of the Lodwar-Nakodok Road

- Project is beneficial to the project area community, the region and the country at large in facilitating the smooth and quick passage of goods being transported from the Port of Mombasa to other destinations including neighbouring countries (Uganda, Sudan, Rwanda etc.) hence should be implemented without further delay;
- The project should proceed since it will provide the following additional benefits:
  - The project area will benefit from improve economic activity generating jobs and income for the community;
- The project area community should be adequately consulted and engaged in all the phases of the project implementation;
- The Project Proponent should include the construction of a footbridge at the project area to assist the community and other members of the public to cross the highway since reports indicate that road is prone to motor accidents.
- All personnel should be provided with appropriate safety gear during construction;
- Local community should be given first priority for jobs during construction to enhance acceptance and ownership by project area community.
- The community and local leaders should be encouraged to promote environmental restoration through planting of trees during construction and operation of the project;

- The degraded environment especially excavated areas are prone to soil erosion and should be rehabilitated *in-situ* (as the construction progresses) to avoid soil being washed into river valleys and other water courses;
- The social and health issues of the community should be evaluated and monitored during project implementation to ensure emerging issues promptly addressed;
- Project developer should consider facilitating the putting up of health facility at the project area.
- The hawkers and vendors of various food items and other commodities to truck drivers and other motorists should be assisted to continue doing their businesses and earning a living so that they can support their families;

b) Project Area Community Recommendations

- Local community should be given first priority for job opportunities during construction and operation;
- Project proponent should provide adequate water for construction since water is scarce in the project area;
- The community requested that they be provided with water;
- The community requested that a health facility is put up in the project area to assist the project area community;
- Final designs should be availed to project area community so that they can have full appreciation of the project and also get to know how far they will be affected;

c) Project Impact Mitigation Recommendations

The EMP and monitoring plan in this ESIA Project Report is to be implemented including the following:

- The degraded environment is to be rehabilitated especially after the construction activities through ground levelling and planting of indigenous vegetation to avoid soil being washed off into the water courses. Some of the excavated soil is going to be used to back fill excavated areas;
- Project affected hawkers and food venders will need to be provided alternative sites to sell their merchandise and also given opportunity to provide services to the contractor's camp during construction;
- Contractor staff and community members are to be sensitized on sexually transmitted diseases including STIs and HIV/AIDS;
- Noise pollution is going to be controlled during construction by using low noise generating equipment and vehicles and regular maintenance. Truck drivers and machine operators are to be instructed to avoid excess raving and idling of engines;
- The contractor is going to control dust emissions during construction through spraying of water where necessary and maintain low speeds for any vehicles and trucks being used at the project site;
- Project site clearing is to be done selectively by using appropriate clearing techniques (e.g. hand clearing as opposed to mechanized clearing);
- Skilled and unskilled job opportunities will be given to the local community by the contractor. There is also going to be generation of direct and indirect job opportunities;
- Environmental restoration is going to be encouraged to enhance project area biodiversity through landscaping and planting of trees and grass during construction and operation of the irrigation project;
- There is going to be sensitisation of project area community on various aspects of the project including environmental protection, waste management, safety and security;
- Domestic and other waste is going to be collected and disposed of appropriately following NEMA and Local Authority recommendations;
- Mitigation measures and monitoring plans in the EMP are to be fully implemented;

- Environmental Audit of the project is to be done as often a NEMA deems necessary.

Overall Opinion of the Consultant on the Proposed Project

The proposed upgrading of Lodwar-Nakodok Road is considered important, strategic and beneficial in improving connectivity between Kenya and South Sudan and promoting trade in the area. The upgraded road will also enhance economic growth of the area especially considering the recent oil finds and other potential developments that can take place with improved transport. There will be creation of job opportunities; uplifting the socio-economic status of the project area people. The significant support by the community that the project is enjoying indicates how important this project is to the project area community. The Consultant highly recommends that the project should be allowed to proceed taking into account the Mitigation Measures and Environment and Social Management Plan (EMP) proposed in this ESIA Report.

12 ESIA STUDY TEAM MEMBERS

#	Name	Position
1	Joshua Patrick Oyieko	Team Leader
2.	Eng. Francis Karimi	Highway Engineer
3.	Elsie Ngendo	Sociologist/Community Development Expert
4	Steve Okono	Occupational Health and Safety Expert
5.	John Otuoma	Biologist / Ecologist

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Projects in Disputed Areas OP 7.60

World Bank Safeguard Policy Public Disclosure

Bank Safeguard Policy 4.37-Safety of Dams

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13 COLOPHON

KeNHA/Revised and Updated ESIA for the Upgrading of Lodwar-Lokichogio-Nakodok 240Km (A1) Road
Pan-14-042

Client	:	Kenya National Highways Authority (KeNHA)
Project	:	ESIA for the Proposed Rehabilitation of Lodwar-Nakodok Road
File	:	14-001
Length of report	:	187 pages
Author	:	PANAFCON Ltd.
Contributions	:	Technical Team
Project Manager	:	Joshua Oyieko
Project Director	:	OKELLO, Richard O.
Date	:	December 2014
Name/Initials	:	ro/jo/im

Annexes

attached