MERIDIAM S.A.S., VINCI CONSTRUCTION S.A.S., VINCI CONCESSIONS S.A.S.

NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

KENYA

WSP REF.: 201-10312-00

DATE: FEBRUARY 16, 2022

MERIDIAM S.A.S., VINCI CONSTRUCTION S.A.S., VINCI CONCESSIONS S.A.S.

NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

KENYA

WSP REF.: 201-10312-00
DATE: FEBRUARY 16, 2022

REPORT

WSP CANADA INC.
FLOOR 11
1600 RENÉ-LÉVESQUE BLVD WEST
MONTRÉAL, QC H3H 1P9
CANADA

T: +1-514-340-0046
F: +1-438-843-8111

WSP.COM

QUALITY MANAGEMENT

VERSION	DATE	DESCRIPTION
0A	15 December 2021	Pre-disclosure version
00	16 February, 2022	Version for disclosure

This report was prepared by WSP for the account of Meridiam S.A.S., Vinci Construction S.A.S., Vinci Concessions S.A.S., in accordance with the professional services agreement. The disclosure of any information contained in this report is the sole responsibility of the intended recipient. The material in it reflects WSP's best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This limitations statement is considered part of this report.

The original of the technology-based document sent herewith has been authenticated and will be retained by WSP for a minimum of ten years. Since the file transmitted is now out of WSP's control and its integrity can no longer be ensured, no guarantee may be given with regards to any modifications made to this document.

PRODUCTION TEAM

CLIENT – MERIDIAM S.A.S.

Head of ESG and Sustainability	Ginette Borduas
Investment Director	Bertrand Fournier-Montgieux
Senior Investment Director	Allan Munyua
Environmental & Social Specialist	Apolline Marcilhacy
Analyst	Nebila Ahmed

CLIENT – VINCI CONCESSIONS S.A.S.

Sustainability Director	Sophie Debost
Technical Officer	Thomas Lamothe

CLIENT – VINCI CONSTRUCTION S.A.S.

Technical Director	Guillaume Guillerminet
Project Chief	Anne-Fleur Lefèvre
Acting Project Manager	Thomas Pruvost
Technical Manager	Jerôme Vossier
QHSE Manager	Naveen Dinnoo
Technical Manager	Denis Gibert
Chief Technology Officer	Endaf Griffiths

CLIENT – RIFT VALLEY HIGHWAY LTD.

Chief Executive Officer	Cécile Brandao
Environmental and Social Specialist	Kenneth Kamau

WSP

ESIA and ESMP Project Manager	Ghyslain Pothier
ESIA and ESMP Senior Advisor	Philippe Alary-Paquette
ESIA and ESMP Support	Étienne Le Corff, Evelyn Nyabuto
ESIA and ESMP Senior Peer Reviewers	Caroline Le Page, Katia Santini
Air Quality and GHG Specialist	Sylvain Marcoux
Air Quality and GHG Support	Benjamin Parys, Floriane Desmergers, Camille Taylor, Philippe Lachance, Pascal Rhéaume, Angèle Généreux
Air Quality and Acoustics Field Survey Specialist	Bradley Keiser
Physical Environment Field Survey Supervisor	Tshepo Molapisi
Climate Change Specialist	Yann Chavaillaz
Climate change Support	Virginie Provençal
Ambient Noise and Vibration Specialist	Marc Deshaies
Ambient Noise and Vibration Support	Laurie Jacquemmoz-Jouve, Aniss Skalli, Myriam Vinot, Anne Boiret
Soils Specialist	Daniel Morin
Supporting Soil Quality Specialist	Adam Sanderson

Supporting Soil Stability Specialist	Robert Leyland
Water Quality and Sediment Specialist	Mélanie Lévesque
Water Quality and Sediment Support	Simon Bourgeois, Ariane Aspirault, Jean-Simon Roy
Health, Safety and Security Specialist	Rhys Giljam
Biodiversity and Ecosystem Services Lead Specialist	Maya Brennan-Jacot
Wildlife Specialist	Rodney Van Der Ree
Environmental Technogy Specialist	Mathieu Deshaies
Environmental Technogy Support	Jean-Samuel Gauthier
Socio-Economic and Indigenous Peoples Specialist	Annie Lalancette
Socio-Economic and Indigenous Peoples Support	Joany Landry-Désaulniers, Marie-Andrée Burelle
Socio-Economic and Indigenous Peoples Specialist (replaced)	Éric Deneut
Public/Stakeholder Consultation Specialist	Christine Abdel-Malek
GIS/Cartography Specialist	Mylène Lévesque
GIS Support	Catherine Paul, Christine Thériault, Éric Dulong, Aurélie Monnard, Félix-Antoine Audet, Benjamin Lauzière, Daniel Déry
Editing Services	Mélanie Quenneville, Blanca Alvarado, Karen Jenkins, Donna Ngo, Jeanne Marie Thiakane, Louise Talon.

SUBCONSULTANTS – FFMES LTD.

Biodiversity Survey Lead	Jérôme Gaugris
Biodiversity Survey Support	Phoebe Mottram
Vegetation Survey Specialist	Graeme Wolfaard
Vegetation Survey Specialist	Itambo Malombe
Biomass and carbon Survey Specialist	Ben Orban
Avifauna Survey Specialist	Lukas Niemand
Herpetology Survey Specialist	Marius Burger
Herpetology Survey Specialist	Ryan van Huyssteen
Mammals Survey Specialist	Alain Thomas
Freshwater Ecology Survey Specialist	Gina Walsh
Freshwater Ecology Survey Specialist	Marco Alexandre

SUBCONSULTANTS – UNIVERSITY OF NOTTINGHAM.

Habitat Connectivity Modelling Specialist (lead)	Alex M. Lechner
Habitat Connectivity Modelling Support	Darrel Tiang
Habitat Connectivity Modelling Support	Michelle Ang

SUBCONSULTANTS – NORKEN INTERNATIONAL LTD.

National Environmental Lead	Isaiah Kegora
National Public/Stakeholder Consultation Support	Loise Kioko
National Public/Stakeholder Consultation Support	Hottensia Kabuki
National Public/Stakeholder Consultation Support	Allan Owino
National Public/Stakeholder Consultation Support	Julius Ngundo
National Indigenous Peoples (VMG) Support	Lavina Omondi
National Indigenous Peoples (VMG) Senior Expert	Professor Edward Ontita
National Biodiversity Support	Mohamed Bubicha
National Botanist Support	Dickens Odeny

SUBCONSULTANT – ENDANGERED WILDLIFE TRUST

Wildlife and Transport Expert	Wendy Collinson -Jonker

SUBCONSULTANT – EWASO LION AND GREVY ZEBRA TRUST

Landscape Infrastructure Advisor - Kenya	Sarah Chiles

SUBCONSULTANT – GIRAFFE CONSERVATION FOUNDATION

East Africa Coordinator	Arthur B. Muneza

ABBREVIATIONS AND ACRONYMS

AASHTOP	American Association of State Highway and Transportation Officials
ACHPR	African Commission on Human and Peoples' Rights
ADA	Alcohol and Drug Abuse
AfDB	African Development Bank
AfmB	Afromontane Bamboo
AfR	Afromontane Rainforest
ANZECC	Australian and New Zealand Environment and Conservation Council
AoA	Area of Analysis
ASPT	Average Score Per Taxon
AUF	Afromontane Undifferentiated Forest
Aw	Tropical Savanna Climate
AZE	Alliance for Zero Extinction
BETX	Benzene, Toluene, Ethylbenzene and Xylene
BOD	Biological Oxygen Demand
BOWEC	Building Operations and Works of Engineering Construction Rules, 1984
BPIP	Building Profile Input Program
BS	British Standard
CASP	Country AIDS Strategic Plans
CBC	Competency-Based Curriculum
CBO	Community Based Organisation
CC	County Commissioner
CCKP	Climate Change Knowledge Portal
CCME	Canadian Council of Ministers of the Environment
CCTV	Close-Circuit Television
CEDRAW	Convention on the Elimination of Discrimination against Women
CEO	Chief Executive Officer
CER	Classification Error Rate

CESMP	Contractor Environmental and Social Management Plan
CFA	Community Forest Association
Cfb	Temperate Oceanic Climate
CH	Chainage
CHA	Critical Habitat Assessment
cm	Centimeter
CMIP	Climate Model Intercomparison Project
COD	Chemical Oxygen Demand
CoK	Constitution of Kenya
CPP	Consultation and Public Participation
CRC	Convention on the Rights of the Child
Csb	Temperate Mediterrainean Climate
CSR	Corporate Social Responsibility
CUP	Cattle Underpasses
Cwb	Subtroical Highland Oceanic Climate
dB(A)	A-Weighted Decibel value
DBFOMT	Design, Build, Finance, Operate, Maintain and Transfer
DCC	Deputy County Commissioner
DOSHS	Directorate of Occupational Safety and Health Services
DRC	Democratic Republic of Congo
EA	Environmental Audit
EBA	Endemic Bird Area
EEA	European Environment Agency
EF	Emission Factor
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act, 1999
EOO	Extent of Occurrence
EP	Equator Principles

EPA	Environmental Protection Agency
EPRA	Energy and Petroleum Regulatory Authority
%EPT	Percentage Ephemeroptera-Plecoptera-Trichoptera
ERC	Energy Regulatory Commission
ES	Ecosystem Services
ESEBT	Evergreen and Semi Evergreen Bushland and Thicket
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
EWG	Edaphic Wooded Grassland
Fa	Afromontane rain forest
Fb	Afromontane undifferentiated forest
FAO	Food and Agriculture Organization
Fbj	Afromontane single-dominant *Juniperus procera* forest
Fd	Afromontane single-dominant *Hagenia abyssinica* forest
FFMES	Flora, Fauna & Man, Ecological Services Ltd
FGC	female Genital Cutting
FOB	Foot Over-Bridge
FPIC	Free, Prior, Informed Consent
GBIF	Global Biodiversity Information Facility
GBV	Gender Based Violence
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Greenhouse gas
GJ	Gigajoule
GIIP	Good International Industry Practice
GN	Guidance Notes
GoK	Government of Kenya
GRM	Grievance Redress Mechanism
GSI	Gender and Social Inclusion

GSM	Gravel-Sand-Mud
HalV	Halophytic Vegetation
HCM	Highway Capacity Manual
HGV	Heavy Goods Vehicles
HHV	Higher Heating Value
HMIS	Hazardous Material Identification System
IAS	Invasive Alien Species
IBA	Important Bird Areas
ICERD	International Convention on the Elimination of All Forms of Racial Discrimination
ICP	Informed consultation and participation
IDP	Internally Displaced Persons
IFC PS	International Finance Corporation Performance Standards
IHAS	Invertebrate Habitat Assessment System
IHI	Index of Habitat Integrity
ILO	International Labour Organization
IOD	Indian Ocean Dipole
IPCC	Intergovernmental Panel on Climate Change
IRIS	Incorporated Research Institutions for Seismology
ISO	International Standard Organization
ITCZ	Intertropical Convergence Zone
IUCN	International Union for Conservation of Nature
KALRO	Kenyan Agricultural and Livestock Research Organization
KASF	Kenya AIDS Strategy Framework
KBA	Key Biodiversity Areas
KEBS	Kenya Bureau of Standards
KeNHA	Kenya National Highways Authority
KeRRA	Kenya Rural Roads Authority
KESHP	Kenya Environmental Sanitation and Hygiene Policy
KETRACO	Kenya Electricity Transmission Company

KFS	Kenya Forest Service
KMD	Kenya Meteorological Department
KMFRI	Kenya Marine and Fisheries Research Institute
KP	Kilometer Point
KPC	Kenya Pipeline Company
Ksh	Kenyan Shilling
KURA	Kenya Urban Roads Authority
KWS	Kenya Wildlife Service
KWSTI	Kenyan Wildlife Service Training Institute
LAA	Local Assessment Area
LALRP	Land Acquisition and Livelihood Restoration Plan
Leq	Equivalent Continuous Sound Level
LHS	Left Highway Side
LULUCA	Land Use and Land Use Change Analysis
LV	Light Vehicle
m3	Cubic meter
MDA	Ministries, Departments and Agencies
Mbgl	Meters Below Ground Level
MMI	Modified Mercalli Intensity
MoF	Ministry of Finance
MOTI	Ministry of Transport, Infrastructure, Housing and Urban Development
MOVES	Motor Vehicle Emission Simulator
MSDS	Material Safety Data Sheet
MSE	Mechanically Stabilized Earth
MSME	Micro Small and Medium Enterprises
NARC	Nartional Rainbow Coalition
NCCAP	National Climate Change Action Plan
NEMA	National Environment Management Authority
NGO	Non-Governmental Organisation

NLC	National Land Commission
NLUP	National Land Use Policy
NMH	National Museums and Heritage
NMK	National Museums of Kenya
NNM	Nairobi-Nakuru-Mau Summit
NNM	Nairobi National Museum
NPCH	National Policy on Culture and Heritage
NR	Noise Rating
NTP	Notice to Proceed
NTSA	National Transport and Safety Authority
NWP	National Water Policy
O&M	Operation and Maintenance
OCDP	Officer Commanding Police Depatment
ODF	Open Defecation Free
ODS	Ozone Depleting Substances
OECD	Organisation for Economic Co-operation and Development
OPDP	Ogiek People's Development Program
OSHA	Occupational Safety and Health Act
PAH	Poly Aromatic Hydrocarbon
PAHs	Project Affected Households
PCCRA	Preliminary Climate Change Risk Assessment
PDA	Project Development Area
PEL	Adverse Effects Frequently Occur to Benthic Organisms
PES	Priority Ecosystem Services
PLWD	People Living with Disabilities
PM	Particulate Matter
PPE	Personal Protection Equipment
PPP	Public-Private Partnership
PPV	Positive Predictive Value

PSD	Particle Size Distribution
%PTV	Percentage Pollution Tolerant Values
PUP	Pedestrian Underpasses
RAA	Regional Assessment Area
RAP	Resettlement Action Plan
RCMRD	Regional Centre for Mapping of Resources for Development
RCP	Representative Concentration Pathway
RFP	Request for Proposal
RHS	Right Highway Side
ROB	Road Over Bridge
ROW	Right-of-Way
RSA	Republic of South Africa
RVH	Rift Valley Highways
RWV	Riverine Wooded Vegetation
SAC	Species Accumulation Curves
SBSA	Standardized Biodiversity Sensitivity Analysis
SD	Slow-Deep
SDG	Sustainable Development Goals
SEP	Stakeholder Engagement Plan
SGBV	Sexual and Gender Based Violence
S&H	Safety and Health
SIC	Stone-in-Current
SOOC	Stones Out of Current
SPCC	Spill Prevention, Control and Countermeasures
SPV	Special Purpose Vehicle
SRTM	Shuttle Radar Topography Mission
SS	Snapshot Serengeti Dataset
SSV	Soil Screening Values
STI	Sexually Transmitted Infections

SVS	Slow-very-shallow
TAH	Trans-African Highway
TDI	Trophic Diatom Index
TDS	Total Dissolved Solids
TEL	Adverse Effects Occasionally Occur to Benthic Organisms
TMP	Traffic Management Plan
TNM	Traffic Noise Model
TOR	Terms of Reference
TPH	Total Petroleum Hydrocarbon
TPR	True Positive Rate
TSP	Total Suspended Particles
TSS	Total Suspended Solids
TVOC	Total Volatil Organic Componds
TWA	Time weighted average
UAWG	Upper Acacia Wooded Grassland
UNDRIP	United Nation Declaration on the Rights of Indigenous Peoples
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
VEC	Valued Environmental Component
VECEA	Vegetation and Climate Change in East Africa
VEG	Vegetation
VMG	Vulnerable, Marginalized Groups
VMS	Variable Message Signs
VOC	Volatile Organic Compound
VOP	Vehicle Overpass
VU	Vulnerable
VUP	Vehicle Underpass
WASREB	Water Services Regulatory Board
WCMA	Wildlife Conservation and Management Act, 2013

We	Upland *Acacia* wooded grasslands
Wd	Edaphic wooded grassland on drainage-impeded or seasonally flooded soils
WIBA	Work Injury Benefits Act
WRA	Water Resources Authority
WVC	Wildlife Vehicle Collisions

EXECUTIVE SUMMARY

INTRODUCTION (CHAPTER 1)

The Government of the Republic of Kenya (GoK), as part of its vision 2030 to become an industrialized middle-income country, has embarked on infrastructure development as a key pillar to invigorate the economy. To achieve this, the GoK is engaging private investors under Public Private Partnerships (PPP). The rehabilitation, improvement and expansion of the Nairobi-Mau Summit (A8) Highway and the strengthening of the A8 South Highway (the Project) is targeted as a priority project.

The Project Proponent is Rift Valley Highway Limited (RVH), which was selected as PPP partner by the Kenya National Highways Authority (KeNHA) following an international tender. RVH is owned by VINCI Highways, VINCI Concessions, and Meridiam SAS, and is in charge of the Project development.

The overall objective of the Project is to improve the movement of goods and people along the Nairobi-Mau Summit road, and to enhance connectivity between other parts of Kenya and the larger East and Central Africa as it is part of the Trans-African Highway (Northern Corridor). The road in its current condition is insufficient to serve the traffic of travellers and freight transporters using it.

The five key Project-related objectives and benefits include:

- **Employment Generation:** Road upgrades and maintenance activities provide good direct and indirect employment opportunities to skilled as well as unskilled manpower. The Project is expected to generate 1,500 jobs during construction and 200 jobs during operation, all primarily local.
- **Local Content:** The Project will have at least 40% of labour by value and 40% of materials by value (excluding petroleum and petroleum products) for construction sourced in Kenya.
- **Reduced Travel Times:** Improved highways conditions will lead to considerable time savings for travelling and freight shipping.
- **Enhanced Safety:** The proposed road upgrades include provision of four-lane separated carriageway (A8) that will reduce likelihood of head-on collision of vehicles.
- **Economic Impacts:** The Project will result in reduced transaction costs in transportation for enterprises and in more certainty, in using the Project road for transport given the elevated standard.

RVH has commissioned WSP Canada Inc. (WSP) to conduct the Project's ESIA and Environmental and Social Management System (ESMS) in compliance with the laws of Kenya and the International Finance Corporation Performance Standards (IFC PS). WSP has done so in collaboration with Norken International Ltd. and Flora Fauna & Man, Ecological Services Ltd. (FFMES).

The main objectives of the ESIA are to:

- identify and evaluate potential environmental and social effects associated with the Project development and implementation;
- ensure that anticipated effects are adequately mitigated or enhanced;
- propose adequate management and follow-up mechanisms to monitor the potential effects predicted.

The ESMS is submitted as a standalone document distinct from the ESIA report, and incorporates the following elements: (i) policy and legal framework; (ii) organizational capacity and competency; (iii) identification of risks and impacts; (iv) management programs; (v) communication and grievance management; (vi) capacitation training; (vii) document control and record management; and (ix) monitoring and review. A Resettlement Action Plan (RAP) has also been developed by KeNHA as a standalone document and is currently being implemented by KeNHA. The RAP is therefore excluded from the Consultant's scope of work.

LEGAL, REGULATORY AND POLICY FRAMEWORK (CHAPTER 2)

The ESIA was prepared according to the legislative framework of Kenya, as well as with the International Finance Corporation (IFC) performance standards, the African Development Bank's (AfDB) operational safeguards and international conventions to which Kenya is a party. Relevant Kenyan policies and statutes have therefore been analyzed and the Institutional framework within which it is being developed has also been described.

In addition to the Performance Standards, the IFC's Environmental, Health, and Safety (EHS) Guidelines and the EHS Guidelines for Toll Roads were also analyzed. A gap analysis (see section 2.7) between domestic requirements and international standards and requirements has been realized, and recommendations have been given to fill any gaps.

ALTERNATIVES ANALYSIS (CHAPTER 3)

The ESIA considered various project alternatives (see section 3.1) from the conceptual design stage to the construction activities. Alternatives reviewed at the conceptual design stage include:

- the no project alternative;
- the development and use of alternative transportation (railway lines);
- the construction of a new distinct road corridor;
- the development of alternate route alignments, and the crossing or bypass of the Nakuru City area.

The various options presented above were compared through a multicriteria analysis based on criteria such as capacity to reduce congestion and accommodate future demands, economic viability, financial attractiveness, complexity of land acquisition, environmental impact, road safety, and engineering challenges. The project alignment as described below was selected as it scored highest or amongst the highest on all criteria.

Construction aspects for which alternatives were considered are work sites selection, material sourcing, traffic management, and construction approaches (see section 3.2).

PROJECT DESCRIPTION (CHAPTER 4)

The Project involves two primary components:

- dualling, into a four-lane dual carriageway, of a portion (175 km) of 4 sections of A8 Highway between Rironi and Mau Summit, including operation and maintenance;
- strengthening of 2 sections of A8 South Highway between Rironi and Naivasha (57.2 km), including operation and maintenance.

The Project is located in the south west portion of Kenya along the existing Limuru-Naivasha-Nakuru-Mau Summit Highway system. The works will be distributed along two paths, one follows the existing corridors of Highway A104 from Rironi north to Mau Summit and the second Highways C88 and B3 from Rironi north to Naivasha. Map 1 illustrates the general location of the works and Table 1 presents the details on the planned roads sections.

Table 1 Road Sections Included in the Nairobi-Nakuru-Mau Summit Highway Project

Segment	Road	Road Section	Nature of Work	Section No.	Start-End Points	CH	Existing No. of Lanes	Planned No. of Lanes	Approx. Length (km)
1	A8	Rironi to Mau Summit	Dualling	1	Rironi – Naivasha	0 – 58+700	2	4	58.7
				2	Naivasha – Elmenteita Road	58+700 – 114+000	2	4	55.3
				3	Elmenteita Road – Njoro Turnoff (Nakuru City)	114+000 – 129+540	4	4 and 6 from 123+500 to 127+700	15.5
				4	Njoro Turnoff – Mau Summit	129+540 – 175+ 000	2	4	45.5
								Sub-Total	**175**
2	A8 South	Rironi Interchange to Naivasha Interchange	Strengthening	5	Rironi – Mai Mahiu	0 – 19+870	2	2	19.9
				6	Mai Mahiu – Naivasha	19+870 – 57+180	2	2	37.3
								Sub-Total	**57.2**
								Total Length (km)	**232.2**

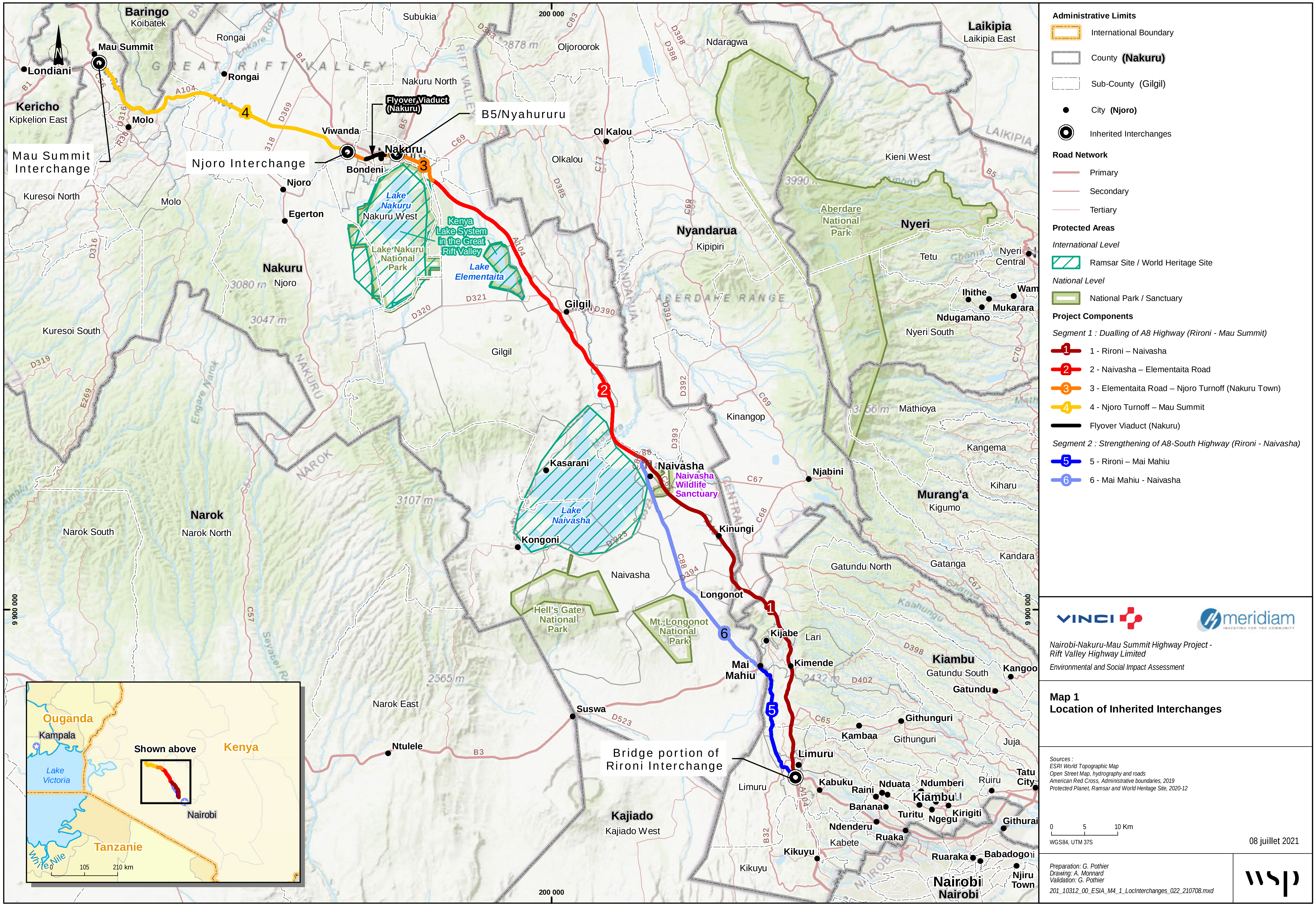
The Project’s delimitation coordinates are as follow:

- from (x) 236820.65, (y) 9874606.05 (Arc_1960_UTM _zone_37S) in the Limuru area;
- to (x) 799767.25 (y) 9982461.45 (Arc_1960_UTM _zone_36S) in the Mau Summit area.

In addition, the following auxiliary features are included in the Project:

- Establishment of construction sites and material sites.
- Combination of two elevated structures over roundabouts 1 and 2, one at-grade section between roundabouts 1 and 2, an elevated section (3,5 m) between roundabouts 2 and 3 and two viaducts to cross roundabouts 3 and 4 in Nakuru City.
- Improvements of junctions with major and minor roads and U-turn facilities, as well as construction of grade separated interchanges.
- Service lanes where relevant, as well as climbing lane at steep gradient locations.
- Bridges, extension of existing culverts or replacement of undersized ones.
- Underpasses and overpasses (trains, vehicles, pedestrians).
- Wildlife and livestock crossing points, bus bays and shelters, and truck lay-byes.
- Reinforcement of embankments and cuts as well as construction of retaining walls where required.
- Street lighting and high mast lighting facilities, gantries and road furniture (delineator, departure terminal, safety barrier, vertical road signs…), as well as landscaping.

A brief description and illustrations of the Project components and auxiliary features are presented in Chapter 4. The Atlas, which is presented as a separate document, illustrates the location of many Project components along A8 Highway and A8 South Highway. Other relevant Project description aspects such as design standards, Project activities (pre-construction/construction/operation), inputs and material, outputs and waste, equipment and machinery, workforce, schedule, and lifespan are also presented.



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

APPROACH AND METHOD (CHAPTER 5)

The assessment of the Project's impacts is conducted in accordance with the following spatial boundaries (see Maps 5-1and 5-2):

- The **Project Development Area (PDA)** corresponds to the existing Road Reserve and Project footprint or direct influence area associated with the implementation of the Project;
- The **Local Assessment Area (LAA)** includes the PDA and its nearby and adjacent surroundings where Project impact can be induced, anticipated, and reasonably expected. The LAA is specific to each VEC.
- The **Regional Assessment Area (RAA)** includes a broader geographical zone used to capture the regional context and where some potential Project impact can be induced, anticipated, and reasonably expected for a reduced number of valued components. The RAA is specific to each VEC.

This assessment specifically targets valued environmental components (VECs) that are of value or interest to local communities and regulatory authorities, and that are likely to be directly or indirectly affected by the construction activities of the proposed Project (see section 5.3).

VECs were selected based on the IFC Performance Standards and Guidelines, the scope of the Project, the stakeholder engagement program, experience on similar projects, and professional judgment of the Environmental and Social Evaluation practitioners.

Relevant baseline information relating to each VEC and sub-component was collected using different methods (see section 5.4), such as:

- desktop review and analysis of existing data;
- extensive field surveys conducted according to detailed sectoral protocols presented in Appendices 5-1 and 5-2.
- meetings with key national agencies and stakeholders to present the Project and collect actualized technical, environmental, and social data when possible.

Once baseline conditions were determined, the Project-related impacts were assessed (see section 5.5).

A systematic evaluation was conducted to determine what activities of the Project could result in an impact on each of the selected physical, biological, and socioeconomic VECs.

Following the identification of potential interactions and Project-related adverse impacts on each of the VECs were assessed. The assessment is based on a methodology using a combination of a prescriptive approach and professional judgment to identify the intensity, geographical extent, duration, and magnitude of the pre-mitigation and residual adverse impacts.

BASELINE CONDITIONS (CHAPTER 6)

PHYSICAL ENVIRONMENT

Climate

Kenya is generally known to offer a tropical climate, although topography causes climate variations throughout the country. The Project is essentially present within the temperate Mediterranean climate and temperate oceanic climate regions (see section 6.2.1.1). Meteorological conditions at the scale of the country show a high level of complexity both in time and space, resulting in a large range of temperature, rain fall, wind, and humidity. Variations are also observed in the different regions of the project area and described in the baseline.

Air Quality

An air quality sampling program was implemented in the Project area (see section 6.2.1.2). Particulate matter and other contaminants were sampled in the Limuru Area, Nakuru City, and Sobea Area. Standards considered for assessing ambient air quality are generally those from the IFC Environmental, Health, and Safety Guidelines (IFC EHS Guidelines), except for TSP (24 h), NO_2 (24 h) and TVOC (24 h) for which, in absence of an IFC standard, Kenya's NEMA standards were used. Results show that PM_{10} and $PM_{2.5}$ levels exceed applicable standards at all stations and exceedances are more important at the Nakuru sampling station. Total suspended particles (TSP) exceedances were also recorded in Nakuru. As for other ambient air contaminants (NO_2, SO_2, O_3, VOCs), all results comply with standards except for TVOCs at the Sobea sampling site, which might result from non-recurrent painting works noticed on a nearby residence three days after the beginning of the sampling.

GHG Emissions

GHG emissions of highways A8 Highway and A8 South Highway were quantified in CO_2 equivalent (CO_2e) for the year 2025, totalling 115 kT CO_2e (see section 6.2.1.3). The 2018 total Kenyan transport sector GHG emissions amounting to 9,29 Mt CO_2e, emissions of both highways therefore represent approximately 1.2% of Kenyan national transport sector emissions. This estimate considers emissions of A8 Highway and A8 South Highway as a whole, and not only the portion attributable to the Project.

Ambient Noise

An ambient noise survey campaign was conducted in 2021 to assess existing levels in the Project area in relation with IFC EHS Guidelines (see section 6.2.2). Ambient noise levels with the current highway configuration were then modelled for 2025 (estimated year 0 for starting operation of Project) and 2040 (target year to assess sound impact). Results for year 2025 show that with the current road configuration (no project scenario), most receptors would suffer sound levels exceeding daytime IFC criteria for residential, institutional, and educational areas. Three readings also show levels equivalent and above the daytime criteria for industrial and commercial areas. By 2040, an increase of 2 to 3 dBA is to be expected along the entire highway with the current highway configuration.

Geological Aspects

The region crossed by the Project is considered active in terms of volcanic activity, with five volcanic formations recorded at a relatively close distance from the Project (see section 6.2.3). The Rift Valley area, along with the counties of Nakuru and Kiambu, is classified as high hazard level, even though no eruptions have been registered in the area for over a century. The Project area is also seismically active, where a new divergent plate margin is developing. According to IRIS (Incorporated Research Institutions for Seismology) data, very few events have been recorded recently (since 1970) in the Project region, and none exceeded a Richter scale magnitude of 5.0. According to GFDRR ThinkHazard System, the area crossed by the Project has a low to a medium hazard level of being potentially damaged by an earthquake in the next fifty years.

Water Resources and Quality

The Project is located entirely within the Rift Valley basin area at an average elevation varying between 1500 and 2500 meters, specifically within sub-catchments of lakes Naivasha, Elmenteita, and Nakuru. These catchments play important roles in the regional economy. The Project does not directly interact with these lakes, but does cross a number of watercourses flowing into lakes Naivasha, and Elmenteita (see section 6.2.5).

Flood hazards in Kenya are a recurrent phenomenon. In the Project area, the rising lake levels and flooding in the Naivasha and Nakuru lake areas will need to be considered by the Project to ensure proper design of surface water runoff management. Local flood-prone areas were also identified during stakeholder consultations and compiled in the ESIA.

An extensive water quality sampling campaign was conducted in watercourses crossed by the Project. Anthropogenic activities are the main factor of the deterioration of general water quality in the region. Overall, water quality data considered in this study demonstrate a few instances of watercourses with low dissolved oxygen and high pH, certain levels of turbidity, nitrate, phosphate, total/fecal coliforms and E. coli, ubiquitous high level of phenols, as well as metals and derivatives concentrations consistently higher than quality guidelines and criteria in all water samples collected.

Soils and Sediments

Finally, a soil and sediment sampling campaign was also undertaken as part of the ESIA development (see section 6.2.6). It was concluded that chemical quality of soils is unlikely to represent a significant constraint, pending on site-specific variations. Additionally, all organic determinants were recorded below their compound specific laboratory limits of detection within each of the ten soil samples obtained. Whilst hydrocarbon staining and odours were noted at certain positions, the results indicate that these impacts are highly localised and are thus not considered to be significant. As for sediments, a minority of samples showed metal concentrations above the considered guidelines which could origin in part from human activities and naturally occurring concentration in soils.

BIOLOGICAL ENVIRONMENT

Habitats Description

A thorough literature review combined with field surveys were undertaken to describe the Project biological baseline conditions. A first biodiversity reconnaissance survey was carried out (November 2020), followed by two rounds of biological surveys during the dry season (February 2021) and the wet season (April 2021) to gather field data on terrestrial habitats and flora, birds, amphibians and reptiles, small and large mammals, as well as freshwater ecology (see section 6.3.2). In parallel to these field surveys, camera traps were deployed in two key areas for fauna to better understand wildlife movement and connectivity.

The Regional Project Area is characterized by a complex landscape, rich in habitat types, topography, and species. It is set for the most part in the Southern Kenya Rangeland ecosystems, and more precisely within the Eburru Forest and Naivasha-Elmentaita-Nakuru lakes sub-ecosystem. The Regional Assessment Area consists of agricultural and grass lands, agricultural plains, natural and sub-natural forests, dense mountainside woodlands, and plantation of exotic species such as eucalyptus and resinous. A total of twenty protected areas, either private or internationally recognised areas, are present in the Project's Regional Assessment Area (RAA).

The principal threat observed in the area is linked to human-induced environmental degradation. The rapid growth of human population led to severe deforestation and land degradation. Since year 2000, agricultural expansion has resulted in natural land retreat and a clear degradation of land under woodland or forest cover. These changes in land use impact wildlife populations, as they face loss of habitats. There is only about 10% of the wildlife in Eburru Forest and Naivasha-Elmentaita-Nakuru lakes sub-ecosystems which is found inside protected areas.

Habitat types traversed by the Project are described by a summary of field observations made in each habitat and are presented in Chapter 6 (section 6.3.3).

Flora

A total of 889 flora taxa from 123 families were recorded in the Project's Local Assessment Area (LAA) during surveys that have taken place on 219 sampling plots (see section 6.3.3). Among the species identified, three are considered as vulnerable and one as near threatened by the IUCN Red-Listed Species. These are camphor (*Ocotea kenyensis* – VU), red stinkwood (*Prunus Africana* – VU), leopard orchid (*Ansellia Africana* – VU), and the succulent tree *Euphorbia bussei* (NT). The Kenyan endemic species *Kleinia gregorii* was also confirmed as present in the evergreen and semi-evergreen bushland and thicket vegetation unit, but it is not assessed by IUCN (no status).

An assessment of habitat degradation, fragmentation, and quality was performed. The habitat degradation assessment highlighted that despite obvious degradation evidence, the LAA retains the potential to rapidly bounce back naturally should it be left unperturbed for a short period of time. However, some habitat types have lost this potential and may not be able to regenerate naturally. The habitat fragmentation assessment made it clear that the study area has reached an advanced stage of fragmentation with 41% of sites visited falling within that class. Some fragmentation had occurred in at least two thirds of the sites visited and was a prevalent matter. The habitat quality assessment showed that at least one third of the Biodiversity LAA is already within the realm of modified conditions and no longer retains the basic structure necessary for natural conditions. For the remainder of the study area, whilst it technically falls within the natural condition realm, most of it has already suffered light to medium modification influences and this is noted as most likely evolving towards a heavily modified stage.

Fauna

The surveys led to identify 439 bird species for the study area, with 375 species recorded during the dry season and 368 during the wet season (see section 6.3.4). A total of 162 additional species are also expected to occur, bringing the total of bird species in the LAA to 601 species. Among the species identified, 19 are classified under threatened or near-threatened by the IUCN Red-List (2021). Seventeen (17) nationally protected bird species are expected to be present in the LAA, of which 12 were observed during the survey campaigns. Only one species (c. Kikuyu White-eye *Zosterops kikuyuensis*) observed in the study site is entirely endemic to Kenya. However, ten species endemic to East Africa were observed, including three species endemic to the Serengeti Plains and Kenyan Highlands Endemic Bird Area. The prevalence of the majority of observed endemic species was higher in forest habitat. Five Important Bird Areas (IBA) are relevant to the project due to their close proximity to the Highway, and represent important habitat for birds. *Lake Elmenteita* is of particular interest as it supports thousands to millions of foraging waterbirds, especially flamingos, and is also an important "staging" or "fuelling" site for passing Palearctic wader species. The Manguo pond and Marula Estate floodplains were also identified as areas of special interest for birds.

In terms of amphibians and reptiles, a total of 28 reptile species and 15 amphibian species were identified during the surveys conducted in the LAA (see section 6.3.5). Two reptiles and three amphibians are listed as threatened or near-threatened on the IUCN Red-List. Seven species who are not listed in the IUCN Red-List are also protected by the Wildlife Conservation and Management Act (WCMA, 2013) of the Kenya Wildlife Service.

Sixty-four (64) species of mammals were noted in the LAA. According to the IUCN Red List, a total of one critically endangered (Nubian Giraffe), two endangered, five vulnerable and four near-threatened mammal species were recorded during the surveys (see section 6.3.6). Five nationally-protected mammal species listed have also been surveyed in the LAA and are designated as endangered. The concentration of species and particularly ungulates can be observed in three areas: the two conservation areas of Soysambu Conservancy and Marula Estates as well as on the plateau south of Naivasha. These areas are also key habitat zones for many species listed on the IUCN Red List of Threatened Species.

Wildlife movement and ecological connectivity in the Project area were studied via two specific studies: a long-term camera trap study and a habitat suitability and ecological connectivity modelling. These studies are available in Appendices 6-19 and 6-20, respectively, and a summary of results is presented in Chapter 6. These results were then used to guide the wildlife crossings recommendations, which are discussed in the Biodiversity Management Plan.

Freshwater Ecology

A thorough freshwater ecology assessment was conducted (see section 6.3.7). Habitat types were characterized, and an assessment of aquatic habitat integrity completed, indicating an overall *Largely to Moderately Modified* state along the road alignment, with the riparian habitat integrity scoring considerably lower compared to that of the instream habitat. Lake Elmentaita sites had the highest habitat integrity whereas Lake Naivasha sites had the poorest habitat integrity. A macroinvertebrate habitat assessment concluded that sites assessed reflect *Poor* to *Adequate* habitat diversity for aquatic macroinvertebrates, and a fish habitat assessment indicates that most freshwater systems have a good mix of habitat and should in theory be able to support a natural community of fishes. Eleven (11) species of fish in five families were sampled in the various habitat types during the 2021 surveys. Four species were exotic species, representing 36% of the total fish community (*Cyprinus carpio, Gambusia affinis, Poecilia reticulata*, and *Oncorhynchus mykiss*), which include habitat modifying and competitive predatory species which affect natural fish communities. Fish diversity was highest in the Molo and Naivasha catchments, however, it was still low overall. The fish communities were mostly dominated by 1 species in high numbers. Fish species richness was generally low across all catchments regardless of the season. Fish species richness was generally low across all catchments regardless of the season, but on average the Molo catchment showed the highest species richness in terms of fish. Interestingly, the headwater sites of the Molo catchment produced no species of fish despite good habitat availability and hydrology. All species of fish sampled in this survey are of least concern (LC) according to the IUCN Red List and relatively widely distributed. The *Clarias* and *Enteromius* species are freshwater migrants, however, these are widely distributed and common in the greater study area. None of the surveyed species are nationally listed as threatened or protected.

Biodiversity Sensitivity

A Standardized biodiversity sensitivity analysis was performed which allowed to develop a map of the biodiversity sensitivity at the Project landscape scale (see section 6.3.8). Sensitivity analyses are typically used to spatially represent the potential conflict zones between humans and biodiversity. Results show the LAA area had a generally low sensitivity for biodiversity with 42% of the area classified in that sensitivity class, while a further 21% was classified as very low sensitivity. The higher sensitivity classes combined (classes 3, 4, and 5) totalled 37% of LAA. The landscape closer to the road is generally less sensitive than the bigger landscape in consideration here.

Critical Habitats

A Critical Habitat Assessment (CHA) was completed following IFC PS6 standard of 2012 (IFC PS6, 2012) and guidance notes of 2019 (IFC PS6, 2019) (see section 6.3.9). Based on this analysis, the following biodiversity features qualify as critical habitat according to IFC PS 6:

- the Critically Endangered Nubian Giraffe (*Giraffa camelopardalis Ssp camelopardalis*);
- the Critically Endangered Rüppell's Vulture (*Gyps rueppelli*);
- the Critically Endangered White backed Vulture (*Gyps africanus*);
- the Endangered Sharpe's Longclaw (*Macronyx sharpei*);
- High biodiversity sensitivity areas within the East to West/Plateau-Escarpment-Lowland landscape;
- Endangered ecosystems, Protected areas and Key Biodiversity Areas.

Potential interactions the Project may have with the critical habitat qualifying features have been analyzed and it was concluded that, in most cases, the Project will have little to no impacts on the qualifying biodiversity features.

Ecosystem Services

Finally, an Ecosystem Services Analysis was carried out to identify ES provided within the Project's RAA, and to determine the Priority Ecosystem Services (PES) as prescribed in IFC's PS6 (see section 6.3.10). The main ES provided in the RAA are described in Table 6-50 of the ESIA, as well as the description of their use by local communities.

HUMAN ENVIRONMENT

Administrative and Socioeconomic Aspects

The human environment baseline description is based on primary and secondary sources (see section 6.4.1). Primary sources were collected through social surveys undertaken from February 5 to March 11, 2021 and targeting six stakeholder groups living or using the right of way (RoW) for livelihood activities: key informants and chiefs, livestock owners/caretakers, households close to the RoW, shop owners/keepers located close to the RoW, street vendors with stalls in the RoW, and Maasai pastoralists. A total of 258 persons completed the survey. This survey provided local-level information that was not available from secondary sources. It did not address topics related to the resettlement program or the advancement of the compensation and resettlement program as they are outside of the ESIA scope. Secondary sources were examined to complete the socioeconomic portrait of the population concerned by the project. In addition, focus groups were conducted during the Public Consultation Round 2 conducted from May 24th to June 7, 2021 in ten different locations. Each session included two groups, one for community leaders and another with women, elders, youth and people living with disabilities representatives.

Counties directly impacted by the Project are: Nakuru, Nyandarua, and Kiambu. It should be noted that the right of way runs parallel to the Baringo county for a few kilometers without formally infringing it.

The Project crosses rural and urbanized areas with widely varying population densities (see section 6.4.2). While large conservancies are very scarcely populated, the rest of the rural and urban areas are generally densely occupied. A majority of social survey respondents declared to belong to the Kikuyu ethnic group, and communities belonging to four distinct Vulnerable and Marginalized Groups (VMGs) have been identified in the Project area. Among them, some Maasai communities will be directly affected by the Project while the Ogiek, Turkana, and Samburu communities in the area will not be affected.

It is estimated that 36% of the Kenyans live below the national overall poverty line, with higher poverty rates in rural areas. Data from the ESIA social survey tends to confirm this as a vast majority of respondent households report experiencing financial difficulties. Education levels in the vicinity of the Project are also considered good, with approximately 60% of respondents having attended high school or a higher level. A proportion of 92% of respondents indicated that they could read.

The presence of the existing A8 and A8 South highways have stimulated growth and development in the Project area, allowed people to develop local skills and labour, improved communities' quality of life, and facilitated the flow and access to goods and services. On one hand, the highways also contribute to local livelihoods by offering an outlet to sell products along the road or pasture for livestock (see section 6.4.3 to 6.4.5). On the other hand, highways are also leading to nuisance and safety risks for communities. Many locations along the Project alignment are currently recognized as "accident black spots" by the National Transport and Safety Authority, and even more have been identified by local communities during consultations. Pedestrians regularly use existing cattle underpasses, vehicle underpasses, and box culverts along the road when available. Conversely, where safe crossing locations are unavailable or are not near key sites (i.e. shopping centres, bus stops, etc.), pedestrians will cross the highways at non-designated crossing locations, in many cases at risk of serious injury or death. More than 98% of participants to the ESIA social survey indicated that they currently cross the road without using specific infrastructure or crossing.

Livelihood

Livestock owners and pastoralists also use the land adjacent to the highway for grazing on both sides of the road for most of the Project's extent (see section 6.4.6). The ESIA social survey confirmed the risks posed by this practice, as 28% of respondent livestock owners reported a loss of at least one animal due to vehicle collision.

People living along the highways have different livelihood strategies depending on their location. In rural areas, livelihoods are mainly land-based. In peri-urban and urban settings, casual labour and business-based livelihoods are more common. Diversified livelihoods are common. Nineteen per cent (19%) of household members near the highways participating in the ESIA social survey indicated engaging in a secondary livelihood activity. The most common livelihoods in the Project area are:

- agriculture and agroforestry (natural, plantation, and private forests);
- livestock rearing (dairy cattle, indigenous chicken, and sheep);
- Micro, Small, and Medium Enterprises (MSMEs);
- street vendors (moving and non-moving vendors will stalls, selling food, vegetables, or various goods).

Fisheries is a growing sector and efforts are made to promote this sector in the three counties crossed by the Project. The industry sector is prominent in Kiambu and Nakuru counties. It counts various sub-sectors such as agro-processing and manufacturing, mining, animal feed production companies, agricultural inputs, engineering works, and hotel industries. Kiambu county has an industrial park, Tatu City, which is also considered as a special economic zone. Neither Nakuru or Nyandarua counties have an industrial park, but their respective governments put efforts to develop their sectors. Nyandarua county does not count any large-scale industry related to manufacturing or processing, although it benefits from a great potential. Benefiting from the A8 and A8 South roads, the transportation sector activities concern the long-distance carriage of goods. An important number of trucks is travelling on the extensive journey from Mombasa westwards to Uganda, South Sudan, Rwanda, and the Democratic Republic of Congo. Finally, tourism is also an important economic sector especially in Nakuru county.

Indigenous Peoples Considerations

Communities belonging to four distinct VMGs or "Indigenous Peoples" according to IFC PS 7 have been identified in the Project area (see section 6.4.8). Some Maasai communities will be directly affected by the Project while the Ogiek, Turkana, and Samburu will not. An overview of the culture, livelihoods, knowledge, and practices of the Maasai living in communities directly affected by the Project is presented, focusing on how they might be impacted. As the Project will impact lands and natural resources subject to traditional ownership or under customary use, a process to ensure the FPIC of the affected Maasai has been implemented. Information on the Ogiek, Turkana, and Samburu peoples is also provided.

STAKEHOLDER CONSULTATIONS (CHAPTER 7)

The ESIA-Stakeholder Engagement Plan (SEP) developed for the Project aims to create and sustain, through various Project development phases, a constructive and collaborative relationship with local authorities, organizations, and communities that are likely to be directly or indirectly affected by the Project (see section 7.2 and 7.3). Its activities included a series of baseline-oriented meetings with targeted actors, social surveys, specific technical meetings (including workshops) with administrators and selected key stakeholders and three rounds of public consultation. Stakeholders were involved at each phase of the ESIA development, and a social and gender inclusion approach was adopted. Separate activities were organized for VMGs to ensure adequate implementation of the Free, Prior and Informed Consent (FPIC) process.

A first consultation round presented the Project and the ESIA process to key authorities and informants (see section 7.4.2). Courtesy visits and subcounty community meetings were organized and conducted during which key issues related to the Project and its study area were discussed. Concerns, expectations, and grievance process were also addressed. Information was given to authorities regarding upcoming social surveys and their authorisation to proceed was secured. A total of 25 meetings was completed. Consultations were done by two distinct teams: a group for the sub-county community meetings and a group for the VMG meetings with both Maasai and Ogiek communities.

A second round of consultation presented the Project's progress since the first round, the proposed detailed design for each subcounty crossed by the Project, and identified potential environmental and social impacts generated (see section 7.4.3). A total of 28 meetings was realized. The objectives were for the stakeholders to identify the potential impacts of the Project and to give their views on the detailed design. Consultations were done by three teams: a group for the sub-county community meetings, a group for the VMG meetings and a group for the specific design technical meetings.

The subcounty community meetings were divided in two parts: 1) plenary sessions, during which a presentation was made to all participants followed by a question-and-answer period; and 2) focus groups where participants were subdivided in sub-groups (community leaders and vulnerable groups representatives) to examine the Project design in detail, spatially identify sensitive elements of the territory under study, make specific requests and Project design suggestions to facilitate its insertion in the receiving environment and communicate information on their communities and on the groups they represented. A significant number of suggestions were collected regarding location of pedestrian crossings, service lanes, truck lay-byes, bus bays, drainage, etc. During the second round, in addition to communicating information on the project's progress, the meetings with the VMG included a specific dialogue to determine whether the Project will generate impact to their community as well as the conditions under which they would grant their FPIC to the Project.

The Project design was indeed adapted to the concerns raised during the first two rounds of consultation. The main concerns were about road crossings, drainage, bus/truck bays and service lanes. Safety concerns were also raised, either in terms of lighting, for bicycle and motorcycle road and access, or for pedestrian. Stakeholders also mentioned the importance to respect the environment and to restore the landscape once the construction is complete. An exhaustive list of the concerns and expectations raised during the consultations is provided in the Chapter 7 of the ESIA.

Lastly, a third round of consultation aimed to present the revised design of the Project, with a focus on modifications made to integrate the comments gathered on the design during the previous two rounds to validate them with stakeholders (see section 7.4.4). The presentation also considered the main results of the ESIA, more specifically impacts identification and proposed mitigation measures. Next steps of ESIA completion and Project construction were also broadly presented.

As per the second round, three types of activities were performed: meetings with subcounty communities, dialogue with VMG and additional design-oriented technical meetings with county committees and selected key stakeholders. An approximate number of 20 meetings was held. The format chosen consisted of a PPT presentation followed by a Q&A question period. Meetings with the VMG were however different as the focus was brought on completing the information required to progress on the FPIC process and to initiate the negotiations to obtain an appropriate consent from the VMG for the project, in line with the IFC PS7 (see sections 7.4.2.1, 7.4.3.1 and 7.4.4.1). This specific process is on-going. All stakeholders welcomed and supported the project, expressed their gratitude for the participatory process; acknowledged the integration of their inputs, and were looking forward for the implementation.

IMPACT ASSESSMENT (CHAPTER 8)

Project impacts have been assessed based on the methodology presented in Chapter 5. Pre-mitigation and residual (post-mitigation) impacts on valued environmental components were analyzed, according to the following parameters:

- intensity of the impact indicates the degree to which the VEC will be disturbed (combination of apprehended impact and sensitivity/vulnerability);
- geographic extent of the impact refers to the spatial area of influence affected;
- duration of the impact refers to the period during which the impacts will be felt;
- magnitude of the impact reflects the overall degree of disturbance considering the intensity, the geographical extent, and the duration.

IMPACT ASSESSMENT

Table 2 summarises the impact assessment for each valued component of the Project. All mitigation measures are presented within the various sections assessing the impact of a specific VEC (see sections 8.1 to 8.3). The residual impact magnitude is indicated for the Pre-construction/Construction Phase and the Operation Phase. It should be noted that no impact has been assessed as having major significance after mitigation.

SOCIAL ACCEPTABILITY

Globally, the Project has a positive reception among the host communities (see section 8.4). The Project is seen as an opportunity to ease the road traffic and to improve safety. Despite the overall positive feedback toward the Project, concerns have been raised during Consultations (Round 1 to 3) and have been taken into consideration through design modifications and development of specific mitigation measures.

CUMULATIVE IMPACTS

A cumulative impacts assessment was performed as part of the ESIA, to assess the result of the combination, or even the synergic effect, of the Project with various other past, present, or future projects (see section 8.5). Such effects were examined for selected VECs (water resources/aquatic habitat, soils, nuisances, terrestrial habitats and fauna, physical well-being and community relations & social justice) considering an area that corresponds to a 5-km zone around the Project and a time period covering two years in the past and five years in the future. Various past, ongoing, and upcoming projects potentially generating impacts that could be cumulative with those of the Project were therefore identified during consultations and discussions with local authorities. Twelve such projects were identified, and their potential impacts on VECs were briefly assessed. Potential for cumulative impacts was then established by considering simultaneous existence of the Nairobi-Mau Summit Project and the severity of its own impacts on the said VECs, revealing cumulative effects with magnitudes expected to remain either minor or moderate.

Table 2 Overview of Impact Assessment Results

Valued Component	Source of Impacts	Potential Impacts	Residual Impact Magnitude *(Pre-Construction and Construction Phase)*	Residual Impact Magnitude *(Operation Phase)*
Atmospheric Environment – Ambient Air Quality	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Structural Works, Base layer and pavement work, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Release of dust and atmospheric contaminants locally.	**Minor**	**Minor**
Atmospheric Environment – GHG Emissions		Contribution to National GHG emissions.	**Minor**	**Positive**
Noise / Vibration	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Structural Works, Presence and use of Highway and Heavy maintenance and rehabilitation.	Local increase of noise and/or vibration locally during construction and operation activities.	**Moderate**	**Moderate**
Water Resources – Hydrology	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Temporary obstruction of surface water flow during construction and maintenance activities.	**Minor**	**Minor**
Water Resources – Surface Water Quality	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Potential introduction of contaminant (suspended solids and others) in the local watercourses and wetlands during construction and operation activities.	**Moderate**	**Minor**
Water Resources – Groundwater quality	Implementation of temporary construction facilities, Site preparation, Use of borrow pits and quarries, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Potential contamination of groundwater through accidental spills and leaks during construction activities.	**Moderate**	**Minor**
Water Resources – Groundwater quantity		Extraction of groundwater for construction and operation requirements.	**Moderate**	**Minor**
Soil and Sediment – Soil stability/erosion	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Structural work, Road furniture work.	Initiation of soil erosion through construction activities (groundworks).	**Moderate**	**N.A.**
Soil and Sediment – Soil quality	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Base-layer and pavement work, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Contamination of surface soils through accidental leaks or spills of contaminants during construction and maintenance activities.	**Minor**	**Minor**
Soil and Sediment – Sediment quality	Implementation of temporary construction facilities, Site preparation, Drainage and stormwater management, Presence and use of Highway and Heavy maintenance and rehabilitation.	Contamination of sediments through accidental leaks and spill of machinery used at the level of watercourses during construction and maintenance activities.	**Minor**	**Minor**
Habitats and Flora	Implementation of temporary construction facilities, Site preparation, Waste and hazardous material management and Presence and use of Highway.	Loss of vegetation cover through site clearing and later through better access to territory favouring an increase in land development. Also, the Project may favour the spreading of invasive species and alteration of local conditions that will alter vegetation composition.	**Minor**	**Minor**
Birds	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Presence of workers and influx of job seekers and Heavy maintenance and rehabilitation.	Habitat loss, degradation or modification through construction work and presence of Highway. Increase in mortality from vehicle collisions. Behaviour disturbances because of artificial lighting and noise generation.	**Minor**	**Minor**
Reptiles and Amphibians	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Presence of workers and influx of job seekers and Presence and use of Highway.	Habitat loss, degradation or modification through construction work and presence of Highway. Increase in mortality from vehicle collisions. Barrier effect caused by the presence of the Highway.	**Minor**	**Moderate**
Mammals – Small Mammals	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Presence of workers and influx of job seekers and Presence and use of Highway.	Habitat loss, degradation or modification through construction work and presence of Highway. Increase in mortality from vehicle collisions. Barrier effect caused by the presence of the Highway. Increased hunting because of an easier access to territory.	**Minor**	**Moderate**
Mammals – Large Mammals	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Presence of workers and influx of job seekers and Presence and use of Highway.	Habitat degradation or modification through construction work and presence of highway. Increase in mortality from vehicle collisions. Barrier effect caused by the presence of the Highway. Increased hunting because of an easier access to territory.	**Minor**	**Moderate**

Valued Component	Source of Impacts	Potential Impacts	Residual Impact Magnitude *(Pre-Construction and Construction Phase)*	Residual Impact Magnitude *(Operation Phase)*
Freshwater Ecology – Aquatic Habitat, Macroinvertebrates and Fish	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Drainage and stormwater management, Structural work, Waste and hazardous material management, Presence and use of Highway and Heavy maintenance and rehabilitation.	Habitat degradation or modification through construction work and presence of highway. Limitation to fish movements. Mortality of fish and macroinvertebrates. Increase fishing because of workers' presence and better access to territory.	**Moderate**	**Minor**
Ecosystem Services – Traditional medicine	Implementation of temporary construction facilities, Site preparation, Waste and hazardous material management and Presence and use of Highway.	Loss of vegetation cover and forested areas. Increase pressure due to better access of territory.	**Minor**	**Minor**
Land Development, Use and Occupation	Land acquisition, Resettlement and compensation and Use of borrow pits and quarries.	Temporary or permanent loss of land due to space needed for construction activities and the presence of some of the infrastructures of the Highway. Potential loss of economic activities for the same reasons.	**Minor**	**N.A.**
Community Well-being – Health and Safety	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Increased risk of injury and health problems for construction workers. Health problems caused by dust and contamination. Safety risk for pedestrians, risk of wildlife-vehicle collisions, and more frequent and severe traffic accidents. Increased prevalence of malaria and dengue and of communicable diseases including STIs and HIV/AIDS. Increased crime in surrounding communities.	**Minor to moderate**	**Minor to moderate**
Community Well-being – Other	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation	Impacts on livelihoods, gender aspects, Indigenous Peoples, and labour conditions as detailed in the Table below. Nuisances (noise, smell, dust, vibrations, and lights). Limitation of pedestrian and livestock movement. Effect on mobility because of traffic diversion and slowing down. Degradation of community relations and cohesion due to land use and compensation disputes, tensions and conflicts over the awarding of jobs and contracts, increased inequities that risk further marginalizing vulnerable groups, and inadequate communication with communities and stakeholders. Increased pressure on local natural resources and services.	**Minor to moderate**	**Minor to moderate**
Living Conditions, Social Amenities and Community Assets – Living Conditions	Land acquisition, Resettlement and compensation, Drainage and stormwater management, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Potential influence on local housing market because of the announcement of the Highway.	**Moderate**	**Moderate**
Living Conditions, Social Amenities and Community Assets – Social Amenities and Community Assets		Reduced access to informal roads due to construction activities and during heavy maintenance of Highway.	**Minor**	**Minor**
Livelihood Strategies and Economic Activities – Land-Based Livelihood Activities	Land acquisition, Resettlement and compensation, Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Reduction of agricultural production by the generation of dust, particles and pollution and by the loss of land. Effect on supply and produced goods circulation because of traffic diversion and slowing down.	**Moderate**	**Minor**
Livelihood Strategies and Economic Activities – Self-Employed and Business Based Livelihood		Effect on supply and produced goods circulation because of traffic diversion and slowing down. Temporary displacement of street vendors.	**Moderate**	**Minor**
Livelihood Strategies and Economic Activities – Fisheries (water-based livelihood)		See impacts on freshwater ecology above. Effect on supply and produced goods circulation because of traffic diversion and slowing down. Increased pressure on the resource because of population influx.	**Moderate**	**Minor to Moderate**
Livelihood Strategies and Economic Activities – Industry (Large-Scale Economic Activities)	Land acquisition, Resettlement and compensation, Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Effect on supply and produced goods circulation because of traffic diversion and slowing down.	**Moderate**	**Minor**
Livelihood Strategies and Economic Activities – Transport Sector		Effect on transport of goods along the Trans-African Highway because of traffic diversion and slowing down.	**Moderate**	**Minor**
Livelihood Strategies and Economic Activities – Tourism and Recreational Activities		Potential loss of ecological components that form part of the attraction for tourists. Effect on transport efficiency of tourists because of traffic diversion and slower pace.	**Moderate**	**Minor**

Valued Component	Source of Impacts	Potential Impacts	Residual Impact Magnitude *(Pre-Construction and Construction Phase)*	Residual Impact Magnitude *(Operation Phase)*
Labour Conditions	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Increased risk of injuries and physical and mental illnesses, risk of abuse by contractors hiring underage workers (child labour, violation of workers' rights, worker insecurity, fatigue and stress generating conflict at the household and community levels and potentially act as a trigger for social problems such as drug and alcohol abuse and GBV influx of workers and job seekers may negatively affect the social acceptability of the Project.	**Minor**	**Minor**
Vulnerable and Marginalized Groups (VMGs)	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Limitation of movement for community member and of access to roadside for selling goods. Potential indirect impact on urban sprawl and land speculation, creating additional pressure on indigenous land. Increased risk of STIs and GBV due to presence of workers.	**Minor to moderate**	**Minor to moderate**
Gender Aspects	Land acquisition, Resettlement and compensation, Purchase of materials, goods and services, Presence of workers and influx of job seekers and Operation and routine maintenance.	Inadequate distribution of dues following land or goods acquisition. Risk of Gender based violence, increase abandonment of wives and of prevalence of sexually transmitted infections because of population influx.	**Moderate**	**Minor**
Public Infrastructure and Services – Roads	Land acquisition, Resettlement and compensation, Implementation of temporary construction facilities, Site preparation, Drainage and stormwater management, Presence and use of Highway, Operation and routine maintenance and Heavy maintenance and rehabilitation.	Potential degradation of public roads due to increase in heavy truck movement and diversion of traffic to secondary roads.	**Moderate**	**Minor**
Public Infrastructure and Services – Railway		Potential temporary interruption of train circulation to allow some specific construction activities associated with the crossing structures.	**Minor**	**N.A**
Public Infrastructure and Services – Electricity and Telecommunication		Displacement or reconnection of some local distribution line for construction work purposes may cause some temporary interruption.	**Minor**	**N.A.**
Public Infrastructure and Services – Underground Utilities		Potential damages and service interruption to underground pipelines crossing the A8 Highway.	**Moderate**	**N.A.**
Archaeology and Cultural Heritage	Site preparation and Use of borrow pits and quarries.	Possibility of destroying undiscovered artefact during the soil movement works associated with construction and operation activities.	**Minor**	**N.A.**
Visual Environment	Transport and circulation, Use of borrow pits and quarries, Structural work, Presence and use of Highway and Operation and routine maintenance.	Reduction of visual fields quality with the presence of the construction activities and the presence of new elevated infrastructures (viaducts, overpasses, elevated structure in Nakuru City).	**Minor to moderate**	**Moderate**

CLIMATE CHANGE RISK ASSESSMENT (CHAPTER 9)

A Climate Change Resilience Assessment was performed in accordance with the methods and requirements of the ISO 31000 standards, using the best available climate projections and historical weather data to assess the Project's vulnerability to changes in climate and extreme weather for the construction, operation, and maintenance life of the assets (see section 9.3). Risks were identified and evaluated based on the likelihood of the risk occurring, the consequence should the risk occur, and the planned control measures (see section 9.4).

The vulnerability assessment showed that 20 potential impacts are likely to occur during the life span of the Project. These impacts are mostly related to heat waves, extreme precipitation, pluvial flooding, landslides, high winds, and drought conditions. Among these impacts, 19 of them are considered to represent a moderate, high, or very high risk for the infrastructure project. Detailed analysis is provided in the Chapter 9 of the ESIA (see section 9.4). Control measures were suggested to ensure a sufficient level of resilience (see section 9.4.3).

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (CHAPTER 10)

The ESMP summarizes important information that will be required for the preparation of the ESMS and ESMP for construction and operation phases of the Project. It includes a summary of the impacts and mitigation measures detailed in Chapter 8 (see section 10.2), an overview of the Projects governance structure at the global project level as well as for the construction and operation phases (see section 10.3) and an indication of the proposed content of the ESMS and list of management plan to be developed and implemented for the Project (see section 10.4.1 and 10.4.2). Finally, it details the monitoring and follow-up requirements for the Project which are respectively associated with the activities to be conducted to ensure implementation of all mitigation measures during construction and their short to long-term effectiveness during operation (see section 10.5).

E&S monitoring is based on site inspections, verification of the effectiveness of mitigation measures as well as reviews and updates, as required, based on observations and potential changes in construction or operation activities. The main E&S monitoring measures to be applied during the construction phase are listed fore each VECs in Table 10-1 of the ESIA. Those monitoring obligations are meant to correlate with the Project impacts and mitigation measures.

Environmental follow-up will be carried out by the Project operator and will take place in the operation phase. The proposed approach aims to monitor the progress of some Project-affected components and to validate the accuracy of the impact assessment. Follow-up programmes are recommended in relation to the following aspects:

- noise;
- surface water and freshwater habitat quality;
- soil stability;
- natural and critical natural habitat loss;
- success of revegetation and compensatory plantation;
- invasive alien flora species;
- use of wildlife crossings by terrestrial fauna;
- population outcomes for wildlife populations;
- roadkill monitoring;
- use and efficiency of pedestrian and cattle crossings;
- VMG's satisfaction and FPIC agreement results, and
- climate change resilience.

TABLE OF CONTENTS

1 INTRODUCTION 1-1
1.1 Project Context 1-1
1.2 Project Objectives 1-5
1.3 Project Proponent 1-6
1.4 ESIA Objectives and Contents 1-6
1.5 Report Structure 1-7
1.6 ESIA Consultants 1-8
1.6.1 WSP Canada Inc. 1-8
1.6.2 ESIA Subconsultants 1-8

2 LEGAL, REGULATORY, AND INSTITUTIONAL FRAMEWORKS 2-1
2.1 Constitutional Requirements for Environmental Protection 2-1
2.2 Policy Provisions 2-1
2.2.1 Vision 2030 2-1
2.2.2 National Environment Policy, 2014 2-2
2.2.3 Kenya National Biodiversity Strategy and Action Plan (NBSAP) 2019-2030 2-2
2.2.4 Kenya Forest Policy 2014 2-3
2.2.5 Wildlife policy of 2011 2-3
2.2.6 Sessional paper no.1 of 2020 on wildlife policy 2-3
2.2.7 The National Occupational Health and Safety Policy of 2012 2-4
2.2.8 Kenya AIDS Strategic Framework 2 (2020/21-2024/25) 2-4
2.2.9 Kenya Health Policy of 2014-2030 2-5
2.2.10 Government of Kenya Medium Term Plan 2018-2022 2-5
2.2.11 Economic Recovery for Wealth and Employment Creation Strategy of 2006 2-6
2.2.12 The Kenya Environmental Sanitation and Hygiene Policy of 2016-2030 2-6
2.2.13 Land Policy of 2009 2-7
2.2.14 The National Policy on Water Resources Management and Development (Sessional Paper No 1 of 1999) 2-7
2.2.15 Land Use Policy of 2017 (Sessional Paper No 1 Of 2017) 2-8
2.2.16 Kenya National Policy on Gender and Development of 2011 2-8
2.3 National Regulatory Framework 2-9
2.3.1 Environment Management and Coordination Act, 1999 (Amended 2015) 2-9
2.3.2 Environment Management and Coordination Act, (Controlled Substances) Regulation ,2007 2-13
2.3.3 Environment Management and Coordination Act (Wetlands, Riverbanks, Lake Shores And Seashores Management) Regulations 2009 2-14
2.3.4 Public Roads and Roads Access Act (CAP 399) 2-14

2.3.5 The Traffic Act CAP 403 of 2013 2-14
2.3.6 Land registration act no:3 of 2012 2-14
2.3.7 The national lands commission act of 2012 2-15
2.3.8 The land laws act (amended) 2016 2-15
2.3.9 The Trust Land Act CAP 288 2-16
2.3.10 Land Valuation Act Of 2010 2-16
2.3.11 HIV/AIDS Prevention and Control Act 2006 2-16
2.3.12 Draft National Building Code 2020 2-17
2.3.13 The National Gender and Equality Act 2011 2-17
2.3.14 Persons with Disability Act CAP 133 2-18
2.3.15 Occupational Safety and Health Act, 2007 2-18
2.3.16 Public Health Act, Cap 242 2-22
2.3.17 Water Act, 2016 2-22
2.3.18 The Forest Conservation and Management Act, 2016 2-23
2.3.19 Energy Act, 2019 2-23
2.3.20 The Land Acquisition Act, Chapter 295 Laws of Kenya, 2012 2-23
2.3.21 Wildlife Conservation and Management Act, 2013 2-24
2.3.22 Employment Act, 2007 2-25
2.3.23 Work Injury Benefits Act (WIBA) 2-25
2.3.24 National Museums and Heritage Act 6 of 2006 2-26
2.3.25 Kenya Roads Act of 2007 2-26
2.3.26 Land and Environment Court Act, 2012 2-27
2.3.27 Physical Planning Act, 2007 2-27
2.3.28 Climate Change Act, 2016 2-27
2.3.29 Urban Areas and Cities Act, No. 13 of 2011 2-27
2.3.30 The Community Land Act 2016 2-28

2.4 Institutional Framework 2-28

2.4.1 Ministry of Transport, Infrastructure, Housing and Urban Development 2-28
2.4.2 Kenya National Highways Authority (KeNHA) 2-28
2.4.3 Rift Valley Highways Limited 2-29
2.4.4 The National Environment Management Authority (NEMA) 2-29
2.4.5 Water Resources Regulatory Board (WASREB) 2-30
2.4.6 Kenya Wildlife Service 2-30
2.4.7 Kenya Forest Service 2-30
2.4.8 The Treasury 2-30
2.4.9 Nakuru, Nyandarua and Kiambu County Governments 2-31
2.4.10 Directorate of Occupational Safety and Health Services (DOSHS) 2-31
2.4.11 National Transport and Safety Authority 2-31

2.5 Applicable International Standards 2-31

2.5.1 International Finance Corporation Perfomance Standards 2-32
2.5.2 African Development Bank Operational Safeguards 2-33
2.5.3 Equator Principles 2-34

2.6 International Agreements 2-35

2.7 Gap Analysis 2-37

3 PROJECT ALTERNATIVES 3-1

3.1 Conceptual Design Alternatives 3-1
3.1.1 No Project Alternative 3-1
3.1.2 Alternative Linear Transport Means 3-2
3.1.3 Alternative Alignment Options 3-2
3.1.4 Alternative Design for Congested Urban Areas (Nakuru City) 3-7

3.2 General construction-related alternatives 3-16
3.2.1 Material Sourcing Sites 3-16
3.2.2 Traffic Management 3-19

4 PROJECT DESCRIPTION 4-1

4.1 Project Context and Justification 4-1

4.2 Anticipated Benefits 4-3

4.3 Project Location 4-4

4.4 Presentation of project components and features 4-5
4.4.1 Overview 4-5
4.4.2 Temporary construction facilities 4-6
4.4.3 Dualling of A8 Highway between Rironi and Mau Summit 4-11
4.4.4 Strengthening of A8-South Highway between Rironi and Naivasha 4-14
4.4.5 6-lanes highway in Nakuru City 4-17
4.4.6 Improvement of Road Junctions and U-Turn Facilities 4-21
4.4.7 Vehicle Overpasses (VOP) and Vehicle Underpasses (VUP) 4-23
4.4.8 Service Lanes 4-25
4.4.9 Climbing Lane at Steep Gradient Locations 4-28
4.4.10 Bridges 4-29
4.4.11 Railway under/over Bridge 4-29
4.4.12 Pedestrian and Cattle Crossing Facilities 4-30
4.4.13 Wildlife Crossings and Fencing 4-35
4.4.14 Surface Water Management 4-37
4.4.15 Bus Bays and Bus Shelters 4-42
4.4.16 Truck Lay Bye 4-43
4.4.17 Lighting Facilities 4-45
4.4.18 Gantries, Road Furniture and Road Signs 4-45
4.4.19 Guard Rail/Crash Barrier Provisions 4-46
4.4.20 Operation and Maintenance Centers 4-46
4.4.21 Project Feature Classification 4-47

4.5 Design Standards 4-51

4.6 Project Activities 4-53
4.6.1 Pre-Construction Activities 4-53

4.6.2 Construction Activities 4-53
4.6.3 Operation 4-56
4.7 Inputs and Material 4-62
4.7.1 Construction 4-62
4.7.2 Operation 4-65
4.8 Outputs and Wastes 4-65
4.9 Equipment and Machinery 4-66
4.9.1 Pre-Construction and Construction 4-66
4.9.2 Operation and Maintenance 4-68
4.10 Workforce 4-68
4.10.1 Pre-Construction and Construction 4-68
4.10.2 Operation and Maintenance 4-69
4.11 Schedule 4-70
4.12 Lifespan of the upgraded road 4-73
5 APPROACH AND METHODOLOGY 5-1
5.1 COVID-19 Considerations 5-1
5.2 Spatial Boundaries 5-2
5.3 Valued Environmental Components 5-9
5.4 Data Collection Methodologies 5-17
5.4.1 Desktop Analyses 5-17
5.4.2 Surveys 5-22
5.5 Assessment of Project Impact 5-71
5.5.1 Sources of Impact Considered 5-71
5.5.2 Impact Considered 5-72
5.5.3 Mitigation Measures 5-72
5.5.4 Characterization of Impact 5-72
5.5.5 Social acceptability Assessment 5-77
5.5.6 Cumulative Impact Assessment 5-78
6 DESCRIPTION OF BASELINE CONDITIONS 6-1
6.1 Preamble 6-1
6.2 Physical Environment 6-1
6.2.1 Atmospheric Environment 6-1
6.2.2 Ambient Noise 6-14
6.2.3 Geology, Volcanism and Seismicity 6-19
6.2.4 Topography 6-27
6.2.5 Water Resources 6-29
6.2.6 Soils and Sediments 6-65
6.3 Biological Environment 6-79

6.3.1 Methodological Considerations ... 6-79
6.3.2 Biodiversity Context ... 6-80
6.3.3 Terrestrial Habitats and Flora ... 6-89
6.3.4 Birds ... 6-105
6.3.5 Amphibians and Reptiles ... 6-123
6.3.6 Mammals ... 6-132
6.3.7 Freshwater Ecology ... 6-144
6.3.8 Standardised Biodiversity Sensitivity Analysis ... 6-160
6.3.9 Critical Habitat Assessment ... 6-163
6.3.10 Ecosystem Services ... 6-181

6.4 Human Environment ... 6-186

6.4.1 Methodological Considerations ... 6-186
6.4.2 Population ... 6-187
6.4.3 Land Development, Use, and Occupation ... 6-195
6.4.4 Community Wellbeing and Safety ... 6-197
6.4.5 Living Conditions, Social Amenities and Community Assets ... 6-204
6.4.6 Livelihood Strategies and Economic Activities ... 6-206
6.4.7 Labour Conditions ... 6-228
6.4.8 Indigenous Peoples (Vulnerable and Marginalized Groups - VMGs) ... 6-231
6.4.9 Gender Aspects ... 6-245
6.4.10 Public Infrastructure and Services ... 6-249
6.4.11 Archaeology and Cultural Heritage ... 6-254
6.4.12 Visual Environment ... 6-255
6.4.13 Known and Relatively Foreseen Development Projects ... 6-255

7 STAKEHOLDER ENGAGEMENT ... 7-1

7.1 Introduction and Objectives ... 7-1

7.1.1 Objectives ... 7-1

7.2 Overview of Engagement Requirements ... 7-2

7.2.1 National Requirements ... 7-2
7.2.2 International Requirements ... 7-3

7.3 Rationale for Distinct Consultation Processes ... 7-4

7.4 Engagement Approach: Affected Communities and Other Stakeholders ... 7-5

7.4.1 Stakeholder Identification ... 7-5
7.4.2 Consultation and Message ... 7-5
7.4.3 Consultation Activities Framework ... 7-6
7.4.4 Grievance Redress Mechanism ... 7-9
7.4.5 Recording and Disclosure of Project Information and Minutes of Consultations ... 7-9
7.4.6 Integration of Consultation outcomes in the ESIA ... 7-9

7.5 Engagement Activities Description and Results: Affected Communities and Other Stakeholders ... 7-10

7.5.1 Baseline-Oriented Meetings and Social Surveys 7-10
7.5.2 First Round of Consultation 7-13
7.5.3 Second Round of Consultation 7-21
7.5.4 Third Round of Consultation 7-42

7.6 Engagement Approach: Indigenous Peoples 7-51

7.6.1 Consultation Activities Framework 7-51
7.6.2 Free, Prior, and Informed Consent (FPIC) Procedure 7-52
7.6.3 Stakeholder Identification and Preliminary Consultations 7-53
7.6.4 Consultation and Message 7-54
7.6.5 Recording and Disclosure of Project Information and Minutes of Consultations 7-55
7.6.6 Integration of consultation outcomes in the ESIA 7-55

7.7 Engagement Activities Description and Results: Indigenous Peoples 7-55

7.7.1 First Round of Consultation 7-56
7.7.2 Second Round of Consultation 7-58
7.7.3 Third Round of Consultation 7-64

8 IMPACT ASSESSMENT AND MITIGATIONS 8-1

8.1 Physical Environment 8-2

8.1.1 Atmospheric Environment 8-2
8.1.2 Ambient Noise 8-8
8.1.3 WATER RESOURCES 8-15
8.1.4 Soil and Sediments 8-33

8.2 Biological Environment 8-42

8.2.1 Habitat and Flora 8-42
8.2.2 Fauna 8-49
8.2.3 Freshwater Ecology 8-66
8.2.4 Ecosystem Services 8-70

8.3 Human environment 8-74

8.3.1 Land Development, Use and Occupation 8-74
8.3.2 Community Well-Being and Safety 8-75
8.3.3 Living Conditions, Social Amenities and Community Assets 8-87
8.3.4 Livelihood Strategies and Economic Activities 8-92
8.3.5 Labour Conditions 8-110
8.3.6 Vulnerable and Marginalized Groups (VMGs) 8-113
8.3.7 Gender Aspects 8-121
8.3.8 Public Infrastructure and Services 8-127
8.3.9 Archaeology and Cultural Heritage 8-134
8.3.10 Visual Environment 8-136

8.4 Social Acceptabillty 8-139

8.5 Cumulative Impacts 8-142

8.5.1 Potential Cumulative Effects on Valued Environmental and Social Components 8-142
8.5.2 Evaluation of Cumulative Effects on VECs 8-145

9 CLIMATE CHANGE RISK ASSESSMENT 9-1

9.1 Methodology 9-1
9.1.1 Our Approach 9-1
9.1.2 Step-by-Step Methodology 9-2
9.1.3 Context and Risk Identification 9-5
9.1.4 Analysis of Climate Observations and Projections 9-5

9.2 Risk Identification 9-7
9.2.1 Context of the Project 9-7
9.2.2 Identification of Climate Hazards 9-10
9.2.3 Exposure Assessment 9-10

9.3 Vulnerability Assessment 9-20
9.3.1 Potential Impacts 9-20
9.3.2 Sensitivity and Adaptive Capacity 9-22
9.3.3 Vulnerability Scoring 9-29

9.4 Risk Evaluation 9-30
9.4.1 Likelihood and Selection of Relevant Impacts 9-30
9.4.2 Severity of Impacts and Initial Risk Rating 9-31
9.4.3 Control Measures and Residual Risk Rating 9-32

9.5 Conclusion 9-35

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN 10-1

10.1 Objectives 10-1

10.2 Summary of impacts and mitigation measures 10-1

10.3 Governance 10-21

10.4 ESMS and associated Management/Action Plans 10-24
10.4.1 Environmental and Social Management System 10-24
10.4.2 Procedures and Management Plans 10-25

10.5 Environmental and Social Monitoring and Follow-up 10-28
10.5.1 Environmental and Social Monitoring 10-28
10.5.2 Environmental and Social Follow-up 10-39

11 REFERENCES 11-1

TABLES

TABLE 2-1	MAXIMUM PERMISSIBLE NOISE LEVELS - CONSTRUCTION PHASE	2-11
TABLE 2-2	MAXIMUM PERMISSIBLE NOISE LEVELS - OPERATION PHASE	2-12
TABLE 2-3	NATIONAL ROADS CLASSIFICATIONS AS PER KENYA ROADS ACT	2-26
TABLE 2-4	INTERNATIONAL ENVIRONMENTAL AGREEMENTS RELEVANT TO KENYA	2-36
TABLE 2-5	INTERNATIONAL LABOUR ORGANIZATION FUNDAMENTALS AND OTHER CONVENTIONS	2-37
TABLE 2-6	GAP ANALYSIS	2-38
TABLE 4-1	ROAD SECTIONS INCLUDED IN THE NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT	4-4
TABLE 4-2	EXISTING ROAD RESERVE HIGHWAY A8	4-12
TABLE 4-3	EXISTING CARRIAGEWAY FOR HIGHWAY A8	4-12
TABLE 4-4	DETAILS OF THE EXISTING CARRIAGEWAY FOR HIGHWAY A8 SOUTH	4-14
TABLE 4-5	DESCRIPTION OF INHERITED INTERCHANGES	4-17
TABLE 4-6	LOCATION OF KEY FEATURES OF THE NAKURU CITY CROSSING STRATEGY	4-17
TABLE 4-7	LOCATIONS OF CROSSROADS WITH APPROXIMATE CHAINAGES	4-22
TABLE 4-8	U-TURNS IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH	4-23
TABLE 4-9	VEHICULAR OVERPASSES IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH	4-23
TABLE 4-10	VEHICULAR UNDERPASSES IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH	4-24
TABLE 4-11	PROPOSED CLIMBING LANE LOCATIONS	4-28
TABLE 4-12	RAILWAY OVERPASSES AND UNDERPASSES IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH	4-29
TABLE 4-13	FOOT-OVER-BRIDGE FACILITIES IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND A8 SOUTH	4-31
TABLE 4-14	CATTLE CROSSING FACILITIES IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH	4-34

TABLE 4-15 EXISTING WILDLIFE CROSSINGS............4-36
TABLE 4-16 LIST OF PROPOSED TREATMENT INFRASTRUCTURES AND LOCATION 4-41
TABLE 4-17 BUS BAYS IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH................................4-42
TABLE 4-18 TRUCK BAYS IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH................................4-44
TABLE 4-19 LIGHTING IN THE DIFFERENT SECTIONS OF HIGHWAY A8 AND HIGHWAY A8 SOUTH................................4-45
TABLE 4-20 EXPECTED SURFACES OF THE O&M CENTER AND NAKURU SUPPORT UNIT..4-46
TABLE 4-21 LISTING OF PROJECT COMPONENTS, ANCILLARY FACILITIES AND ASSOCIATED FACILITIES 4-48
TABLE 4-22 LIST OF STANDARDS AND SPECIFICATIONS FOR DESIGN AND CONSTRUCTION WORKS 4-51
TABLE 4-23 INTERNATIONAL STANDARDS AND SPECIFICATIONS FOR DESIGN AND CONSTRUCTION WORKS TO BE USED FOR MISSING REFERENCES OF STANDARDS AND SPECIFICATIONS IN THE KENYAN MANUALS..4-52
TABLE 4-24 MAINTENANCE ACTIVITIES OF FACILITIES AND TYPICAL LIFECYCLE 4-61
TABLE 4-25 MAINTENANCE ACTIVITIES OF INFORMATION SYSTEM COMPONENTS AND TYPICAL LIFECYCLE 4-62
TABLE 4-26 MATERIALS REQUIRED FOR ROAD CONSTRUCTION.......................................4-63
TABLE 4-27 STONE MATERIAL REQUIREMENTS (IN METRIC TONS)...................................4-63
TABLE 4-28 LIST OF CEMENT FACTORIES AVAILABLE NEAR THE PROJECT ROAD...4-64
TABLE 4-29 FUEL CONSUMPTION FOR CONSTRUCTION WORK...........................4-65
TABLE 4-30 EQUIPMENT TO BE USED DURING CONSTRUCTION.......................................4-66
TABLE 4-31 PRE-CONSTRUCTION AND CONSTRUCTION WORKS PROGRAM 4-71
TABLE 5-1 SELECTED VALUED ENVIRONMENTAL COMPONENTS FOR THE NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT...................5-11
TABLE 5-2 GHG EMISSIONS FOR EACH SCOPE 5-19

TABLE 5-3 EMISSION FACTORS FOR VEHICLES – ROAD TRANSPORTATION 5-20
TABLE 5-4 HHV FOR DIFFERENT TYPES OF FUEL 5-21
TABLE 5-5 EMISSION FACTORS FOR VEHICLES IN G/L 5-21
TABLE 5-6 AIR QUALITY SAMPLING POINT LOCATION 5-24
TABLE 5-7 REFERENCE STANDARDS SELECTED ... 5-25
TABLE 5-8 AMBIENT NOISE SAMPLING POINT LOCATION 5-32
TABLE 5-9 SOIL SAMPLING POINTS LOCATION 5-37
TABLE 5-10 GENERAL PARAMETERS OF VEGETATION SURVEY SITE LOCATIONS WITHIN THE BIODIVERSITY LAA 5-47
TABLE 5-11 POINT COUNT STATIONS PER HABITAT TYPES WITHIN THE BIODIVERSITY LAA 5-50
TABLE 5-12 CRITERIA AND WEIGHTS USED FOR THE ASSESSMENT OF HABITAT INTEGRITY (ADAPTED FROM KLEYNHANS, 1996) 5-64
TABLE 5-13 FISH SAMPLING EQUIPMENT USED, AND THE SAMPLING EFFORT FOLLOWED DURING SURVEYS. 5-65
TABLE 5-14 WSP SURVEY LOCATIONS AND EFFECTIVE EFFORT BY COUNTY TRAVERSED BY THE PROJECT 5-68
TABLE 5-15 WSP SURVEY PARTICIPANTS BY STAKEHOLDER GROUP AND GENDER ... 5-69
TABLE 5-16 SOURCES OF IMPACT 5-71
TABLE 5-17 IMPACT IDENTIFICATION MATRIX 5-73
TABLE 5-18 MAGNITUDE ASSESSMENT MATRIX 5-76
TABLE 5-19 EXAMPLE OF THE PRE-MITIGATION IMPACT SUMMARY TABLE COMPLETED FOR EACH VEC 5-76
TABLE 6-1 AMBIENT AIR QUALITY CONSIDERED AS PART OF THE ESIA 6-10
TABLE 6-2 AMBIENT AIR QUALITY RESULTS FOR A1 (LIMURU AREA) – PARTICULATE MATTER 6-10
TABLE 6-3 AMBIENT AIR QUALITY RESULTS FOR A2 (NAKURU CITY) – PARTICULATE MATTER 6-11
TABLE 6-4 AMBIENT AIR QUALITY RESULTS FOR A3 (SOBEA AREA) – PARTICULATE MATTER 6-11
TABLE 6-5 AMBIENT AIR QUALITY RESULTS FOR A1 (LIMURU AREA)– OTHER CONTAMINANTS 6-11
TABLE 6-6 RESULTS FOR A2 (NAKURU CITY) – OTHER CONTAMINANTS 6-11

TABLE 6-7	RESULTS FOR A3 (SOBEA AREA) – OTHER CONTAMINANTS	6-12
TABLE 6-8	GHG BY SECTORS – 2018	6-12
TABLE 6-9	GHG EMISSIONS FOR ENERGY BY SUB SECTORS – 2018	6-13
TABLE 6-10	GHG EMISSION RATES AT TIME ZERO (2025) BY KM FOR EACH ROAD SECTIONS CONSIDERED	6-13
TABLE 6-11	SUMMARY OF GHG EMISSION RATES AT TIME ZERO (2025) FOR EACH CONTAMINANT AND FOR EACH HIGHWAY SEGMENT	6-14
TABLE 6-12	SUMMARY OF ANNUAL GHG EMISSIONS AT TIME ZERO (2025) BY CONTAMINANTS AND FOR EACH HIGHWAY SEGMENT	6-14
TABLE 6-13	TOTAL YEARLY BASELINE GHG EMISSION RATES AT TIME ZERO (2025)	6-14
TABLE 6-14	AMBIENT NOISE STANDARDS CONSIDERED AS PART OF THE ESIA	6-15
TABLE 6-15	2021 TRAFFIC COUNTS RESULTS	6-16
TABLE 6-16	EXISTING MEASURED AND SIMULATED BASELINE MEAN HOURLY SOUND LEVELS	6-17
TABLE 6-17	MEAN DAILY (24H) SOUND LEVELS CALCULATED IN CURRENT ROAD CONFIGURATION PROJECTED IN 2025 AND 2040	6-17
TABLE 6-18	DOCUMENTED FLOOD RISK AREAS ALONG THE PROJECT'S ALIGNMENT	6-39
TABLE 6-19	SURFACE WATER QUALITY STANDARDS CONSIDERED AS PART OF THE ESIA	6-42
TABLE 6-20	SUMMARY OF EXISTING WATER QUALITY DATA	6-45
TABLE 6-21	SURFACE WATER SAMPLING CHARACTERIZATION	6-47
TABLE 6-22	SUMMARY OF SURFACE WATER ANALYTICAL RESULTS FROM RAINY SEASON	6-53
TABLE 6-23	SUMMARY OF SURFACE WATER ANALYTICAL RESULTS FROM DRY SEASON	6-56
TABLE 6-24	WRA AQUIFER CLASSIFICATION	6-61
TABLE 6-25	WRMA GROUNDWATER WELL INFORMATION	6-64
TABLE 6-26	SUMMARY OF PHYSICAL PROPERTIES	6-67
TABLE 6-27	SUMMARY OF CHEMICAL ANALYTICAL RESULTS	6-69

TABLE 6-28 RECORDED CONCENTRATIONS (MG/KG) VERSUS SOUTH AFRICAN SSVS FOR ANALYSED METALS 6-72
TABLE 6-29 SEDIMENT SAMPLING LOCATIONS AND OBSERVATIONS 6-74
TABLE 6-30 SUMMARY OF SEDIMENT ANALYTICAL RESULTS 6-77
TABLE 6-31 PROTECTED AREAS AND INTERNATIONALLY RECOGNIZED AREAS WITHIN THE RAA 6-83
TABLE 6-32 PRIVATE CONSERVANCIES WITHIN THE RAA 6-84
TABLE 6-33 VECEA HABITAT TYPES OCCURRING THROUGHOUT THE BIODIVERSITY RAA 6-89
TABLE 6-34 FLORA DIVERSITY SURVEYED WITHIN THE LAA 6-102
TABLE 6-35 FLORA SPECIES OF CONSERVATION INTEREST SURVEYED IN THE LAA 6-103
TABLE 6-36 SUMMARY TABLE OF THE TOTAL NUMBER OF SPECIES OBSERVED AND EXPECTED IN THE LAA 6-106
TABLE 6-37 SUMMARY OF THE OBSERVED SPECIES RICHNESS AND NUMBER OF INDIVIDUALS CONFINED TO THE BROAD-SCALE HABITAT TYPES IN THE LAA. 6-107
TABLE 6-38 TYPICAL BIRD SPECIES IN THE LAA 6-108
TABLE 6-39 THREATENED AND NEAR-THREATENED BIRD SPECIES OBSERVED IN THE LAA 6-111
TABLE 6-40 IMPORTANT BIRD AREAS WITHIN THE BIODIVERSITY RAA 6-121
TABLE 6-41 SUMMARY OF RESULTS OF THE TWO HERPETOFAUNA SURVEYS THAT WERE CONDUCTED DURING FEBRUARY AND APRIL 2021 WITHIN THE LAA. 6-123
TABLE 6-42 SUMMARY TABLE OF AMPHIBIAN AND REPTILE SPECIES SAMPLED IN THE LAA 6-125
TABLE 6-43 LIST OF HERPETOFAUNA SPECIES THAT WERE HIGHLIGHTED IN THE BENNUN ET AL. (2018) REPORT. BEING OF SPECIAL SIGNIFICANCE FOR THE PROJECT, AND THAT WERE SPECIFICALLY TARGETED DURING THE FIELD SURVEYS. 6-127
TABLE 6-44 SUMMARY TABLE OF MAMMAL SPECIES SAMPLED IN THE LAA 6-133
TABLE 6-45 ECOLOGICAL DESCRIPTORS FOR THE SITES BASED ON THE DIATOM

	COMMUNITY (VAN DAM ET AL., 1994 AND TAYLOR ET AL., 2007)....................6-152
TABLE 6-46	DIATOM INDEX SCORES FOR THE STUDY SITES INDICATING THE ECOLOGICAL WATER QUALITY.............6-153
TABLE 6-47	TEMPORAL TREND ANALYSIS OF THE DIATOM RESULTS (FEBRUARY 2020-APRIL 2021) 6-154
TABLE 6-48	FISH ABUNDANCES FOR SITES SAMPLED IN THE FEBRUARY AND APRIL 2021 STUDY 6-157
TABLE 6-49	SUMMARY TABLE OF THE CRITICAL HABITAT QUALIFYING FEATURES AS PER IFC PS6 -CRITERIA 1 CRITICALLY ENDANGERED AND/OR ENDANGERED SPECIES........................6-169
TABLE 6-50	SUMMARY TABLE OF THE CRITICAL HABITAT QUALIFYING FEATURES AS PER IFC PS6 -CRITERIA 2: ENDEMIC AND/OR RESTRICTED-RANGE SPECIES 6-171
TABLE 6-51	POTENTIAL INTERACTION OF CRITICAL HABITAT QUALIFYING BIODIVERSITY FEATURES WITH THE PROJECT 6-176
TABLE 6-52	MAIN ES PROVIDED INSIDE THE LSA ...6-183
TABLE 6-53	COUNTIES, SUB-COUNTIES, AND WARDS IN THE VICINITY OF THE PROJECT 6-188
TABLE 6-54	DEMOGRAPHIC DATA FOR THE COUNTIES CONCERNED BY THE PROJECT 6-189
TABLE 6-55	POPULATION OF MAIN URBAN CENTERS ALONG THE PROJECT..........6-189
TABLE 6-56	DISTRIBUTION OF THE POPULATION BY AGE GROUP 6-190
TABLE 6-57	NUMBER OF HOUSEHOLDS BY AREA OF RESIDENCE.......................................6-190
TABLE 6-58	DISTRIBUTION OF POPULATION AGE 14 AND ABOVE BY SCHOOL ATTENDANCE STATUS 6-192
TABLE 6-59	DISTRIBUTION OF ESIA SOCIAL SURVEY PARTICIPANTS ACCORDING TO THEIR ETHNIC GROUP AND THE COUNTY OF AFFILIATION (N=238). KEY INFORMANTS AND CHIEFS (N=20) WERE NOT ASKED ABOUT THEIR ETHNICITY WHICH IS WHY THE NUMBER OF RESPONDENTS IS LOWER THAN THE TOTAL PREVIOUSLY REPORTED.......................6-194
TABLE 6-60	DISTRIBUTION OF POPULATION BY RELIGIOUS AFFILIATION 6-194

TABLE 6-61 PROJECT SEGMENTS WHERE LOW VISIBILITY IS IDENTIFIED AS AN ACCIDENT FACTOR IN NTSA HANDBOOK 6-199
TABLE 6-62 ACCESSIBILITY TO PUBLIC SERVICES IN LOCATIONS COVERED BY THE ESIA SOCIAL SURVEY BY COUNTY ACCORDING TO KEY INFORMANTS AND CHIEFS 6-204
TABLE 6-63 AGRICULTURE IN COUNTIES AND SUB-COUNTIES CONCERNED BY THE PROJECT 6-208
TABLE 6-64 NUMBER OF HOUSEHOLDS GROWING PERMANENT CROPS BY TYPE IN THE COUNTIES CONCERNED BY THE PROJECT 6-208
TABLE 6-65 NUMBER OF HOUSEHOLDS GROWING OTHER CROPS BY TYPE IN COUNTIES AND SUB-COUNTIES CONCERNED BY THE PROJECT............ 6-209
TABLE 6-66 NUMBER OF HOUSEHOLDS REARING LIVESTOCK IN COUNTIES AND SUB-COUNTIES CONCERNED BY THE PROJECT 6-211
TABLE 6-67 GAZETTED FORESTS BY COUNTIES CONCERNED BY THE PROJECT............ 6-212
TABLE 6-68 NUMBER OF MICRO, SMALL, AND MEDIUM ESTABLISHMENTS (MSMES) BY ESTABLISHMENT SIZE AND LICENSING STATUS IN COUNTIES CONCERNED BY THE PROJECT............ 6-214
TABLE 6-69 NUMBER OF EMPLOYEES BY ESTABLISHMENT SIZE AND LICENSING STATUS IN COUNTIES CONCERNED BY THE PROJECT............ 6-214
TABLE 6-70 DISTRIBUTION OF EMPLOYEES IN LICENSED MSMES BY SEX IN COUNTIES CONCERNED BY THE PROJECT 6-215
TABLE 6-71 NUMBER OF LICENSED BUSINESS ESTABLISHMENTS BY CATEGORY IN COUNTIES CONCERNED BY THE PROJECT 6-215
TABLE 6-72 DISTRIBUTION OF MSME EMPLOYEES BY SEX AND BUSINESS CATEGORY.. 6-216
TABLE 6-73 NUMBER OF HOUSEHOLDS ENGAGED IN AQUACULTURE AND FISHING BY COUNTIES AND SUB-COUNTIES CONCERNED BY THE PROJECT 6-223
TABLE 6-74 DISTRIBUTION OF KIAMBU COUNTY POPULATION AGED FROM 5 YEARS

	OLD AND ABOVE BY ACTIVITY STATUS	6-229
TABLE 6-75	DISTRIBUTION OF NAKURU COUNTY POPULATION AGED FROM 5 YEARS OLD AND ABOVE BY ACTIVITY STATUS	6-230
TABLE 6-76	DISTRIBUTION OF NYANDARUA COUNTY POPULATION AGED FROM 5 YEARS OLD AND ABOVE BY ACTIVITY STATUS	6-231
TABLE 6-77	NUMBER OF VEHICLES PER DAY ALONG THE A8 SOUTH HIGHWAY (2017)	6-250
TABLE 6-78	NUMBER OF VEHICLES PER DAY CROSSING THE NAKURU VIADUCT (2017)	6-251
TABLE 6-79	ELECTRICITY TRANSMISSION LINES CROSSING THE PROJECT	6-253
TABLE 6-80	PIPELINES CROSSING THE PROJECT IN NAKURU COUNTY	6-253
TABLE 6-81	HERITAGE AND CULTURAL SITES IN KIAMBU AND NAKURU COUNTIES	6-254
TABLE 6-82	KNOWN AND RELATIVELY FORESEEN DEVELOPMENT PROJECTS IN THE PROJECT AREA	6-256
TABLE 7-1	ROUNDS OF PUBLIC CONSULTATIONS FOR THE ESIA	7-7
TABLE 7-2	BASELINE-ORIENTED MEETINGS HELD DURING THE ESIA PROCESS	7-10
TABLE 7-3	GROUPS CONSULTED FOR ECOSYSTEM SERVICES CHARACTERISATION	7-12
TABLE 7-4	BASELINE-ORIENTED WORKING SESSIONS HELD DURING THE ESIA PROCESS FOR THE BIODIVERSITY ASPECTS	7-13
TABLE 7-5	COURTESY VISITS AND SUBCOUNTY COMMUNITY MEETINGS HELD DURING THE FIRST ROUND OF CONSULTATION	7-14
TABLE 7-6	SUBCOUNTY MEETINGS HELD DURING THE SECOND ROUND OF CONSULTATION	7-24
TABLE 7-7	SPECIFIC MEETINGS HELD BY RVH DURING THE SECOND ROUND OF CONSULTATION	7-26
TABLE 7-8	RESULTS OF THE STAKEHOLDERS INPUTS FOR THE SECOND ROUND OF SUBCOUNTY COMMUNITY MEETINGS	7-27
TABLE 7-9	SUBCOUNTY MEETINGS HELD DURING THE THIRD ROUND OF CONSULTATION	7-43

TABLE 7-10	SPECIFIC MEETINGS HELD BY RVH DURING THE THIRD ROUND OF CONSULTATION....7-44
TABLE 7-11	DETAILS OF CONSULTATIONS HELD BY KENHA AS PART OF THE DEVELOPMENT OF THE VMGPF....7-54
TABLE 7-12	MEETINGS HELD DURING THE FIRST ROUND OF INDIGENOUS CONSULTATIONS....7-57
TABLE 7-13	MEETINGS HELD DURING THE SECOND ROUND OF INDIGENOUS CONSULTATIONS....7-60
TABLE 7-14	WORKPLAN AND TIMELINE TO MEET THIRD ROUND OF CONSULTATION OBJECTIVES....7-67
TABLE 7-15	PRELIMINARY LIST OF STAKEHOLDERS TO REACH DURING THE THIRD ROUND OF CONSULTATIONS....7-69
TABLE 8-1	PRE-CONSTRUCTION AND CONSTRUCTION PHASES IMPACT ASSESSMENT FOR AMBIENT AIR QUALITY....8-3
TABLE 8-2	DETERMINATION OF THE PROJECT'S RESIDUAL PRE-CONSTRUCTION AND CONSTRUCTION PHASES IMPACTS ON AMBIENT AIR QUALITY....8-4
TABLE 8-3	OPERATION AND MAINTENANCE ACTIVITIES IMPACT ASSESSMENT FOR AMBIENT AIR QUALITY....8-5
TABLE 8-4	GHG EMISSION FROM GAS OIL USED FOR ALL CONSTRUCTION ACTIVITIES....8-6
TABLE 8-5	PRE-CONSTRUCTION AND CONSTRUCTION PHASES IMPACT ASSESSMENT FOR GHG EMISSIONS....8-7
TABLE 8-6	ANNUAL GHG EMISSIONS FOR THE A8 AND A8 SOUTH HIGHWAYS....8-8
TABLE 8-7	ANNUAL GHG EMISSIONS FOR OPERATION PHASE....8-8
TABLE 8-8	IMPACT ASSESSMENT FOR AMBIENT NOISE....8-9
TABLE 8-9	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON AMBIENT NOISE....8-10
TABLE 8-10	RESULTS OF AMBIENT NOISE MODELLING FOR BOTH SCENARIOS "WITHOUT THE PROJECT" AND "WITH THE PROJECT" FOR THE YEAR 2040 (OPERATION PHASE)....8-11
TABLE 8-11	IMPACT ASSESSMENT FOR AMBIENT NOISE....8-13

TABLE 8-12 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON AMBIENT NOISE........8-15
TABLE 8-13 IMPACT ASSESSMENT FOR HYDROLOGY........8-16
TABLE 8-14 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON HYDROLOGY....8-17
TABLE 8-15 IMPACT ASSESSMENT OF ROUTINE MAINTENANCE ACTIVITIES FOR HYDROLOGY........8-18
TABLE 8-16 DETERMINATION OF THE PROJECT'S ROUTINE MAINTENANCE ACTIVITIES RESIDUAL IMPACTS ON HYDROLOGY....8-18
TABLE 8-17 IMPACT ASSESSMENT FOR SURFACE WATER QUALITY........8-21
TABLE 8-18 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SURFACE WATER QUALITY........8-22
TABLE 8-19 LOCATION OF IMPORTANT WATERCOURSES AND WETLANDS AND PRESENCE OF WATER TREATMENT INFRASTRUCTURE........8-23
TABLE 8-20 IMPACT ASSESSMENT FOR SURFACE WATER QUALITY........8-25
TABLE 8-21 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SURFACE WATER QUALITY........8-26
TABLE 8-22 PRE-CONSTRUCTION AND CONSTRUCTION PHASES IMPACT ASSESSMENT FOR GROUNDWATER QUALITY........8-27
TABLE 8-23 DETERMINATION OF THE PROJECT'S RESIDUAL PRE-CONSTRUCTION AND CONSTRUCTION PHASES IMPACTS ON GROUNDWATER QUALITY........8-29
TABLE 8-24 OPERATION PHASE IMPACT ASSESSMENT FOR GROUNDWATER QUALITY........8-30
TABLE 8-25 DETERMINATION OF THE PROJECT'S RESIDUAL OPERATION PHASE IMPACTS ON GROUNDWATER QUALITY........8-30
TABLE 8-26 PRE-CONSTRUCTION AND CONSTRUCTION PHASES IMPACT ASSESSMENT FOR GROUNDWATER QUANTITY........8-31
TABLE 8-27 DETERMINATION OF THE PROJECT'S RESIDUAL CONSTRUCTION PHASE IMPACTS ON GROUNDWATER QUANTITY........8-32
TABLE 8-28 OPERATION PHASE IMPACT ASSESSMENT FOR GROUNDWATER QUANTITY........8-32

TABLE 8-29 DETERMINATION OF THE PROJECT'S RESIDUAL OPERATION PHASE IMPACTS ON GROUNDWATER QUANTITY 8-33
TABLE 8-30 PRE-CONSTRUCTION AND CONSTRUCTION IMPACT ASSESSMENT FOR SOIL STABILITY/EROSION 8-34
TABLE 8-31 DETERMINATION OF THE PROJECT'S RESIDUAL PRE-CONSTRUCTION IMPACTS ON SOIL STABILITY/EROSION 8-34
TABLE 8-32 PRE-CONSTRUCTION AND CONSTRUCTION IMPACT ASSESSMENT FOR SOIL QUALITY 8-36
TABLE 8-33 DETERMINATION OF THE PROJECT'S RESIDUAL PRE-CONSTRUCTION AND CONSTRUCTION IMPACTS ON SOIL QUALITY 8-37
TABLE 8-34 OPERATION IMPACT ASSESSMENT FOR SOIL QUALITY 8-38
TABLE 8-35 DETERMINATION OF THE PROJECT'S RESIDUAL OPERATION IMPACTS ON SOIL QUALITY 8-38
TABLE 8-36 IMPACT ASSESSMENT FOR SEDIMENT QUALITY 8-39
TABLE 8-37 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SEDIMENT QUALITY 8-40
TABLE 8-38 IMPACT ASSESSMENT FOR SEDIMENT QUALITY 8-41
TABLE 8-39 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SEDIMENT QUALITY 8-42
TABLE 8-40 TOTAL AREA OF MODIFIED, NATURAL AND CRITICAL HABITAT WITHIN THE BIODIVERSITY LAA AND RAA 8-43
TABLE 8-41 DISTANCE TO PROTECTED AREAS, INTERNATIONALLY RECOGNIZED AREAS AND PRIVATE CONSERVANCIES FROM THE ROAD ROW 8-43
TABLE 8-42 IMPACT ASSESSMENT FOR HABITAT AND FLORA 8-45
TABLE 8-43 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON HABITAT AND FLORA 8-46
TABLE 8-44 IMPACT ASSESSMENT FOR HABITAT AND FLORA 8-48
TABLE 8-45 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON HABITAT AND FLORA 8-48
TABLE 8-46 IMPACT ASSESSMENT FOR BIRDS 8-51

TABLE 8-47 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON BIRDS 8-52
TABLE 8-48 IMPACT ASSESSMENT FOR BIRDS 8-53
TABLE 8-49 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON BIRDS 8-54
TABLE 8-50 IMPACT ASSESSMENT FOR REPTILES AND AMPHIBIANS 8-55
TABLE 8-51 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON REPTILES AND AMPHIBIANS 8-56
TABLE 8-52 IMPACT ASSESSMENT FOR REPTILES AND AMPHIBIANS 8-57
TABLE 8-53 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON REPTILES AND AMPHIBIANS 8-58
TABLE 8-54 IMPACT ASSESSMENT FOR SMALL MAMMALS 8-59
TABLE 8-55 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SMALL MAMMALS 8-60
TABLE 8-56 IMPACT ASSESSMENT FOR SMALL MAMMALS 8-61
TABLE 8-57 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SMALL MAMMALS 8-61
TABLE 8-58 IMPACT ASSESSMENT FOR LARGE MAMMALS 8-62
TABLE 8-59 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON LARGE MAMMALS 8-63
TABLE 8-60 IMPACT ASSESSMENT FOR LARGE MAMMALS 8-64
TABLE 8-61 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON LARGE MAMMALS 8-65
TABLE 8-62 IMPACT ASSESSMENT FOR FRESHWATER ECOLOGY (AQUATIC HABITATS, FISH AND MACROINVERTEBRATES) 8-67
TABLE 8-63 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS FOR FRESHWATER ECOLOGY (AQUATIC HABITATS, FISH AND MACROINVERTEBRATES) 8-67
TABLE 8-64 IMPACT ASSESSMENT FOR FRESHWATER ECOLOGY (AQUATIC HABITAT, FISH AND MACROINVERTEBRATES) 8-69
TABLE 8-65 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS FOR FRESHWATER ECOLOGY (AQUATIC HABITATS, FISH AND MACROINVERTEBRATES) 8-69

TABLE 8-66 IMPACT ASSESSMENT FOR TRADITIONAL MEDICINE 8-71
TABLE 8-67 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON TRADITIONAL MEDICINE 8-72
TABLE 8-68 IMPACT ASSESSMENT FOR TRADITIONAL MEDICINE 8-73
TABLE 8-69 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON TRADITIONAL MEDICINE 8-73
TABLE 8-70 IMPACT ASSESSMENT FOR LAND DEVELOPMENT, USE AND OCCUPATION 8-74
TABLE 8-71 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON LAND DEVELOPMENT, USE AND OCCUPATION 8-75
TABLE 8-72 IMPACT ASSESSMENT FOR COMMUNITY USE OF THE HIGHWAY, WELL-BEING AND SAFETY 8-77
TABLE 8-73 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON COMMUNITY HEALTH AND SAFETY 8-79
TABLE 8-74 IMPACT ASSESSMENT FOR COMMUNITY HEALTH AND SAFETY 8-80
TABLE 8-75 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON COMMUNITY USE OF THE HIGHWAY, WELL-BEING AND SAFETY 8-81
TABLE 8-76 IMPACT ASSESSMENT FOR COMMUNITY WELL-BEING 8-82
TABLE 8-77 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON COMMUNITY WELL-BEING 8-85
TABLE 8-78 IMPACT ASSESSMENT FOR COMMUNITY WELL-BEING 8-86
TABLE 8-79 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON COMMUNITY WELL-BEING 8-87
TABLE 8-80 IMPACT ASSESSMENT FOR HOUSING CONDITIONS 8-88
TABLE 8-81 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON HOUSING CONDITIONS 8-88
TABLE 8-82 IMPACT ASSESSMENT FOR SOCIAL AMENITIES AND COMMUNITY ASSETS 8-90
TABLE 8-83 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SOCIAL AMENITIES AND COMMUNITY ASSETS 8-90

TABLE 8-84	IMPACT ASSESSMENT FOR SOCIAL AMENITIES AND COMMUNITY ASSETS	8-91
TABLE 8-85	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SOCIAL AMENITIES AND COMMUNITY ASSETS	8-91
TABLE 8-86	IMPACT ASSESSMENT FOR LAND-BASED LIVELIHOOD ACTIVITIES	8-93
TABLE 8-87	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON LAND-BASED LIVELIHOOD ACTIVITIES	8-94
TABLE 8-88	IMPACT ASSESSMENT FOR LAND-BASED LIVELIHOOD ACTIVITIES	8-94
TABLE 8-89	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON LAND-BASED LIVELIHOOD ACTIVITIES	8-95
TABLE 8-90	IMPACT ASSESSMENT FOR SELF-EMPLOYED AND BUSINESS-BASED LIVELIHOOD	8-96
TABLE 8-91	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SELF-EMPLOYED AND BUSINESS-BASED LIVELIHOOD	8-97
TABLE 8-92	IMPACT ASSESSMENT FOR SELF-EMPLOYED AND BUSINESS-BASED LIVELIHOOD	8-97
TABLE 8-93	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON SELF-EMPLOYED AND BUSINESS-BASED LIVELIHOOD	8-98
TABLE 8-94	IMPACT ASSESSMENT FOR FISHERIES (WATER-BASED LIVELIHOODS)	8-99
TABLE 8-95	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON FISHERIES (WATER-BASED LIVELIHOODS)	8-100
TABLE 8-96	IMPACT ASSESSMENT FOR FISHERIES (WATER-BASED LIVELIHOODS)	8-101
TABLE 8-97	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON FISHERIES (WATER-BASED LIVELIHOODS)	8-101
TABLE 8-98	IMPACT ASSESSMENT FOR INDUSTRY (LARGE-SCALE ECONOMIC ACTIVITIES)	8-102
TABLE 8-99	DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON INDUSTRY (LARGE-SCALE ECONOMIC ACTIVITIES)	8-103
TABLE 8-100	IMPACT ASSESSMENT FOR INDUSTRY (LARGE-SCALE ECONOMIC ACTIVITIES)	8-104

TABLE 8-101 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON INDUSTRY (LARGE-SCALE ECONOMIC ACTIVITIES) 8-104
TABLE 8-102 IMPACT ASSESSMENT FOR TRANSPORT SECTOR 8-105
TABLE 8-103 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON TRANSPORT SECTOR 8-106
TABLE 8-104 IMPACT ASSESSMENT FOR TRANSPORT SECTOR 8-106
TABLE 8-105 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON TRANSPORT SECTOR 8-107
TABLE 8-106 IMPACT ASSESSMENT FOR TOURISM AND RECREATIONAL ACTIVITIES 8-108
TABLE 8-107 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON TOURISM AND RECREATIONAL ACTIVITIES 8-109
TABLE 8-108 IMPACT ASSESSMENT FOR TOURISM AND RECREATIONAL ACTIVITIES 8-109
TABLE 8-109 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON TOURISM AND RECREATIONAL ACTIVITIES 8-110
TABLE 8-110 IMPACT ASSESSMENT FOR LABOUR CONDITIONS 8-111
TABLE 8-111 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON LABOUR CONDITIONS 8-113
TABLE 8-112 IMPACT ASSESSMENT FOR VULNERABLE AND MARGINALIZED GROUPS (VMGS) 8-115
TABLE 8-113 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON VULNERABLE AND MARGINALIZED GROUPS (VMGS) 8-117
TABLE 8-114 IMPACT ASSESSMENT FOR VULNERABLE AND MARGINALIZED GROUPS (VMGS) 8-119
TABLE 8-115 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON VULNERABLE AND MARGINALIZED GROUPS (VMGS) 8-120
TABLE 8-116 IMPACT ASSESSMENT FOR GENDER ASPECTS 8-122
TABLE 8-117 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON GENDER ASPECTS 8-124
TABLE 8-118 IMPACT ASSESSMENT FOR GENDER ASPECTS 8-125
TABLE 8-119 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON GENDER ASPECTS 8-127
TABLE 8-120 IMPACT ASSESSMENT FOR ROADS 8-128

TABLE 8-121 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON ROADS............8-129
TABLE 8-122 IMPACT ASSESSMENT FOR ROADS 8-129
TABLE 8-123 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON ROADS............8-130
TABLE 8-124 IMPACT ASSESSMENT FOR RAILWAYS 8-131
TABLE 8-125 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON RAILWAYS......8-131
TABLE 8-126 IMPACT ASSESSMENT FOR ELECTRICITY AND TELECOMMUNICATION...........................8-132
TABLE 8-127 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON ELECTRICITY AND TELECOMMUNICATION..................8-133
TABLE 8-128 IMPACT ASSESSMENT FOR UNDERGROUND UTILITIES 8-133
TABLE 8-129 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON UNDERGROUND UTILITIES 8-134
TABLE 8-130 IMPACT ASSESSMENT FOR ARCHAEOLOGY AND CULTURAL HERITAGE...8-135
TABLE 8-131 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON ARCHAEOLOGY AND CULTURAL HERITAGE...8-136
TABLE 8-132 IMPACT ASSESSMENT FOR VISUAL ENVIRONMENT 8-137
TABLE 8-133 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON VISUAL ENVIRONMENT 8-137
TABLE 8-134 IMPACT ASSESSMENT FOR VISUAL ENVIRONMENT 8-138
TABLE 8-135 DETERMINATION OF THE PROJECT'S RESIDUAL IMPACTS ON VISUAL ENVIRONMENT 8-139
TABLE 8-136 PAST, PRESENT AND FUTURE PROJECT/INFRASTRUCTURE THAT MAY HAVE A POTENTIAL EFFECT ON VECS 8-144
TABLE 9-1 TERMINOLOGY OF THE PCCRA 9-3
TABLE 9-2 MATRIX FOR VULNERABILITY RATINGS...9-4
TABLE 9-3 MATRIX FOR THE LIKELIHOOD OF IMPACT 9-4
TABLE 9-4 RISK RATING MATRIX 9-4
TABLE 9-5 COMPONENTS OF THE NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT 9-9
TABLE 9-6 CLIMATE BASELINE AND PROJECTIONS FOR OBSERVATION LOCATION #1 (NEAR NAIROBI) 9-12

TABLE 9-7 CLIMATE BASELINE AND PROJECTIONS FOR OBSERVATION LOCATION #2 (NEAR NAIVASHA) 9-13
TABLE 9-8 CLIMATE BASELINE AND PROJECTIONS FOR OBSERVATION LOCATION #3 (NEAR MAU SUMMIT) 9-14
TABLE 9-9 TERMINOLOGY OF THE LIKELIHOOD OF OBSERVING A CHANGE IN A CLIMATE VARIABLE 9-15
TABLE 9-10 LIKELIHOOD AND CONFIDENCE OF CLIMATE TRENDS FOR THE 2060-2079 PERIOD UNDER RCP4.5 AND RCP8.5 9-16
TABLE 9-11 PROBABILITY SCORES FOR BASELINE AND FUTURE OCCURRENCE OF THE SELECTED CLIMATE HAZARDS 9-20
TABLE 9-12 LIST OF POTENTIAL IMPACTS FOR EACH CLIMATE HAZARD IDENTIFIED 9-21
TABLE 9-13 SENSITIVITY AND ADAPTIVE CAPACITY RATIONALES FOR EACH POTENTIAL IMPACT 9-23
TABLE 9-14 VULNERABILITY RATINGS FOR EACH POTENTIAL IMPACT 9-29
TABLE 9-15 LIKELIHOOD OF IMPACT FOR IMPACTS WITH A RATING OF 'MODERATE' OR HIGHER.......................... 9-30
TABLE 9-16 SEVERITY RATINGS FOR IMPACTS WITH LIKELIHOODS OF 'MODERATE' OR HIGHER... 9-31
TABLE 9-17 LIST OF CONTROL AND ADAPTATION MEASURES FOR HIGHER RISKS IDENTIFIED 9-33
TABLE 10-1 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN................................ 10-3
TABLE 10-2 PROPOSED PROCEDURES AND MANAGEMENT/ACTION PLANS.............. 10-25
TABLE 10-3 ENVIRONMENTAL AND SOCIAL MONITORING ACTIVITIES....................... 10-29

FIGURES

FIGURE 3-1 CONCEPTUAL ILLUSTRATION OF THE PROPOSED ALIGNMENT OPTION 5 3-6
FIGURE 3-2 GENERAL OVERVIEW OF CONSIDERED SOUTHERN AND NORTHERN BYPASSES 3-8
FIGURE 3-3 VARIATIONS CONSIDERED FOR A NORTHERN BYPASS OF NAKURU............. 3-9
FIGURE 3-4 NORTHERN DETOUR AROUND MOUNT MENENGAI 3-10

FIGURE 3-5 SOUTHERN DETOUR AROUND THE NAKURU LAKE AND NATIONAL PARK.....3-11
FIGURE 3-6 TYPICAL CROSS SECTION OF A 6-LANES FLYOVER 3-12
FIGURE 3-7 TYPICAL CROSS SECTION OF A DUPLEX TYPE STRUCTURE.....................3-13
FIGURE 3-8 TYPICAL VIEW (IN 3D) OF AN UNDERPASS ABOVE ROUNDABOUT 3 AND ROUNDABOUT 4................................3-13
FIGURE 3-9 COMBINATION DESIGN SCHEMATIC REPRESENTATION...................................3-15
FIGURE 3-10 PROPOSED REROUTING THROUGH NAROK, BOMET AND KERICHO COUNTIES 3-19
FIGURE 4-1 OVERVIEW OF TAH NETWORK..................4-2
FIGURE 4-2 LOCATION OF TEMPORARY CONSTRUCTION FACILITIES......................4-7
FIGURE 4-3 SCHEMATIC OF A TYPICAL ASPHALT PRODUCTION (LEFT IMAGE), MIXING (CENTRAL IMAGE) AND EMULSION PRODUCTION (RIGHT IMAGE) PLANTS..4-9
FIGURE 4-4 TYPICAL CROSS SECTION FOR ECCENTRIC WIDENING OF EXISTING 2-LANE SECTION TO 4-LANE DIVIDED CARRIAGEWAY..4-13
FIGURE 4-5 SCHEMATIC OF THE NAKURU CITY CROSSING (IN BLUE ACCESS RAMPS) ..4-18
FIGURE 4-6 TYPICAL CROSS-SECTION OF THE FLYOVER 4-19
FIGURE 4-7 3D REPRESENTATION OF THE FIRST FLYOVER SECTION OVER NAKURU'S 1ST ROUNDABOUT WITH A VIEW ON THE AT GRADE SECTION 4-20
FIGURE 4-8 3D REPRESENTATION OF THE SECOND FLYOVER SECTION OVER NAKURU'S 2ND ROUNDABOUT WITH A VIEW ON THE EMBANKED SECTION.......4-20
FIGURE 4-9 3D REPRESENTATION OF THE VIADUCT OVER NAKURU'S 3RD ROUNDABOUT 4-21
FIGURE 4-10 3D PICTURE OF A VEHICLE OVERPASS 4-24
FIGURE 4-11 3D OF A VEHICLE UNDERPASS...............4-25
FIGURE 4-12 TYPICAL CROSS SECTION FOR ECCENTRIC WIDENING OF EXISTING 2-LANE SECTION TO 4-LANE DIVIDED CARRIAGEWAY WITH SERVICE ROAD IN RURAL AREA AND HILLY TERRAIN.....4-26
FIGURE 4-13 TYPICAL CROSS SECTION FOR ECCENTRIC WIDENING OF EXISTING 2-LANE SECTION TO 4-LANE DIVIDED CARRIAGEWAY WITH SERVICE ROAD

IN RURAL AREA AND ROLLING TERRAIN 4-27
FIGURE 4-14 TYPICAL HIGHWAY CROSS SECTION WITH A CLIMBING LANE 4-28
FIGURE 4-15 TYPICAL FOB WITH (BELOW) AND WITHOUT (ABOVE) RAMPS FOR LOW MOBILITY PEOPLE. 4-30
FIGURE 4-16 AT-GRADE PEDESTRIAN CROSSING IN URBAN AREA OF THE A8 SOUTH 4-31
FIGURE 4-17 AT-GRADE PEDESTRIAN CROSSING IN RURAL AREAS AT THE LEVEL OF A BUS STOP 4-32
FIGURE 4-18 AT-GRADE PEDESTRIAN CROSSING IN RURAL AREAS AT THE LEVEL OF A SCHOOL 4-32
FIGURE 4-19 PROPOSED PEDESTRIAN CROSSINGS FOR THE NAKURU CROSSING SECTION 4-33
FIGURE 4-20 TYPICAL AT-GRADE CROSSING THROUGH A MSE WALL FOR THE NAKURU CITY 4-33
FIGURE 4-21 3D PICTURE OF CATTLE UNDERPASS 4-35
FIGURE 4-22 3D RENDITION OF A PROPOSED WILDLIFE OVERPASS 4-36
FIGURE 4-23 3D SIDEVIEW RENDITION OF A PROPOSED WILDLIFE OVERPASS 4-37
FIGURE 4-24 DESIGN DRAWINGS OF PROPOSED WILDLIFE RELATED FENCING 4-38
FIGURE 4-25 TYPICAL CROSS SECTIONS OF GRASSED AND LINED DITCHES 4-39
FIGURE 4-26 TYPICAL CROSS SECTION OF A BOX CULVERT 4-40
FIGURE 4-27 TYPICAL CROSS SECTION OF A RETENTION BASIN 4-40
FIGURE 4-28 TYPICAL BUS-BAY ARRANGEMENTS WITH AND WITHOUT SERVICE ROAD 4-43
FIGURE 4-29 TYPICAL TRUCK-BAY CROSS-SECTION WITH AND WITHOUT SERVICE ROAD 4-44
FIGURE 4-30 EXAMPLE OF A MAJOR PREFABRICATED BOX CULVERT 4-55
FIGURE 4-31 TRAFFIC PROJECTIONS FROM 2025 TO 2040 IN MATHORE (A* HIGHWAY) 4-56
FIGURE 4-32 TRAFFIC PROJECTIONS FROM 2025 TO 2040 IN GILGIL (A8 HIGHWAY) 4-57
FIGURE 4-33 TRAFFIC PROJECTIONS FROM 2025 TO 2040 IN NAKURU (A8 HIGHWAY) 4-57
FIGURE 4-34 TRAFFIC PROJECTIONS FROM 2025 TO 2040 IN MAI MAHU (A8 SOUTH HIGHWAY) 4-58
FIGURE 4-35 ORGANISATIONAL CHART OF THE OPERATING AND ROUTINE MAINTENANCE TEAM 4-69

FIGURE 4-36 PLANNED COMPLETION TIMELINE OF THE DIFFERENT ROAD SECTIONS 4-70
FIGURE 5-1 TYPICAL RECEPTOR GRID DENSITY FOR SEGMENT 3 5-30
FIGURE 5-2 LOCATION OF HABITAT AND FLORA SURVEY POINTS.......................................5-48
FIGURE 5-3 LOCATION OF BIRD SURVEY STATIONS IN THE LAA 5-51
FIGURE 5-4 LOCATION OF HERPETOFAUNA SAMPLING POINT 5-52
FIGURE 5-5 A SCHEMATIC REPRESENTATION OF THE STRAIGHT-LINE TRAP ARRAY DESIGN THAT WAS USED DURING THE SECOND FIELD SURVEY 5-53
FIGURE 5-6 EXAMPLES OF TRAP ARRAYS THAT WERE DEPLOYED IN THE LAA.................5-54
FIGURE 5-7 EXAMPLES OF THE COLLECTION METHODS USED DURING THE MAMMAL SURVEY 5-55
FIGURE 5-8 COVERAGE OF THE SAMPLING EFFORT FOR MAMMALS...........................5-56
FIGURE 5-9 LOCATION OF THE FIXED CAMERA-TRAPS 5-58
FIGURE 5-10 DEVELOPMENT CYCLE FOR AUTOMATED PROCESSING OF PICTURES...5-60
FIGURE 5-11 EXAMPLE CONFUSION MATRIX (GIRAFFE) ROWS = GROUND TRUTH, COLUMNS = MODEL OUTPUT 5-61
FIGURE 5-12 LOCATION OF FRESHWATER ECOLOGY SAMPLING POINTS (NORTH)...5-62
FIGURE 5-13 LOCATION OF FRESHWATER ECOLOGY SAMPLING POINTS (SOUTH) 5-63
FIGURE 5-14 DISTRIBUTION OF WSP SURVEY PARTICIPANTS BY AGE GROUP (N=258) COMPARED TO THE AVERAGE ADULT POPULATION BY AGE GROUP IN THE COUNTIES TRAVERSED BY THE PROJECT (KIAMBU, NAKURU, AND NYANDARUA) 5-70
FIGURE 5-15 DISTRIBUTION OF WSP SURVEY PARTICIPANTS BY ETHNIC GROUP (N=238). NUMBER OF RESPONDENTS IS LOWER THAN THE TOTAL SURVEYED BECAUSE ETHNICITY WAS NOT REQUESTED FROM KEY INFORMANTS AND CHIEFS. 5-70
FIGURE 6-1 CLIMATIC REGIONS OF KENYA ACCORDING TO THE KOPPEN-GEIGER CLASSIFICATION 6-2

FIGURE 6-2 AVERAGE TEMPERATURE AND RAIN FALL (LIMURU) 6-4
FIGURE 6-3 AVERAGE WIND SPEED AND DIRECTION (LIMURU) 6-4
FIGURE 6-4 AVERAGE TEMPERATURE AND RAIN FALL (NAIVASHA) 6-5
FIGURE 6-5 AVERAGE WIND SPEED AND DIRECTION (NAIVASHA) 6-6
FIGURE 6-6 AVERAGE TEMPERATURE AND RAIN FALL FOR THE LONGONOT AREA 6-7
FIGURE 6-7 AVERAGE WIND SPEED AND DIRECTION FOR THE LONGONOT AREA 6-7
FIGURE 6-8 AVERAGE TEMPERATURE AND RAIN FALL (NAKURU) 6-8
FIGURE 6-9 AVERAGE WIND SPEED AND DIRECTION (NAKURU AREA) 6-9
FIGURE 6-10 SIMPLIFIED GEOLOGICAL MAP OF WIDER PROJECT AREA 6-19
FIGURE 6-11 OVERVIEW OF VOLCANO HAZARD LEVELS IN KENYA ACCORDING TO WORLD BANK THINKHAZARD RISK ASSESSMENT TOOL 6-21
FIGURE 6-12 LOCATION OF MAIN VOLCANIC FORMATION IN THE PROJECT AREA 6-22
FIGURE 6-13 THE DISTRIBUTION OF THE 1000 MOST RECENT EARTHQUAKES IN KENYA AND SURROUNDING COUNTRIES ALONG THE AFRICAN RIFT VALLEY 6-24
FIGURE 6-14 DISTRIBUTION OF EARTHQUAKES RECORDED SINCE 1970 IN THE PROJECT AREA 6-25
FIGURE 6-15 OVERVIEW OF THE EARTHQUAKE HAZARDS IN KENYA 6-26
FIGURE 6-16 RELIEF MAP OUTLINING COUNTY BOUNDARIES AND THE ROAD SEGMENTS INCLUDED IN THE PROJECT 6-27
FIGURE 6-17 ELEVATION MAP OUTLINING COUNTY BOUNDARIES AND THE ROAD SEGMENTS INCLUDED IN THE PROJECT 6-28
FIGURE 6-18 DISTRIBUTION OF REGIONAL TOPOGRAPHIC FEATURES IN THE PROJECT AREA 6-28
FIGURE 6-19 MAXIMUM SLOPE PERPENDICULAR TO ROAD ALIGNMENTS OVER FIRST 58.5 KM (MEASURED AT 500 M INTERVALS OVER DISTANCE 200 M EITHER SIDE OF THE ALIGNMENT) 6-29
FIGURE 6-20 MAXIMUM SLOPE PERPENDICULAR TO ROAD ALIGNMENT FROM 59.0 KM

TO END OF THE ROUTE (MEASURED AT 500 M INTERVALS OVER DISTANCE 200 M EITHER SIDE OF THE ALIGNMENT) 6-29
FIGURE 6-21 LOCATION OF MAIN WATER TOWERS OF KENYA 6-30
FIGURE 6-22 WATER CATCHMENT AREAS OF KENYA 6-32
FIGURE 6-23 LAKE NAIVASHA CATCHMENT AREA 6-34
FIGURE 6-24 LAKE ELMENTAITA CATCHMENT AREA 6-35
FIGURE 6-25 LAKE NAKURU CATCHMENT AREA 6-36
FIGURE 6-26 KENYA FLOOD HAZARD DISTRIBUTION ADAPTED FROM WHO 6-37
FIGURE 6-27 MAP OF HYDROGEOLOGY OF KENYA ADOPTED FROM AFRICA GROUNDWATER ATLAS 6-60
FIGURE 6-28 HYDROGEOLOGY OF THE KENYAN CENTRAL RIFT VALLEY ADAPTED FROM OLAGO ET AL. 2009: GROUND WATER AND CLIMATE IN AFRICA 6-61
FIGURE 6-29 GROUND WATER FLOW DIRECTIONS AROUND LAKE NAIVASHA 6-63
FIGURE 6-30 TOPOGRAPHIC AND GEOLOGIC PROFILE ALONG LAKE NAIVASHA-ELMENTAITA BASIN 6-64
FIGURE 6-31 METAL CONCENTRATIONS IN COLLECTED SOIL SAMPLES 6-71
FIGURE 6-32 LAND USE AND LAND USE CHANGE ANALYSIS IN THE BIODIVERSITY RAA. REFERENCE MAP FOR THE LAND USE/LANDCOVER CHANGES BETWEEN YEAR 2000 AND 2020 6-88
FIGURE 6-33 VECEA HABITAT TYPES THAT OCCUR THROUGHOUT THE BIODIVERSITY LOCAL ASSESSMENT AREA 6-90
FIGURE 6-34 PICTURE OF AFROMONTANE BAMBOO IN THE LAA 6-91
FIGURE 6-35 PICTURE OF AFROMONTANE RAIN FOREST IN THE LAA 6-92
FIGURE 6-36 PICTURE OF AFROMONTANE UNDIFFERENTIATED FOREST IN THE LAA 6-93
FIGURE 6-37 PICTURE OF EDAPHIC WOODED GRASSLAND ON DRAINAGE-IMPEDED OR SEASONALLY FLOODED SOILS IN THE LAA 6-94
FIGURE 6-38 PICTURE OF EVERGREEN AND SEMI-EVERGREEN BUSHLAND AND THICKET IN THE LAA 6-95
FIGURE 6-39 PICTURE OF HALOPHYTIC VEGETATION IN THE LAA 6-96

FIGURE 6-40 PICTURE OF A RIVERINE WOODED VEGETATION IN THE LAA 6-97
FIGURE 6-41 PICTURE OF AN UPLAND ACACIA WOODED GRASSLAND IN THE LAA 6-98
FIGURE 6-42 PICTURE OF A FRESHWATER SWAMP IN THE LAA 6-99
FIGURE 6-43 COMPARISON OF (A) ABOVEGROUND CARBON PER HA; (B) BELOWGROUND CARBON PER HA; (C) CARBON IN DEAD WOOD PER HA; AND (D) TOTAL CARBON IN ABOVEGROUND, BELOWGROUND AND DEAD WOOD PER HA PER HABITAT CLASS IN THE BIODIVERSITY LAA 6-100
FIGURE 6-44 IMPORTANT HABITATS FOR FLORA 6-105
FIGURE 6-45 THE PROPORTION (%) OF PRIMARY TROPHIC GUILDS FOR BIRD SPECIES OBSERVED FROM THE POINT COUNTS IN THE LAA 6-109
FIGURE 6-46 EXAMPLE THREATENED SCAVENGING SPECIES 6-115
FIGURE 6-47 EXAMPLE OF THREATENED LARGE TERRESTRIAL BIRDS OBSERVED IN THE LAA 6-116
FIGURE 6-48 EXAMPLE OF THREATENED BIRDS OF PREY IN THE LAA 6-117
FIGURE 6-49 EXAMPLE OF THREATENED SMALL PASSERINES IN THE LAA 6-118
FIGURE 6-50 EXAMPLE OF WATERBIRDS AND SHOREBIRDS IN THE LAA, AT LAKE ELMENTAITA 6-119
FIGURE 6-51 EXAMPLES OF ALIEN VEGETATION HEDGES 6-130
FIGURE 6-52 EXAMPLES OF CLUSTERS OF ROCKY HABITAT (E) ARE PRESENT ALONG A FEW SECTIONS OF HIGHWAY 6-131
FIGURE 6-53 EXAMPLES OF ROAD-SIDE FLOODED TERRAIN AND DITCHES......................... 6-132
FIGURE 6-54 DETECTION CHECK FOR ALL 4 SPECIES. FIGURES HAVE BEEN DIVIDED BASED ON THE CAMERA TRAP LOCATIONS IN THE (A) SOYSAMBU, (B) MARULA WEST AND (C) MARULA EAST 6-142
FIGURE 6-55 COMPARISON OF TOTAL CAPTURE RATE AND CAPTURE RATES FOR EACH SPECIES PER CAMERA. FIGURES HAVE BEEN DIVIDED BASED ON THE CAMERA TRAP LOCATION IN THE (A) SOYSAMBU, (B) MARULA WEST AND (C) MARULA EAST 6-143

FIGURE 6-56 FRESHWATER ECOREGIONS IN THE LAA 6-144
FIGURE 6-57 EXAMPLES OF FRESHWATER HABITAT TYPES NOTED IN THE FRESHWATER SURVEY (A), (B), (C), (D) AND (E)..6-146
FIGURE 6-58 PIE CHART ILLUSTRATING THE PERCENTAGE DISTRIBUTION OF THE ASSOCIATED IHI CATEGORIES FOR THE FRESHWATER STUDY SITES.........6-147
FIGURE 6-59 AVERAGE IHI REPRESENTED PER CATCHMENT WITH STANDARD DEVIATION (SD) 6-148
FIGURE 6-60 AVERAGE TOTAL IHAS % FOR THE DIFFERENT CATCHMENTS ASSOCIATED WITH THE STUDY AREA DURING THE DRY AND WET SEASONS..6-149
FIGURE 6-61 FISH HABITAT SHOWING VELOCITY-DEPTH TYPES PER FISH SAMPLING SITE, PER SAMPLING SEASON..............6-150
FIGURE 6-62 FISH HABITAT SHOWING SUBSTRATE TYPES PER FISH SAMPLING SITE.........6-150
FIGURE 6-63 FISH HABITAT SHOWING COVER TYPES PER FISH SAMPLING SITE.........6-151
FIGURE 6-64 SENSITIVITY ANALYSIS RESULTS IN THE EXTENDED LAA PRESENTED AT FINE SCALE RESOLUTION USING 1 HA SIZED PIXELS.................................6-162
FIGURE 6-65 REPRESENTATION OF THE SEPARATION BETWEEN NATURAL AND MODIFIED HABITAT IN THE RAA...6-165
FIGURE 6-66 CRITICAL HABITAT ASSESSMENT AREA OF ANALYSIS 6-167
FIGURE 6-67 REPRESENTATION OF HABITAT CLASSIFICATION IN THE NAIROBI-NAKURU-MAU SUMMIT STUDY AREA AS PER IFC PS6 GUIDELINES 6-181
FIGURE 6-68 EDUCATION LEVEL OF ESIA SURVEY PARTICIPANTS (N=238). KEY INFORMANTS AND CHIEFS (N=20) WERE NOT ASKED ABOUT THEIR EDUCATION LEVEL, WHICH IS WHY THE NUMBER OF RESPONDENTS IS LOWER THAN THE TOTAL PREVIOUSLY REPORTED.......................6-192
FIGURE 6-69 DISTRIBUTION OF ESIA SOCIAL SURVEY PARTICIPANTS ACCORDING TO THEIR ETHNIC GROUP (N=238). KEY INFORMANTS AND CHIEFS (N=20) WERE NOT ASKED ABOUT THEIR ETHNICITY WHICH IS WHY THE NUMBER OF RESPONDENTS IS

LOWER THAN THE TOTAL PREVIOUSLY REPORTED. 6-193
FIGURE 6-70 PHOTOGRAPHS OF THE SOYSAMBU KINGDOM CITY DEVELOPMENT PLAN..6-196
FIGURE 6-71 MEANS OF TRANSPORTATION USED BY HOUSEHOLD MEMBERS CLOSE TO THE ROW PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=62) 6-198
FIGURE 6-72 OVERVIEW OF EXISTING UNDERPASSES......................................6-200
FIGURE 6-73 MEANS USED TO CROSS THE HIGHWAYS BY HOUSEHOLD MEMBERS CLOSE TO THE ROW PARTICIPATING IN THE ESIA SOCIAL SURVEY (N = 62; MULTIPLE ANSWERS ALLOWED). 6-200
FIGURE 6-74 REASONS TO CROSS THE HIGHWAYS OF HOUSEHOLD MEMBERS CLOSE TO THE ROW PARTICIPATING IN THE ESIA SOCIAL SURVEY (N = 62; MULTIPLE ANSWERS ALLOWED). 6-201
FIGURE 6-75 FREQUENCY OF HIGHWAY CROSSING WITH LIVESTOCK OF HERDERS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N = 32) 6-201
FIGURE 6-76 LOSS OF LIVESTOCK DUE TO A VEHICLE COLLISION OF HERDERS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N = 32).....................................6-202
FIGURE 6-77 GRAZING OF LAND ADJACENT TO THE A8 AND A8 SOUTH HIGHWAYS......6-202
FIGURE 6-78 LOCATION OF STREET VENDORS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N = 71).....................................6-203
FIGURE 6-79 FREQUENCY OF HIGHWAY CROSSING OF STREET VENDORS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N = 71).....................................6-203
FIGURE 6-80 PRIMARY SOURCE OF DRINKING WATER FOR HOUSEHOLD MEMBERS CLOSE TO THE ROW PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=62)....6-205
FIGURE 6-81 LOCATION OF LIVELIHOOD ACTIVITIES OF HOUSEHOLD MEMBERS CLOSE TO THE ROW PARTICIPATING IN THE ESIA SOCIAL SURVEY (N = 62).....................................6-207
FIGURE 6-82 MSME OWNERSHIP BY SEX OF OWNER AND LICENSING STATUS.........6-213
FIGURE 6-83 TYPE OF STREET VENDORS PARTICIPATING IN THE ESIA SOCIAL SURVEY BY SEX (N=71)..........................6-217

FIGURE 6-84 OWNERSHIP OF SHOPS BY SIZE AND SEX OF OWNER IN SHOP TENANTS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=68) 6-217
FIGURE 6-85 LOCATION OF STREET VENDORS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=71) 6-218
FIGURE 6-86 CHARACTERISTICS OF STREET VENDORS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=71) 6-218
FIGURE 6-87 ECONOMIC SIGNIFICANCE OF TRADING FOR STREET VENDORS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=71) 6-219
FIGURE 6-88 FREQUENCY OF HIGHWAY CROSSING BY STREET VENDORS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=71) 6-220
FIGURE 6-89 SIGNIFICANCE OF THE A8 AND A8 SOUTH HIGHWAYS FOR SHOPS PARTICIPATING IN THE ESIA SOCIAL SURVEY (N=68) 6-220
FIGURE 6-90 CHARACTERISTICS OF SHOP TENANTS PARTICIPATING IN THE ESIA SOCIAL SURVEY 6-221
FIGURE 6-91 ESTIMATED MONTHLY GROSS REVENUE OF SHOP TENANTS PARTICIPATING IN THE ESIA SOCIAL SURVEY 6-222
FIGURE 6-92 TYPICAL TRUCK STOPOVER ALONG THE PROJECT SECTIONS 6-226
FIGURE 6-93 LOCATION AND EXTENT OF CONTEMPORARY MAASAILAND 6-234
FIGURE 6-94 DISTRIBUTION OF CHORES PERFORMED BY GENDER AMONG SURVEYED HOUSEHOLDS 6-246
FIGURE 7-1 STAKEHOLDER REQUESTS PER TOPIC 7-41
FIGURE 7-2 REQUEST INTEGRATION LEVEL 7-42
FIGURE 7-3 OBJECTIVES FOR ROUND 3 CONSULTATIONS WITH INDIGENOUS COMMUNITIES 7-66
FIGURE 8-1 IMPACTS OF ROADS ON WILDLIFE 8-50
FIGURE 9-1 ISO 31000 RISK MANAGEMENT STANDARDS 9-1
FIGURE 9-2 RISK ASSESSMENT FRAMEWORK BASED ON IPCC'S FIFTH REPORT 9-2
FIGURE 9-3 NET CO_2 EMISSIONS FOR EACH RCP SCENARIO UNTIL 2100 9-6
FIGURE 9-4 LOCATIONS USED AS REFERENCES FOR CLIMATE DATA 9-7
FIGURE 9-5 LOCATION OF THE NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT 9-8

FIGURE 9-6 AVERAGE MONTHLY TEMPERATURE AND RAINFALL IN KENYA FROM 1901 AND 2016 9-11
FIGURE 9-7 CURRENT LANDSLIDE SUSCEPTIBILITY FOR DIFFERENT REGIONS OF KENYA 9-18
FIGURE 10-1 PROPOSED ORGANISATIONAL STRUCTURE OF RVH FOR THE PROJECT 10-22
FIGURE 10-2 E&S AND QHSE MANAGEMENT STRUCTURE FOR THE PROJECT 10-23

MAPS

MAP 1-1 OVERVIEW OF THE NAIROBI-NAKURU-MAU SUMMIT HIGHWAY PROJECT 1-3
MAP 3-1 PROPOSED ALIGNMENTS INITIALLY CONSIDERED FOR THE PROJECT 3-3
MAP 3-2 LOCATION OF THE QUARRY SITES CONSIDERED 3-17
MAP 4-1 LOCATION OF INHERITED INTERCHANGES 4-15
MAP 5-1 SPATIAL BOUNDARIES FOR THE BIOPHYSICAL ASPECTS 5-5
MAP 5-2 SPATIAL BOUNDARIES FOR THE SOCIOECONOMIC ASPECTS 5-7
MAP 5-3 LOCATION OF AIR QUALITY, AMBIENT NOISE AND SOIL SAMPLING SITES 5-27
MAP 5-4 LOCATION OF SURFACE WATER AND SEDIMENT SAMPLING SITES 5-35
MAP 5-5 AMBIENT NOISE VIRTUAL SAMPLING STATION FOR NOISE MODELING 5-39
MAP 6-1 REGIONAL BIODIVERSITY CONTEXT 6-85
MAP 6-2 LOCATION OF INDIGENOUS TERRITORIES, COMMUNITIES, AND GRAZING AREAS IN THE VICINITY OF THE PROJECT 6-235

APPENDICES

1-1 ESIA Terms of References (2019-12-06)
5-1 Field Survey protocols
5-2 Social Survey Questionnaires
6-1 Air quality survey photographs
6-2 Noise survey - weather condition data
6-3 Surface Water Survey - Field Data Sheets
6-4 Surface Water Survey - Field Photographs
6-5 Surface water survey - Laboratory Certificates
6-6 Soil Quality Survey - Field Data Sheets
6-7 Soil Quality Survey - Site Photographs

6-8	Soil Quality Survey - Physical Analysis Laboratory Results
6-9	Soil Quality Survey - Chemical Analysis Laboratory Results
6-10	Sediment Quality Survey - Field Data Sheets
6-11	Sediment Quality Survey - Physical Analysis Laboratory Results
6-12	Sediment Quality Survey - Chemical Analysis Laboratory Results
6-13	Land Use and Land Use change Analysis
6-14	Biodiversity Baseline Investigation - Vegetation, Plants and Habitats
6-15	Biodiversity Baseline Investigation - Vegetation: Woody Biomass, Carbon and Woody Populations Condition
6-16	Biodiversity Baseline Investigation - Avifauna
6-17	Biodiversity Baseline Investigation - Herpetology
6-18	Biodiversity Baseline Investigation - Mammals
6-19	Camera Trap Study
6-20	Habitat suitability and Ecological Connectivity Modelling
6-21	Freshwater Ecology Baseline Study
6-22	Standardised Biodiversity Sensitivity Analysis
6-23	IFC PS6 Habitat Analysis
6-24	Ecosystem Services Baseline
6-25	Maps of Protected Areas and Conservancies
7-1	Stakeholder Map
7-2	Baseline-Oriented Meetings
7-3	First Round Consultation Activities
7-4	Second Round Consultation Activities
7-5	Third Round Consultation Activities
7-6	First Round Indigenous Community (VMG) Consultation Activities
7-7	Second Round Indigenous Community (VMG) Consultation Activities
7-8	Consultation Tools and Supporting Material
7-9	Other Stakeholders Comments Received
7-10	Stakeholder Request Integration
8-1	Atmospheric Dispersion Modeling
8-2	Wildlife Mitigation Plan
9-1	Detailed Consequence Scoring
9-2	Risk Register

1 INTRODUCTION

1.1 PROJECT CONTEXT

The Government of the Republic of Kenya's (GoK) in its vision 2030 seeks to transform Kenya into an industrialized middle-income country by the year 2030. It has embarked on Infrastructure development as a key pillar to invigorate the economy as per the Kenya vision 2030. To achieve this, the GoK is engaging private investors in the financing, construction, development, operation, or maintenance of infrastructure under Public Private Partnerships (PPP), according to the provisions of the PPP Act 2013. Amongst the projects considered is the need for the rehabilitation, improvement and expansion of the Nairobi-Mau Summit (A8) highway and the strengthening of the A8 South highway.

The Kenya National Highways Authority (KeNHA), as the Contracting Authority for the GoK, initiated an international tender and completed a fair and transparent process to select an entity for the development, operation and maintenance (O&M) of the Nairobi-Nakuru-Mau Summit Highway Project (the Project) through competitive bidding under the PPP Act 2013. The selected entity is a special purpose vehicle (SPV) know as Rift Valley Highway Limited (RVH) and owned by VINCI Highways, VINCI Concessions, and Meridiam SAS.

This Project is part of the Trans-African Highway (Northern Corridor), a section of the main transport route connecting the landlocked countries of East and Central African Countries. The Northern Corridor commences from the Indian Ocean seaport of Mombasa and provides a gateway through Kenya to the landlocked economies of Uganda, Rwanda, Burundi, Southern Sudan and Eastern Democratic Republic of Congo (DRC), facilitating the efficient and reliable movement and transportation of goods and services to and from Mombasa.

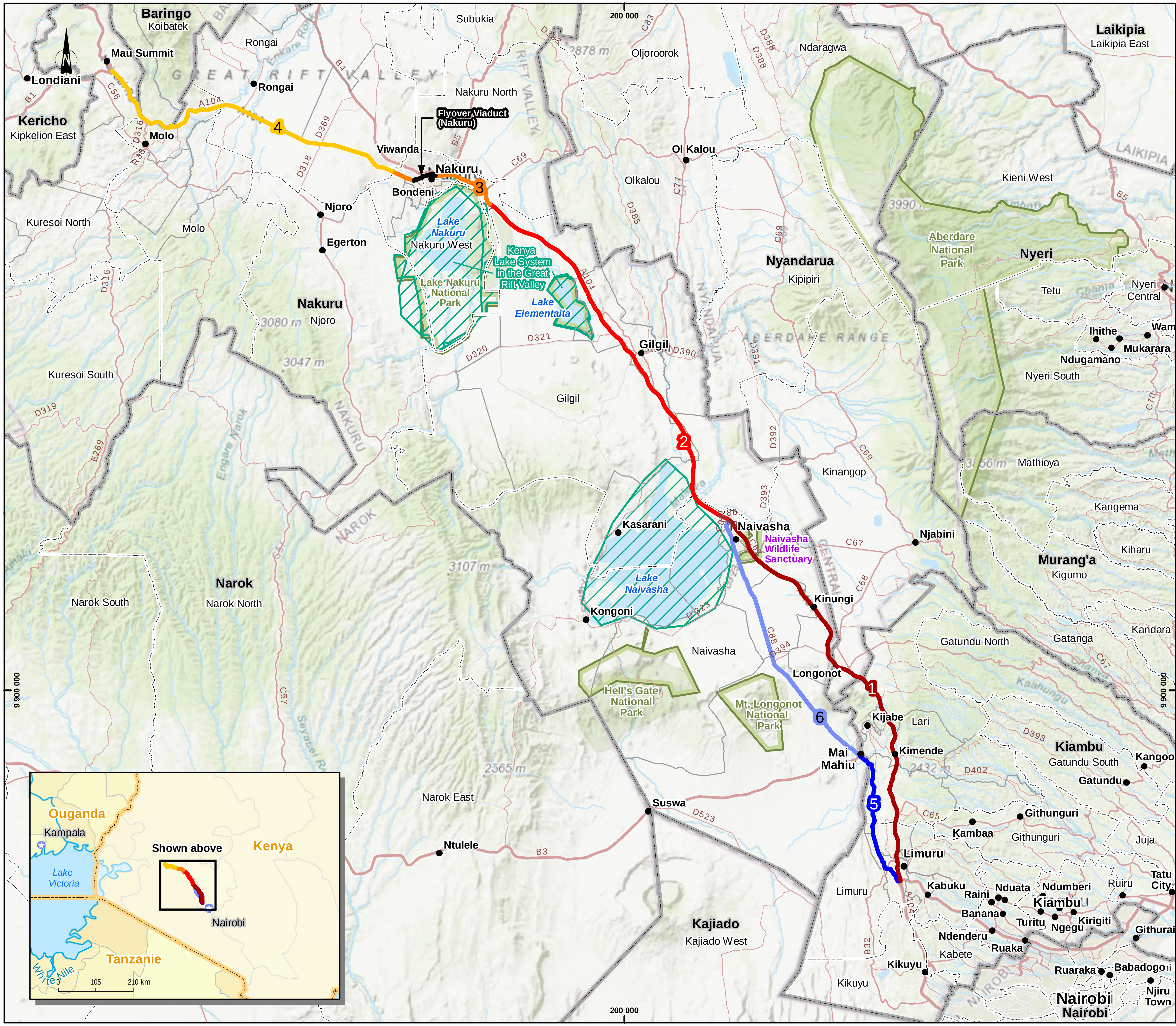
The Project scope primarily includes:

- Dualling, into a four-lane dual carriageway, of a portion (175 km) of 4 sections of A8 Highway between Rironi and Mau Summit, including operation and maintenance;
- Strengthening of 2 sections of A8-South Highway between Rironi and Naivasha (57.18 km), including operation and maintenance;
- Connection of all existing A/B/C roads and other strategic secondary roads that join A8;
- Inherited stretches consisting of four interchanges only, to be operated and maintained;
- Construction of service lanes in Nakuru (to be maintained by GoK road agency);
- Construction and O&M of pedestrian facilities, bus bays/shelters, truck lay bays, street lighting, highway information system, wildlife crossings/fencing, and rail underpass/overpass.

Contingent to the flow of traffic, the A8 Highway could be further developed into a 6 (six) lane dual carriageway.

The portion of the highway A8 included in the Project is mainly located in Kiambu, Nyandarua and Nakuru counties and borders, and for a short section, Baringo county near Mau Summit (See Map 1-1). It starts from Limuru Township and continues northwards, towards Kijabe Escarpment at an altitude of 2,480 meters at the eastern rim of the Rift Valley. From Kijabe, it continues in the Northwest direction to Kinungi in Nyandarua County, then proceeds for approximately 90 km to Naivasha at an altitude of 1,900 m in the Rift Valley. It by-passes Gilgil Township into Nakuru City and stretches in a northwesterly direction to Salgaa truck stop and market and climbs to Mau Summit on the western rim of the Rift Valley.

As for the A8-South portion of the Project, it is essentially located within the Kiambu and Nakuru counties. The A8 South, starts from Limuru Township and follows the eastern rim of the Rift Valley gradually descending into the valley until reaching Mai Mahiu. From this point it continues into the valley for approximately 37 km, crossing the community of Longonot and continuing to the city of Naivasha where it reconnects with the highway A8.



Administrative Limits

- International Boundary
- County (Nakuru)
- Sub-County (Gilgil)
- City (Njoro)

Road Network

- Primary
- Secondary
- Tertiary

Protected Areas

International Level

- Ramsar Site / World Heritage Site

National Level

- National Park / Sanctuary

Project Components

Segment 1 : Dualling of A8 Highway (Rironi - Mau Summit)

- 1 - Rironi – Naivasha
- 2 - Naivasha – Elementaita Road
- 3 - Elementaita Road – Njoro Turnoff (Nakuru Town)
- 4 - Njoro Turnoff – Mau Summit
- Flyover Viaduct (Nakuru)

Segment 2 : Strengthening of A8-South Highway (Rironi - Naivasha)

- 5 - Rironi – Mai Mahiu
- 6 - Mai Mahiu - Naivasha

VINCI meridian

Nairobi-Nakuru-Mau Summit Highway Project - Rift Valley Highway Limited

Environmental and Social Impact Assessment

Map 1-1
Overview of the Road Sections included in the Nairobi-Nakuru-Mau Summit Highway Project

Sources :
ESRI World Topographic Map
Open Street Map, hydrography and roads
American Red Cross, Administrative boundaries, 2019
Protected Planet, Ramsar and World Heritage Site, 2020-12

0 5 10 Km

WGS84, UTM 37S

08 juillet 2021

Preparation: C. Le Page
Drawing: M. Lévesque
Validation: G. Pothier

201_10312_00_ESIA_M1_1_ProjectLocation_003_210708.mxd

wsp

Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

1.2 PROJECT OBJECTIVES

The overall objective of the project is to improve the movement of goods and people along the Nairobi-Mau Summit road and enhance connectivity between other parts of Kenya and the larger East and Central Africa as it is part of the Trans African Highway (Northern Corridor). The road in its current condition is insufficient in serving the traffic of travellers and freight transporters using it.

The five key Project related objectives and benefits include:

- **Reduced Travel Times**: Improved highway conditions will lead to a considerable time saved for travelling and freight shipping. Time savings are estimated to 2 hours on A8 by relieving congestion and upgrading standards (SETEC, 2018[1]). This could also result in a positive environmental impact from reduced time/emissions.
- **Enhanced Safety:** The NNM road has been categorized as one of the most dangerous roads globally due to accidents/fatalities, and the Project will help rehabilitate and increase standards. The proposed road upgrades include provision of 4 lanes separated carriageway (A8) that will reduce likelihood of head-on collision of vehicles. Other proposed measures such as major and minor junction improvements, enhancement of road surface (A8 South) as well as provision of adequate lighting and trains, vehicles, cattle, wildlife and pedestrian overpass and underpass crossings will help in reducing number of accidents. Thus, reduction in number of fatal and severe injuries will add in the benefits likely to be generated by proposed improvement of Nairobi-Nakuru- Mau Summit highway. The 30-year Concession will assist in having strong operations and maintenance on a long term.
- **Economic Impacts for Individual Drivers**: Savings are anticipated in vehicle operating cost, as deteriorated roads are known to cause more damage to vehicles, which lead to frequent break down and higher wear and tear of tires as well as the higher probability of accidents.
- **Economic Impacts for Regional and Country Wide Development**: The Project will result in reduced transaction costs in transportation for enterprises and create more certainty in using the Project road for transport, given the elevated standard. Furthermore, availability of reliable transport infrastructure and efficient transportation services is an essential requirement for achieving goals of any development plan. The proposed highway's improvement will facilitate efficient and reliable transportation of freight to and from Mombasa Port.
- **Employment Generation:** Road upgrades and maintenance activities provide good direct and indirect employment opportunities to skilled, as well as unskilled manpower. The Project is expected to generate 1,500 jobs during construction and 200 jobs during operation, all primarily local. The enhanced income of the local skilled and unskilled work force will also bring out a multiplier effect to other sectors of the economy.
- **Local Content:** The Project will have at least 40% of labour by value and 40% of materials by value (excluding petroleum and petroleum products) for construction sourced in Kenya.

[1] SETEC International. 2018. *PPP Competition Nairobi-Nakuru-Mau Summit Highway in Kenya – Traffic Study.* 173 p.

1.3 PROJECT PROPONENT

The Project Proponent is the Rift Valley Highway Limited (RVH), a special purpose vehicle (SPV) company owned by VINCI Highways (Lead Member), VINCI Concessions, and Meridiam SAS. RVH is mandated under a PPP agreement with the Kenya National Highway Authority to undertake development and O&M of the Nairobi-Nakuru-Mau Summit Highway Project on a Design, Build, Finance, Operate, Maintain and Transfer (DBFOMT) basis.

VINCI Highways, a subsidiary of VINCI Concessions, is a world leader in road concessions, operations and services. Through its 5,500 employees worldwide, VINCI Highways designs, finances, builds and operates a network of highways, urban road networks, bridges, tunnels and toll services facilities spanning over 3,700 km in 14 countries. VINCI Highways will capitalize on its technical and operational expertise to implement new traffic management patterns, deploy advanced equipment and maintenance plans and provide local employees with training programs for this project.

VINCI Concessions is a global leader in mobility infrastructure and specializes in successfully unlocking the potential of public private partnerships in several countries. Through the VINCI Group's integrated concession and construction model and expertise in design, financing, programme management and operation and maintenance of infrastructure, VINCI Concessions and its subsidiary VINCI Highways, form part of the RVH consortium.

Meridiam was founded in 2005 by Thierry Déau, with the belief that the alignment of interests between the public and private sector can provide critical solutions to the collective needs of communities. Meridiam is an independent investment Benefit Corporation under French law and an asset manager. The firm specializes in the development, financing, and long-term management of sustainable public infrastructure in three core sectors: mobility, energy transition and environment, and social infrastructure. With nine offices in Europe, Africa and North America, Meridiam currently manages more than 90 projects and assets to date. Meridiam is certified ISO 9001: 2015, Advanced Sustainability Rating by VigeoEiris (Moody's) and applies a proprietary methodology in relation to ESG and impact based on United Nations' Sustainable Development Goals (SDGs). Under its Meridiam Infrastructure Africa Fund, Meridiam S.A.S. is a joint party in the RVH consortium alongside VINCI Concessions, and VINCI Highways.

1.4 ESIA OBJECTIVES AND CONTENTS

Under the laws of Kenya, and as per International Finance Corporation Performance Standards (IFC PS), the Project requires the completion of an Environmental and Social Impact Assessment (ESIA) and an Environmental and Social Management System (ESMS).

The main objectives of the ESIA are to:

- identify and evaluate potential environmental and social effects associated with the Project development and implementation;
- ensure that anticipated effects are adequately mitigated or enhanced;
- propose adequate management and follow-up mechanisms to monitor the potential effects predicted.

The ESIA is prepared according to the Final Version of the ESIA Terms of Reference (TOR) (Appendix 1-1) for the Nairobi-Nakuru-Mau Summit Highway Project dated December 6th, 2019. The TOR details the key methodological guidelines to be considered during the development of the ESIA.

The ESMS, a document distinct from the ESIA report, will incorporate the following elements: (i) policy and legal framework; (ii) organizational capacity and competency; (iii) identification of risks and impacts; (iv) management programs; (v) communication and grievance management; (vi) capacitation training; (vii) document control and record management; and (ix) monitoring and review.

A Resettlement Action Plan (RAP) has also been developed as a standalone document and is currently being implemented by KeNHA. The RAP is therefore excluded from the Consultant's scope of work.

1.5 REPORT STRUCTURE

The ESIA is presented within eight chapters, the contents of each is described as follows:

- **Chapter 1 – Introduction:** outlines the context for the Project and ESIA;
- **Chapter 2 – Legal, Regulatory and Institutional Frameworks:** describes the legal, institutional and regulatory frameworks applicable to the Project;
- **Chapter 3 – Alternatives Analysis:** provides an analysis of the various project design options considered, as well as the process and justification for the selection of preferred options;
- **Chapter 4 – Project Description:** provides a detailed description of Project components and activities;
- **Chapter 5 – Approach and Methodology:** outlines the approach and methodology used to complete the ESIA and establishes the project's spatial boundaries considered;
- **Chapter 6 - Baseline of Environmental and Social Conditions:** describes the existing conditions for the physical, biological and human environments;
- **Chapter 7 – Stakeholder Consultation:** provides a description of the consultations completed during the ESIA process. It also offers a summary of the observations, requests and comments expressed by the participating stakeholders;
- **Chapter 8 – Impact Assessment and Mitigation:** provides an assessment of Project impacts on the physical, biological and socioeconomic environments and a list of proposed mitigation measures. Assessment of cumulative impacts is also presented;
- **Chapter 9 - Climate Change Risk Assessment:** outlines the anticipated consequences of climate change on the people, the economy, and the environment associated with this Project, in compliance with IFC Performance Standard 1.
- **Chapter 10 – Environmental and Social Management Plan:** offers an overview of some of the components of the ESMS and ESMP to be prepared and implemented by RVH and the Contractors (EPC and O&M). The chapter includes a summary of the ESIA impacts and mitigation measures, a highlight of the proposed governance structure, a brief presentation of the ESMS and associated management/action plans and considers the monitoring and follow-up activities to be applied during construction and operation activities to ensure application and success of proposed mitigation measures.

As part of the ESIA, an ESMS is prepared and constitutes the framework for the implementation, monitoring and reviewing of the mitigation and optimization measures identified through of the ESIA. It provides tools to ensure the environmental, social, community and occupational health and safety measures that are recommended to control the identified impacts and risks, are effective and properly implemented. This ESMS is presented as a starting point for the on-going development of a sound management system including a set of environmental and social management plans. It covers the construction, operational and decommissioning phases of the Project. It is expected that the system will be modified and updated as the Project progresses. Effective use of this ESMS will promote improved RVH environmental and social performance, as required by IFC Performance Standard 1.

1.6 ESIA CONSULTANTS

The Project proponents have contracted WSP Canada Inc. as an independent expert consultant to conduct the ESIA. In collaboration with Norken International Ltd. and Flora Fauna & Man, Ecological Services Ltd (FFMES), WSP Canada will carry out the ESIA relevant to the Nairobi-Nakuru-Mau Summit Highway Project.

1.6.1 WSP CANADA INC.

The consultant, WSP Canada Inc. is one of the world's leading professional services consulting firms. We are dedicated to our local communities and propelled by international brainpower. We are technical experts and strategic advisors including engineers, technicians, scientists, architects, planners, surveyors and environmental specialists, as well as other design, program and construction management professionals. We design lasting solutions in the Transportation & Infrastructure, Property & Buildings, Environment, Power & Energy, Resources and Industry sectors, as well as offering strategic advisory services. Our talented people around the globe engineer projects that will help societies grow for lifetimes to come. With approximately 49,500 talented people in 550 offices across 40 countries — we are uniquely positioned to deliver successful and sustainable projects, wherever our clients need us.

We are dedicated in ensuring that projects work with the natural environment which, we believe, is critical to their overall success. By looking at the natural setting and designing with the intention to minimize impacts, WSP's Ecology & Environmental Impact Assessment (EIA) service team develops solutions that meet national and international requirements and policy objectives to integrate with the natural environment as well as surrounding communities.

1.6.2 ESIA SUBCONSULTANTS

1.6.2.1 NORKEN INTERNATIONAL LIMITED

Norken International Limited is an independent company in Kenya and a firm of experts registered with the Kenya National Environment Management Authority (NEMA) Under Registration No.0181, that provides consultancy services in different disciplines of Engineering, Environmental and Project Management with expertise in topographical surveys, geophysical investigations, ground water exploration, geotechnical and environmental sampling.

As one of WSP's subcontractors, Norken will assist WSP with delivery of various aspects of the Project, including but not limited to air quality monitoring, surface water quality monitoring and reporting, soil and sediment quality sampling and reporting, socioeconomic surveys, baseline ambient noise surveys, environmental regulatory support and stakeholder consultation under oversight from WSP specialists.

1.6.2.2 FLORA, FAUNA & MAN, ECOLOGICAL SERVICES LTD

WSP has also subcontracted Flora, Fauna & Man, Ecological Services Ltd. (FFMES) to carry out biodiversity surveys. FFMES specialises in Ecosystem services and habitat evaluations, botanical surveys, Natural resources use surveys, forestry surveys, reducing emissions from deforestation and forest degradation (REDD), ecosystem services valuation among others, and prides itself in a core team of ecology and biodiversity experts, who have extensive work experience in undertaking extensive IFC PS6 compliant biodiversity and natural resource baseline investigations.

2 LEGAL, REGULATORY, AND INSTITUTIONAL FRAMEWORKS

This section presents the institutional actors and legal texts that are relevant to the preparation of the ESIA, as well as an outline of the applicable EIA process. National regulations are discussed along with International Finance Corporation (IFC) performance standards, and international conventions to which Kenya is a party.

2.1 CONSTITUTIONAL REQUIREMENTS FOR ENVIRONMENTAL PROTECTION

The 2010 constitution of Kenya acts as a benchmark for legislations and regulatory frameworks in Kenya by acting as a regulator and supervisor of development measures and project controls. It demands proper management of the environment as a national heritage and benefits to the future generations.

Environment and social sustainability is covered explicitly in the Constitution of Kenya, 2010. Clause 42 under the Bill of Rights of the Constitution of Kenya, 2010 provides inter alia that every person has a right to a clean and healthy environment. Clause 43 of the Constitution provides that every person in Kenya has economic and social rights.

Chapter 5 of the Constitution provides for the sustainable management of land and the environment in Kenya. Specifically, Part 2, Clauses 69 – 72 deals with environmental and natural resources management in Kenya and the proposed project will be conducted in accordance with these Clauses.

Clause 69(1)(f) of the Constitution requires the State to develop systems for environmental impact assessment. The State already has a system for environmental impact assessment in the form of the Environment Management and Coordination Act, 1999 (EMCA) and its subsidiary legislation titled Legal Notice 101: Environment (Impact Assessment and Audit) Regulations, 2003 (L.N. 101).

2.2 POLICY PROVISIONS

2.2.1 VISION 2030

Vision 2030 is Kenya's long–term development blueprint which aims to create a globally competitive and prosperous country providing a high quality of life for all its citizens in a clean and secure environment. It is built of three pillars of economy, society and politics which are anchored on the foundations of macroeconomic stability; infrastructural development; Science, Technology and Innovation; Land Reforms; Human Resources Development; Security and Public-Sector Reforms. The Economic Pillar aims to achieve an average economic growth rate of 10 per cent per annum and sustaining the same until 2030. Under the Social Pillar, it aims at ensuring a just and cohesive society enjoying equitable social development in a clean and secure environment while the Political Pillar aims to realize an issue-based, people-centered, result-oriented and accountable democratic system.

2.2.2 NATIONAL ENVIRONMENT POLICY, 2014

The Environment Policy-Sessional paper No. 10 of 2014 recognizes that the survival and socio-economic wellbeing of Kenyans is ultimately intertwined with the environment. It therefore aims at ensuring better quality of life for present and future generations through integration of environmental concerns in national planning and management processes and ensuring guidelines are provided for environmentally sound development, sustainable management and use of the environment and natural resources.

The policy has seven broad goals under which guiding principles are mainstreamed to achieve conservation and management of the natural resources. Some of the principles outlined in the policy include right to a clean and healthy environment, ecosystem approach, total economic value, sustainable resource use, equity, public participation, precautionary principle, polluter pays principle, international cooperation, community empowerment, benefit sharing and good governance. It promotes the use of Impact Assessment as an innovative environmental management tool. It also calls for the Government of Kenya (GoK) to ensure that all significant development projects are subjected to EIA and regular environmental audits.

Specifically, policy statement number 4 of section 4.1.1 (Forest Ecosystems) calls for conservation of forest ecosystems and their associated resources for sustainable poverty reduction and sustainable development. The Forest ecosystems are important in conservation of soil, water and biodiversity as well as in moderation of climate. They are the richest terrestrial habitats for biodiversity. Maintaining forest biodiversity safeguards the economic potential of future opportunities for new non-timber products such as food and medicine as well as social sustainability by offering aesthetic, spiritual and recreational settings for people.

2.2.3 KENYA NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN (NBSAP) 2019-2030

The NBSAP 2019-2030 is presented as a road map to achieving biodiversity conservation targets in the country while also fulfilling international and regional obligations. The action plan sets the time required to realize the action, performance and verifiable indicators and allocates responsibilities for implementation to different institutions that include Government Ministries, Departments and Agencies (MDAs), County Governments, Private sector, Research and Academic Institutions, NGOs and CBOs. Its vision is to ensure that by 2030, Kenya will have a highly valued, conserved and sustainably utilized biodiversity contributing to socio-economic wellbeing of the people of Kenya.

The following are some of the guiding principals in line with this project.

1. Principle of preventive action: Conservation of biodiversity is better achieved by preventing environmental harm than by endeavoring to remedy or compensate for such harm.
2. Precautionary principle: Where there is a threat of significant reduction or loss of biodiversity, lack of complete scientific certainty should not be used as a reason for postponing cost-effective measures to avoid or minimize such a threat.
3. Polluter Pays principle: Those who cause damage to biodiversity should bear the costs of preventing it, removing it or reducing it.
4. Public participation and public access to information and justice in environmental matters: The public should have access to environmental information and the right to participate in the environmental decision-making process and to have that participation taken into account in the decision-making process.

This policy is triggered by any project with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the Project). The developer is expected to abide by the above provisions.

2.2.4 KENYA FOREST POLICY 2014

This Policy proposes a broad range of measures and actions responding to the challenges faced by the forest sector. It is based upon the views and expert opinion of those participants drawn from the public and private sector, and civil society organizations. A number of strategic initiatives have been introduced to improve and develop the forest resource base; integrate good governance, transparency, and accountability, equity and poverty reduction into the forest. It also presents the issues and the policy recommendations that have been identified, analyzed and debated by the stakeholders. The overall goal of this Policy is sustainable development, management, utilization and conservation of forest resources and equitable sharing of accrued benefits for the present and future generations of the people of Kenya.

The policy seeks to promote investment in commercial tree growing, forest industry and trade, enhance management of forest resources for conservation of soil, water biodiversity and environmental stability.

As the policy is geared towards proper management of forest resources, the Project proponent and associated contractors must adhere to the Forest Act and it provisions.

2.2.5 WILDLIFE POLICY OF 2011

The goal of this policy is to create an enabling environment for conservation and sustainable management of wildlife for current and future generations. The overall objective of this policy is to provide a framework that is dynamic and innovative for re-engineering the wildlife sector. The specific objectives of the Policy are to:

1. Conserve in perpetuity, Kenya's wildlife resources, as a national heritage;
2. Increase access, incentives and sustainable use of wildlife resources, while ensuring equitable sharing of benefits;
3. Promote partnerships and incentives for wildlife-based enterprises;
4. Facilitate collaboration for effective governance and financing of the wildlife sector between communities, private conservancies, counties, national government and international partners; and
5. Promote management of viable wildlife populations and their habitats in Kenya.

2.2.6 SESSIONAL PAPER NO.1 OF 2020 ON WILDLIFE POLICY

The goals of this policy is the sustainable management of Kenya’s wildlife resources through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes in order to provide for the social, economic, ecological, cultural and spiritual needs of present and future generations; contribute to the sustainable development of the country; and enhance the quality of human life.

This policy seeks to conserve wildlife resources in national parks, national reserves and national sanctuaries in an effective and equitable manner, ensure maintenance and enhancement of ecological integrity of wildlife and their habitats through the integration of private and community lands into protected area systems and to harness the contribution of wildlife resources into the national economy and enhance the benefits to all.

It concerns the present Project through:

- The management of the existing ranches within where the road will traverse, in consultations with KWS and local community, guide and provide advice to the contractor on the best working practices. This will include areas whereby existing wildlife, not be interfered with, e.g. quarry sites, borrow pits as well as wildlife access paths, saltlicks etc. This will be mainly during sites preparation and operation phase of the Project.
- The Contractor will be expected to abide by the law during construction phase in enhancing wildlife conservation and management for the entire Project sites with presence of wildlife.

2.2.7 THE NATIONAL OCCUPATIONAL HEALTH AND SAFETY POLICY OF 2012

This National Occupational Safety and Health Policy intends to significantly sustain continual development and implementation of the National Occupational Safety and Health systems and programs to reduce incidences of work-related accidents and diseases. In addition, it seeks to offer equitable compensation to those who suffer physical injuries and contract occupational diseases.

It seeks to address the current challenges, gaps and future development of safety and health systems and programmes in the country. It promotes basic principles of assessing occupational risks and/or hazards; combating occupational hazards at source; and developing a national preventative safety and health culture that includes information, consultation, research and training. The policy will also promote continuous improvement of occupational safety and health by integrating Kenyan national laws and regulations with Regional Protocols, ILO Conventions, ISO standards and the best practices in the world. It also sets up mechanisms for resource mobilization for occupational safety and health programs and activities and provide guidance to all stakeholders in the development and implementation of national occupational safety and health systems and programmes.

The main objective of this policy is to establish national occupational safety and health systems and programmes geared towards the improvement of the work environment. The Policy seeks to reduce the number of work-related accidents and diseases, and equitably provide compensation and rehabilitation to those injured at work or who contract occupational diseases.

It concerns the present Project because:

- The proponent will need to seek to compliance with the provision of the policy in ensuring that workers operate in a safe and healthy environment and that their welfare is safeguarded. There is also a need to establish a safety policy in line with the Act.

2.2.8 KENYA AIDS STRATEGIC FRAMEWORK 2 (2020/21-2024/25)

The Kenya AIDS Strategic Framework (II) provides guidance for implementing an evidence-based HIV response. It outlines priority interventions and emphasis on the need to create an enabling system to maximise on the impact of interventions. KASF II leverages the gains made under Kenya AIDS Strategic Framework I (KASF 1) which was implemented through the County AIDS Strategic Plans (CASPs). It promotes the need to strengthen and bring to scale interventions and approaches that have yielded results. It is also premised on the Constitution of Kenya (2010) that stipulates the right to highest attainable standard of health to all citizens and guides the full engagement of counties in the national health response. The framework builds on the gains made in the devolved system of planning and governance of the AIDS programmes in Kenya. The development of this framework has been informed by epidemic appraisals and the response. The framework has been developed during a period when the world is faced with global COVID-19 pandemic challenge and thus has taken COVID-19 related disruptions into consideration. It provides guidance on priority interventions for implementation. Its vision is to maintain a Kenya free of HIV infections, stigma and AIDS-related deaths. It seeks to provide comprehensive HIV prevention, treatment, care and support towards Universal Health Coverage for all people in Kenya.

Labour intensive projects such as road projects could result in increased HIV/AIDS prevalence rates in an area. This will originate from influx of workers within trading centers with monthly wages and possibly away from their families. The contractor and the proponent are expected to abide by the above provisions during construction period.

2.2.9 KENYA HEALTH POLICY OF 2014-2030

The Kenya Health Policy, 2014–2030 gives directions to ensure significant improvement in overall status of health in Kenya in line with the Constitution of Kenya 2010, the country's long-term development agenda, Vision 2030 and global commitments. It demonstrates the health sector's commitment, under the government's stewardship, to ensuring that the country attains the highest possible standards of health, in a manner responsive to the needs of the population.

This policy is designed to be comprehensive and focuses on the two key obligations of health: realisation of fundamental human rights including the right to health as enshrined in the Constitution of Kenya 2010 and; contribution to economic development as envisioned in Vision 2030; and. It focuses on ensuring equity, people centeredness and a participatory approach, efficiency, a multisectoral approach, and social accountability in the delivery of healthcare services. The policy embraces the principles of protection of the rights and fundamental freedoms of specific groups of persons, including the right to health of children, persons with disabilities, youth, minorities, the marginalised and older members of the society, in accordance with the Constitution.

The policy focuses on six objectives and eight orientations to attain the government's goals in health. It takes into account the functional responsibilities between the two levels of government (county and national) with their respective accountability, reporting, and management lines. It proposes a comprehensive and innovative approach to harness and synergise health services delivery at all levels and engaging all actors, signalling a radical departure from past approaches in addressing the health agenda. There is therefore, need to raise awareness and ensure that the objectives of this policy are understood and fully owned by the various stakeholders and implementing partners.

The proposed Project is expected to employ both skilled and unskilled workers some who might come from the marginalised groups within the project area. The rights and fundamental freedoms of these workers should be protected in compliance with the requirements of this policy.

2.2.10 GOVERNMENT OF KENYA MEDIUM TERM PLAN 2018-2022

The government of Kenya medium term plan for the period 2018-2022 is consistent with the Kenya Vision 2030. It aims at putting the economy on a sustainable growth of 7 per cent by end of the Plan period. The implementation of the framework will be supported by policy, legal, institutional and structural reforms that will be implemented by the Government to strengthen macroeconomic stability, improve business environment and transparency and accountability in use of public resources. The framework will support realization of Vision 2030 and the "Big Four" initiatives, Sustainable Development Goals (SDGs) and aspirations of Africa's Agenda 2063 which seek to achieve broad based inclusive growth that will contribute towards reduction of poverty and income inequality, and employment creation.

The framework targets to create more jobs including enhancing the share of formal sector jobs. Attainment of these objectives were anchored on a macroeconomic foundation that ensured stability in price level, sustainable fiscal deficits, increased share of infrastructure investments to gross domestic product (GDP), sustained levels of public sector debt and balance of payments, transparent and accountable use of public resources and a conducive business environment

As noted previously; the construction of the proposed road project will create employment opportunities for both skilled and unskilled personnel. Skilled personnel will be employed as Managers, Supervisors, Engineers, Architects, Surveyors, Health and Safety, and in other technical positions whereas semi-skilled and unskilled labourers will be employed as support staff and perform non-technical and administrative tasks. Indirect employment through provision of goods and services to the contractor will also be available during construction period.

2.2.11 ECONOMIC RECOVERY FOR WEALTH AND EMPLOYMENT CREATION STRATEGY OF 2006

This Economic Recovery Strategy for Wealth and Employment Creation aims at giving Kenyans a better deal in our lives and in our struggle to build a modern and prosperous nation. It aims to empower Kenyans and to provide them with a democratic political atmosphere under which all citizens can be free to work hard and engage in productive activities to improve their standards of living. In this regard, this strategy is focused on implementing the promises in the Manifesto of the National Rainbow Coalition (NARC), our ruling party, which are based on two concepts: democracy and empowerment.

Physical infrastructure is an important prerequisite in creating and supporting a business environment that facilitates private sector investment, growth and job creation. The provision of adequate infrastructure and the services thereof, coupled with macroeconomic stability and a long-term development strategy, are essential preconditions for sustainable economic and social development.

Deterioration of physical infrastructure has resulted primarily from inadequate allocation of resources for construction, maintenance and rehabilitation of existing facilities, poor contractual work, rapid urbanisation, high population growth, and adverse weather conditions. Therefore, the broad strategies to address these problems in provision of physical infrastructure services will be geared towards creating an environment for facilitating procurement strategies that yield value for money expended, curbing wastage, and enhancing performance of infrastructure services.

The construction of the proposed road project will create employment opportunities for both skilled and unskilled persons. Skilled personnel will be employed as Managers, Supervisors, Engineers, Architects, Surveyors, Health and Safety, and in other technical positions whereas semi-skilled and unskilled labourers will be employed as support staff and perform non-technical and administrative tasks. Indirect employment through selling of foodstuffs to the workers will also be witnessed during construction period.

2.2.12 THE KENYA ENVIRONMENTAL SANITATION AND HYGIENE POLICY OF 2016-2030

The Kenya Environmental Sanitation and Hygiene Policy (KESHP) 2016-2030 provides broad guidelines to both state and non-state actors at all levels to work towards universal access to improved sanitation leading to improved quality of life for the people. Primarily, the KESH policy aims to increase the proportion of the population with access to improved sanitation to 100 percent by 2030 and ensure a clean and healthy environment for all in Kenya. The development of KESHP 2016-2030 is a result of extensive policy review and participatory stakeholder consultations and validation meetings held throughout the country.

The policy sets Kenya on the trajectory of ensuring that all Kenyans have sustainable access to improved sanitation and a clean and healthy environment by 2030. The policy therefore sets the following targets:

1. Achieve and sustain 100 percent open defecation free (ODF) Kenya by 2030;
2. Achieve and sustain 100 percent access to improved sanitation in rural and urban areas by 2030.

Policy Objectives

1. To scale up rural and urban sanitation towards an ODF Kenya and universal access to improved sanitation by 2030;
2. To assure a clean and healthy environment for all Kenyans through appropriate technology choices for waste management and pollution control;
3. To foster strong private sector participation and investment in creating sanitation demand and increasing uptake of appropriate products and services.

4 To establish an enabling legal and regulatory environment for sanitation at both national and county levels;

5 To strengthen institutional and human resource capacity of the environmental sanitation sector for efficient and effective provision of sanitation and hygiene services;

6 To establish an effective research and development framework for sanitation to improve appropriate technology choices and promote evidence-informed sector decision-making;

7 To establish a functionally effective monitoring and evaluation framework for the sanitation sector to ensure maximum accountability in policy implementation at all levels.

The proponent and the contractor will seek to comply with the provision of this policy to achieve 100% ODF at the project area during construction period.

2.2.13 LAND POLICY OF 2009

Chapter three (3) of the National Land Policy is linked to constitutional reforms, regulation of land ownership, and property rights. It is vested in the government by the Constitution with powers to regulate how private land is used in order to protect the public interests. The government exercises these powers through compulsory acquisition and development control. Compulsory acquisition is the power of the State to take owned private land for public purposes defined within the 2009 Policy as:

"Compulsory acquisition is the power of the State to extinguish or acquire any title or other interest in land for a public purpose, subject to prompt payment of compensation, and is provided for in the current Constitution."

In accordance with this policy, the Government must make prompt and reasonable payment for land acquisition compensation (See Section 9.4). The enactment of this policy is laid out in the Land Acquisition Act, Chapter 295, 2012. (See Section 3.5.1) The overall purpose of this policy and implementation thereof is to secure and conserve all affected household's sources of livelihoods while protecting necessary cultural sanctity.

The project will use the current Right of Way but in case there will be need for land acquisition, the proponent in collaboration with the National Land Commission (NLC) will address all issues related to land acquisition and compensation before the project commences.

2.2.14 THE NATIONAL POLICY ON WATER RESOURCES MANAGEMENT AND DEVELOPMENT (SESSIONAL PAPER NO 1 OF 1999)

The National Water Policy (NWP) of Kenya was developed in 1999 as the National Policy on Water Resources Management and Development. It aims at achieving sustainable development and management of the water sector by providing a framework in which the desired targets/goals are set, outlining the necessary measures to guide the entire range of actions and to synchronize all water-related activities and sectors.

The NWP set the following specific policy objectives covering the four basic areas of water resources management, water supply and sewerage development, institutional arrangement and financing of water sector:

1 Preserve, conserve and protect all available water resources and allocate it in a sustainable, rational and economical way;

2 Supply of water of good quality and in sufficient quantities to meet the various water needs including poverty alleviation, while ensuring safe disposal of wastewater and environmental protection;

3 Establish an efficient and effective institutional framework to achieve a systematic development and management of water sector; and

4 Develop a sound and sustainable financing system for effective water resources management, water supply and sanitation development.

The Project should contribute towards the achievement of the first two policy objectives.

2.2.15 LAND USE POLICY OF 2017 (SESSIONAL PAPER NO 1 OF 2017)

The principal objective of the National Land Use Policy (NLUP) is to provide legal, administrative, institutional and technological framework for optimal utilization and productivity of land and land related resources in a sustainable and desirable manner at National, County and Sub- County and other local levels. Specifically, the Policy offers a framework of recommendations and principles designed to ensure the maintenance of a land use system that will provide for:

1. Land use planning, resource allocation and resource management for sustainable development to promote public good and general welfare;
2. Environmental management and sustainable production in the utilization of land resources;
3. Coordination and integration of institutional linkages in planning at sectoral and cross-sectoral levels to foster collaboration and decision making among different land users;
4. Equitable utilization of land resources to meet governance, social economic and cultural obligations of the people of Kenya;
5. Anchoring land development initiatives that will respond positively to the market demands;
6. Integrated framework for the preparation of a National Spatial Plan and review of various land use plans;
7. Mainstreaming of gender and special interest groups in land use planning and management;
8. A comprehensive and efficient GIS-based national land use information management system;
9. An appropriate, independent, accountable and democratic institution for land use conflict resolution; and Mitigating problems associated with poor land use.

2.2.16 KENYA NATIONAL POLICY ON GENDER AND DEVELOPMENT OF 2011

The overall aim of the Gender Policy 2011 is to provide precedence for the prevention of discrimination on the basis of sex in the national development process in order to improve social, legal/civic, economic, and cultural conditions of women, men, girls and boys in Kenya. Of the identified policy priorities, two were identified as relevant to project implementation. One of the priorities is incorporating gender equality objectives, indicators, as well as preventative action identification into the ministerial performance frameworks to which the project must comply. Additionally, the policy lays out a priority that each project will develop integrated gender equality strategies at the initiative level in priority areas.

This policy will be a guide during initial project implementation, especially during hiring of staff, procurement of suppliers, and contracting of sub consultants/contractors.

2.3 NATIONAL REGULATORY FRAMEWORK

2.3.1 ENVIRONMENT MANAGEMENT AND COORDINATION ACT, 1999 (AMENDED 2015)

EMCA, 1999 (The principal Act) and the Environmental Management and Coordination (Amended) Act, 2015 provide the main legal and institutional framework under which the environment in general is to be managed. EMCA's guiding principle is that every person has a right to a clean and healthy environment and can seek redress through the High court if this right has been, is likely to be, or is being contravened.

Section 58 of the Act makes it a mandatory requirement for an EIA study to be carried out prior to implementing projects specified in the Second Schedule of the Act. Such projects have a potential of causing significant impacts on the environment. Similarly, section 68 of the same Act requires operators of existing projects or undertakings to carry out Environmental Audits (EA) in order to determine the level of conformity with statements made during the EIA study. This ESIA Report will be prepared in accordance with the provisions of EMCA.

The Environmental Management and Coordination (Amendment) Act, 2015 has repealed some of the sections in the principal Act. EMCA provides for the establishment of appropriate legal and institutional framework for the management of the environment and for matters connected therewith and incidentals thereto. EMCA outlines the requirements for EIA, environmental audits, monitoring procedures and environmental-quality standards.

The following regulations under EMCA operationalize various provisions under the Act.

2.3.1.1 L.N. 101: EIA/EA REGULATIONS 2003 AND THE 2016 AMENDMENTS

In Kenya the requirement for new and existing projects to undergo EIA and EA respectively follows on the enactment by the Kenya Parliament of the Environmental Management and Coordination Act No. 8 of 1999, and Section 3 of the Environment (Impact and Assessment) Regulation No. 101 of 2003. Under this legal provision major development projects are required to be subject to an EIA process and the resultant EIA report is submitted to NEMA for approval and issuance of an EIA license, after demonstrating that the possible negative impacts of a project will be effectively mitigated.

It is required that an EIA or EA Study in Kenya is undertaken by a firm duly licensed by the NEMA. The EIA/EA Regulations also provide information to project developers on the requirements of either an EIA or EA as required by the EMCA.

The proposed project is subject to relevant provisions of these regulations and therefore ESIAs should be undertaken in accordance with the requirements. It is important to note that KeNHA has already undertaken the ESIA for the project which is based on the concept design and obtained an approval (EIA Licence) from NEMA. The licence was issued with the understanding that there might be no material difference between the concept design and the final design. However, should there be any significant changes, the Developer (Rift Valley Highways Limited) will be required to apply for variation in compliance with Article 25 of the EIA/EA Regulation 2003. This application requires the filling of a form explaining the modifications made to the initial design of the project and presenting it to NEMA with the payment of the associated fee. If NEMA is satisfied that the project's associated variations comply with the requirements of the original licence, the variation will be issued without requiring a new environmental impact assessment. If not, a new ESIA or addendum will be required.

This project falls under the High-Risk Project (4) category of Transportation and related infrastructure projects that includes all new major roads and trunk roads. It is under this premise that this ESIA Report will be prepared.

2.3.1.2 L.N. 120: WATER QUALITY REGULATIONS, 2006

This regulation was promulgated on September 4th, 2006 and became effective on July 1st, 2007. The regulation provides for sustainable management of water resources, including prevention of water pollution and protection of water sources like lakes, rivers, streams, springs, wells and other water sources. Regulation No. 4 (2) prohibits any person from throwing or causing 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 and Regulation No. 11 further prohibits any person to discharge or apply any poison, toxic, noxious or obstructing matter, radioactive waste or other pollutants or permit the dumping or discharge of such matter into the aquatic environment unless such discharge, poison, toxic, noxious or obstructing matter, radioactive waste or pollutant complies with the standards for effluent discharge into the environment. The regulation requires that Developers apply for an "Effluent Discharge License" annually for discharging process wastewater either into the environment, aquatic environment or public sewers.

For effluent discharges into the environment and aquatic environment, a Developer needs to apply directly to the NEMA. For discharges into public sewers, a Developer needs to apply for the license to the relevant county. The regulation contains discharge limits for various environmental parameters into public sewers and the environment.

These regulations will apply to the proposed project during the construction and operation phase, as the project will require water and generate some wastewater from vehicles oil, asphalt plant, asphalt products and at the batching site. In addition, the camp sites may also produce wastewater in the form of effluents and kitchen wastewater. There are numerous seasonal water crossings along the project road that need protection from pollution through compliance with the wastewater discharge standards specified in this regulation. RVH will be required to properly manage the effluent from construction activities in accordance with the above regulations prior to discharge into the environment.

2.3.1.3 L.N. 121: WASTE MANAGEMENT REGULATIONS, 2006

The Waste Management Regulations were promulgated on 4th September 2006 and became effective on 1st July 2007. These regulations are comprehensive and cover the management of all categories of wastes including; solid waste, Industrial waste, hazardous waste, toxic substances and waste, biomedical waste, and radio-active substances. Generally, under the regulations it is the responsibility of the waste generator to segregate waste (hazardous and non-hazardous) by type and then dispose of the wastes in an environmentally acceptable manner.

Under the regulation, it is a requirement that waste be transported using a vehicle in possession of an approved "Waste Transportation License" issued by NEMA. Wastes generated in Kenya must be disposed of in a licensed disposal facility. Such a facility will require annual environment audits to be undertaken by NEMA registered Lead Experts.

The regulations are formed under sections 92 and 147 of the Environmental Management and Coordination Act, 1999 and are aimed at developing proper and sustainable structures for handling, transporting, and disposal of waste in a manner that ensures adequate protection of human health and environment. Even though waste management systems in the country seem unpopular and disregarded due to haphazard disposal and lack of sanitary landfills, the regulations provide precedence to waste minimization, cleaner production mechanism, and proper segregation of waste at the points of production. This regulation empowers NEMA to license transporters of waste, incinerators, sanitary landfill developers, composers, recyclers and waste transfers stations.

It is further a requirement under the regulation for a developer to install at their premises anti-pollution equipment for treatment of various types of wastes. The treatment options shall be approved by the NEMA in consultation with the relevant lead agency.

The regulation contains definitions of hazardous wastes in the Fourth Schedule. The regulation requires that prior to generating any hazardous waste, a Developer shall undertake an EIA Study and seek approval from the NEMA.

Labeling of hazardous wastes is mandatory under the regulation and the specific labeling requirements are provided in Rule 18. The treatment options for hazardous waste disposal provided in Rule 19 include incineration or any other option approved by the NEMA.

During the construction phase, the proposed project will generate various types of wastes including the construction spoils, domestic wastes and redundant equipment among others. For the most part, it is expected that the wastes will be non-hazardous in nature and can be disposed of in accordance with the above regulations.

2.3.1.4 L.N. 61: NOISE AND EXCESSIVE VIBRATION CONTROL REGULATIONS, 2009

In May 2009, the Minister for Environment and Mineral Resources promulgated the above regulations for management of environmental noise and excessive vibration as shown in Table 2-1. The general prohibition states that no person shall make or cause to be made any loud, unreasonable, unnecessary or unusual noise, which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment.

These Regulations provide thresholds within specified environments for noise and excessive vibrations. It includes provisions on noise from related sources such as vibration of machinery, motor vehicles, blasting activities, and construction at night. Excessive vibration under these regulations is defined as any vibration that exceeds 0.5 centimeters per second (cm/s) at 30 meters (m) from the source.

Rules 13 and 14 of the regulations define the permissible noise levels for construction and Rules 5 and 6 of the regulations define noise levels for various types of activities that generate noise. Measures shall be put in place to ensure the permissible noise levels by the regulation are not exceeded by the project activities. These regulations are summarised in the Table 2-1 below:

Table 2-1 Maximum Permissible Noise Levels - Construction Phase

Facility		Maximum noise level permitted (Leq) in dB(A)	
		Day	**Night**
i)	Health facilities, educational institutions, homes for the disabled, etc.	60	35
ii)	Residential	60	35
iii)	Areas other than those in (i) and (ii) above	75	65

Time frame:
Day: 6.01 am – 8:00 pm (Leq, 14 hours)
Night: 8:01 pm – 6:00 am (Leq, 10 hours)

The Second Schedule of the regulations defines permissible noise levels to be complied with during the operational phase of a project and is reproduced in Table 2-2 below.

Table 2-2 Maximum Permissible Noise Levels - Operation Phase

Facility		Sound Level Limits (dBA) (Leq, 14 h)		Noise Rating Level (NR) (Leq, 14 h)	
		Day	Night	Day	Night
i)	Silent Zone	40	35	30	25
ii)	Places of Worship	40	35	30	25
iii)	Residential - Indoor	45	35	35	25
iv)	Residential - Outdoor	50	35	40	25
v)	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
vi)	Commercial	60	35	55	25

Time frame:
Day: 6.01 am – 8:00 pm (Leq, 14 hours)
Night: 8:01 pm – 6:00 am (Leq, 10 hours)

The regulation further stipulates that a permit will be required during the construction and operational phase of a project if there will be equipment that will produce noise during this phase of the project.

Some road construction activities such as operation of heavy construction equipment are likely to generate noise levels that will exceed the limits given in this regulation. In such situations the appointed Contractor shall apply for a noise permit from NEMA for the duration of exceedance. The Fourth Schedule of the regulations contains details of the application for a noise license while the Fifth Schedule provides a description of the noise permit that the NEMA will grant the main project Contractor.

2.3.1.5 EMCA (CONSERVATION OF BIOLOGICAL DIVERSITY AND RESOURCES, ACCESS TO GENETIC RESOURCES AND BENEFITS SHARING) REGULATION, 2006

This regulation aims at enhancing the preservation of biodiversity as well as safeguarding the endangered and rare species of plants and animals existing within a project area. Part II on conservation of biological diversity stipulates the prohibitions on the extraction and use of biological resources. Section 4 (1) states that a person shall not engage in any activity that may:

- Have an adverse impact on any ecosystem;
- Lead to introduction of any exotic species; and
- Lead to unsustainable use of natural resources.

Documentation on the regulation states that such activities can only be carried out upon presentation of a comprehensive EIA report and licensing by NEMA. The regulations also empower lead agencies in the conservation and natural resource management to keep and update an inventory on the endangered species in the country.

Safeguarding the ecosystem resources in accordance with the EIA License during the project implementation phase ensures compliance with these regulations.

2.3.1.6 ENVIRONMENTAL MANAGEMENT AND COORDINATION (AIR QUALITY) REGULATIONS, 2014

These Regulations cover air quality standards that are requisite to protect human health and allow an adequate margin of safety. These Regulations specify priority air pollutants, mobile and stationary sources as well as stipulates emission standards. The emissions likely to result from road construction activities (such as dust and exhaust emissions from running vehicles and equipment engines) and particulate matter have the potential of polluting the immediate environment. Bush clearing, earthworks and bulk delivery of construction material, if unmanaged may result in generation of dust. Thus, the need for strict adherence to these Regulations and standards therein in preventing and monitoring possible pollutants and managing sources.

2.3.1.7 LICENSES AND PERMITS REQUIRED UNDER THE EMCA

The subsidiary legislation under the EMCA is partially monitored through the use of permits and licenses. Subsequently all licenses and permits required during the construction phase shall be the responsibility of the individual Contractors and their agents. During the operational phase, all permits and licenses required to operate the project will be the responsibility of the Developer.

The subsidiary legislation under the EMCA requires some, or all the following types of permits to be available for inspection during the construction and operational phases of the project:

- Effluent Discharge License under Legal Notice 120: The Environment Management and Coordination (Water Quality) Regulations 2006;
- Waste Transport License under Legal Notice 121: The Environment Management and Coordination (Waste Management) Regulations 2006 for disposal of all types of wastes; and
- Noise Permit under Legal Notice 61: The Environment Management and Coordination (Noise and Excessive Vibration Pollution) (Control) Regulations, 2009.

2.3.2 ENVIRONMENT MANAGEMENT AND COORDINATION ACT, (CONTROLLED SUBSTANCES) REGULATION ,2007

These Regulations aim to regulate the production, trade and use of controlled substances and products. It provides for a system of data collection to facilitate compliance with relevant reporting requirements under the Montreal Protocol on Substances that Deplete the Ozone Layer and promote the use of ozone friendly substances, products, equipment and technology. It also ensures the elimination of substances and products that deplete the ozone layer. Ozone Depleting Substances (ODS) are chemicals that destroy the stratospheric ozone layer in the atmosphere by increasing the ultraviolet rays from the sun to the earth’s surface. Kenya is currently a consumer of ODS and therefore relies on importation and exportation of ODS. Any importer or exporter is required under these regulations to obtain an import license or export license respectively. An importer or exporter of any ODSs in piecemeal must obtain a permit for the same. It is a requirement that the developer should comply with the license and permit conditions.

2.3.3 ENVIRONMENT MANAGEMENT AND COORDINATION ACT (WETLANDS, RIVERBANKS, LAKE SHORES AND SEASHORES MANAGEMENT) REGULATIONS 2009

This regulation seeks to ensure wetland resources are utilized in a sustainable manner compatible with the continued presence of wetlands and their ecological goods and services. The sustainable use of wetlands should be integrated into the national and local land use plans to ensure sustainable use and management of the resources.

The main purpose is to provide for the conservation and sustainable use of wetlands and their resources in Kenya. Environmental Impact Assessment and Environmental Audit as required under the EMCA shall be mandatory for all activities likely to have adverse impact on the management of wetlands.

The Project will utilise the existing Right of Way but in case there will be need for land acquisition, the contractor will be required to abide by regulations provided.

2.3.4 PUBLIC ROADS AND ROADS ACCESS ACT (CAP 399)

This is an Act of Parliament to provide roads of public travel and access to public roads. The Act consolidates the law relating to traffic on all public roads. It also prohibits encroachment on and damage to roads including land reserved for roads.

Section 8 and 9 of the Act provides for the dedication of land for its conversion or alignment of public communication routes including construction of access roads adjacent to the nearest part of a public road. Sections 10 and 11 provide for advance notices to be served on the affected land and property owners seeking their permission to construct the respective access roads. This must be duly compensated on a mutually agreed upon land acquisition plan and the proponent intends to abide by this regulation.

2.3.5 THE TRAFFIC ACT CAP 403 OF 2013

This Act specifies that motor vehicles use proper fuel. The Traffic regulations promulgated under the Act specifies that every vehicle is required to be so constructed, maintained and used so as not to emit any smoke or visible vapour.

The Act also empowers police officers to stop and remove from the road vehicles producing noxious emissions or to charge their owners in a court of law. Pollution of the atmosphere occurs on the road either by use of adulterated petroleum products or un-roadworthy vehicles. The Act requires that the vehicles shall only use the fuel specified in the vehicle license but does not specify air pollution/quality standards. The contractor should abide by this regulation especially during construction phase.

2.3.6 LAND REGISTRATION ACT NO:3 OF 2012

This act gives effect to the principles and objects of devolved government as provided for under Chapter 11 of the Kenyan Constitution. This document also strives to revise, consolidate and rationalize the registration of titles to land. The National Land Commission is requested to constitute areas of land as land registration units which will be divided into registration sections, then further into blocks and finally into parcels. For each registration unit, the Law establishes a land registry which is managed by the Chief Land Registrar at the national level and County Land Registrar at the county level. This act also establishes a Community Land Register which should contain a cadastral map showing the extent of the community land and the identified areas of common interest.

It contains the general principles that will govern general dispositions affecting land such as; leases, charges, transmissions and trusts, co-tenancy and partitions as well as easements and analogous rights. The developer is expected to liaise with the ministry of land on issues pertaining land in order to abide by this act.

2.3.7 THE NATIONAL LANDS COMMISSION ACT OF 2012

This Act provides with respect to the administration, structure, operations, powers, responsibilities and (additional) functions of the National Land Commission established by Article 67 of the Constitution and for certain aspects of management and administration of land in accordance with the principles of land policy set out in Article 60 of the Constitution and the national land policy. Pursuant to Article 67(2) of the Constitution, the functions of the Commission include:

1. To manage public land on behalf of the national and county governments;
2. To recommend a national land policy to the national government;
3. To advise the national government on a comprehensive programme for the registration of title in land throughout Kenya;
4. To conduct research related to land and the use of natural resources, and make recommendations to appropriate authorities;
5. To initiate investigations, on its own initiative or on a complaint, into present or historical land injustices, and recommend appropriate redress;
6. To encourage the application of traditional dispute resolution mechanisms in land conflicts;
7. To assess tax on land and premiums on immovable property in any area designated by law; and
8. To monitor and have oversight responsibilities over land use planning throughout the country.

The proponent should liaise with the National Land Commissions County Offices of Nakuru, Nyandarua, Kiambu and Baringo counties on issues regarding land acquisition and compensation to ensure compliance with these provisions of the act.

2.3.8 THE LAND LAWS ACT (AMENDED) 2016

The land laws (Amendment) of 2016 were done on the principal land Act No. 6 of 2012. This is an Act of Parliament to give effect to Article 68 of the Constitution, to revise, consolidate and rationalize land laws; to provide for the sustainable administration and management of land and land-based resources, and for connected purposes. It has repealed the Way leaves Act, Cap. 292; and the Land Acquisition Act, Cap. 295.

The Act identifies the following forms of land tenure:

1. Freehold;
2. Leasehold;
3. Such forms of partial interest as may be defined under this Act and other law, including but not limited to easements; and
4. Customary land rights, where consistent with the Constitution.

The Act outlines methods of acquisition of title to land, which include: (a) allocation; (b) land adjudication process; (c) compulsory acquisition; (d) prescription; (e) settlement programs; (f) transmissions; (g) transfers; (h) long term leases exceeding twenty-one years created out of private land; or (i) any other manner prescribed in an Act of Parliament.

Section 9 gives provision for conversion of land from one category to another in accordance with the provisions of this Act or any other written law.

Section 9 (2) (c) outlines ways in which private land may be converted to public land, this may be through:

1. Compulsory acquisition;
2. Reversion of leasehold interest to Government after the expiry of a lease; and
3. Transfers; or
4. Surrender

The proponent will utilise the existing right of way for the project, in case of land acquisition, the proponent will abide by the provisions in this law.

2.3.9 THE TRUST LAND ACT CAP 288

This Act makes provision for the administration of Trust land as defined by section 114 of the Constitution of Kenya, the setting apart of an area of Trust land for use and occupation for specified purposes, the use of Trust land and for other related purposes. The act applies to all land which for the time being is trust land The local authority in whom the Trust land is vested ("council") shall divide the Trust land vested in it into such divisions as appear to it to be necessary or expedient for the purposes of this Act, or may declare the whole of that land to be a division for purposes of this Act. Land may be set apart on request of the Government for purposes set out in section 118 of the Constitution.

In pursuance of section 117 (I) of the Constitution, a council may set apart an area of Trust land vested in it for use and occupation: (a) by any public body or authority for public purposes; (b) for the purpose of the extraction of minerals or mineral oils; or (c) by any person or persons for purposes for the benefit of residents. The council may, with the approval of the Minister, grant a licence to any person for the purpose of: (a) the grazing of livestock; (b) the removal of timber or other forest produces from Trust land which is not included in a forest area within the meaning of the Forests Act; (c) the taking of common minerals; (d) wayleaves; or (e) the establishment of temporary labour accommodation.

There is no trust land along the project area, hence this act may not apply to this project. However, if construction quarry/material sites and construction camps will fall on trust land, the developer will be expected to abide by the above act.

2.3.10 LAND VALUATION ACT OF 2010

This Law provides the legal framework for the registration of valuers as well as establishes the Valuers Registration Board, which is mandated to regulate the activities and conduct of the registered valuers. With regards to the registration process, the relevant Ministerial head is required to appoint a public officer as the Registrar of the Board who keeps and maintains a register of valuers and eventually issues them with a certificate of registration in the prescribed form. The Board has the powers to conduct an inquiry against any registered valuer and the latter has the right to appeal, in the High Court, against the Board's decision. The developer will utilise the existing land reserve. In case of land acquisition, the proponent shall engage a registered land valuer.

2.3.11 HIV/AIDS PREVENTION AND CONTROL ACT 2006

An Act of Parliament to provide measures for the prevention, management and control of HIV and AIDS, to provide for the protection and promotion of public health and for the appropriate treatment, counseling, support and care of persons infected or at risk of HIV and AIDS infection, and for connected purposes.

HIV AND AIDS EDUCATION AND INFORMATION

The Government shall promote public awareness about the causes, modes of transmission, consequences, means of prevention and control of HIV and AIDS through a comprehensive nationwide educational and information campaign conducted by the Government through its various Ministries, Departments, authorities and other agencies. In conducting the educational and information campaign referred to in this section, the Government shall collaborate with relevant stakeholders to ensure the involvement and participation of individuals and groups infected and affected by HIV and AIDS, including persons with disabilities

HIV AND AIDS EDUCATION IN THE WORKPLACE:

The Government shall ensure the provision of basic information and instruction on HIV and AIDS prevention and control to: Employees of all Government Ministries, Departments, authorities and other agencies; and employees of private and informal sectors.

HIV AND AIDS INFORMATION IN COMMUNITIES:

Every Local Authority, in collaboration with the Ministry, shall conduct an educational and information campaign on HIV and AIDS within its area of jurisdiction. The contractor and proponent to abide by this regulation especially during the construction phase.

As noted previously, labour intensive projects such as road projects could result in increased HIV/AIDS prevalence rates in an area. This will originate from influx of workers within the camps and trading centers with monthly wages and possibly away from their families. The contractor and the proponent are expected to abide by the above provisions during construction period.

2.3.12 DRAFT NATIONAL BUILDING CODE 2020

This Code provides; (a) for the design, construction, operation, inspection and maintenance of buildings; (b) standards for building materials, products, elements, systems and services; (c) standards for infrastructure services; (d) standards for the operations and works at construction sites; (e) for disaster management at construction sites; and (f) for the safety and security of the users and occupants of a building.

A person who erects a building or develops land or changes the use of a building or land, or who owes or occupies a building or land shall comply with requirements of these laws. It is expected that the contractor will put up construction camps during the road construction period, hence the need to abide by the above laws.

2.3.13 THE NATIONAL GENDER AND EQUALITY ACT 2011

The overall aim of the Gender Policy 2011 is to provide precedence for the prevention of discrimination on the basis of sex in the national development process in order to improve social, legal/civic, economic, and cultural conditions of women, men, girls and boys in Kenya. Of the identified policy priorities, two were identified as relevant to project implementation. One of the priorities is incorporating gender equality objectives, indicators, as well as preventative action identification into the ministerial performance frameworks to which the project must comply. Additionally, the policy lays out a priority that each project will develop integrated gender equality strategies at the initiative level in priority areas. This policy will be adhered to during initial project implementation, especially during hiring of staff, procurement of suppliers, and contracting of sub consultants/contractors.

2.3.14 PERSONS WITH DISABILITY ACT CAP 133

The Government of Kenya took a step to the maximum of its available resources with a view to achieving the full realization of the rights of persons with disabilities set out in this act. The act provides for the rights and rehabilitation of persons with disabilities, to achieve equalisation of opportunities for persons with disabilities and to establish the National Council for Persons with Disabilities.

With regards to this project, the act mandates that:

- No person shall deny a person with a disability access to opportunities for suitable employment. A qualified employee with a disability shall be subject to the same terms and conditions of employment and the same compensation, privileges, benefits, fringe benefits, incentives or allowances as qualified able-bodied employees.
- No employer shall discriminate against a person with a disability in relation to:
  1. The advertisement of employment;
  2. The recruitment for employment;
  3. The creation, classification or abolition of posts;
  4. The determination or allocation of wages, salaries, pensions, accommodation, leave or other such benefits;
  5. The choice of persons for posts, training, advancement, apprenticeships, transfer, promotion or retrenchment;
  6. The provision of facilities related to or connected with employment;
  7. Any other matter related to employment.

During construction period, the project will offer employment opportunities to both skilled and non skilled persons. The proponent and contractor should abide by the provisions in this act.

2.3.15 OCCUPATIONAL SAFETY AND HEALTH ACT, 2007

The Occupational Safety and Health Act (OSHA) was enacted to provide for the health, safety and welfare of persons employed in workplaces, and for matters incidental thereto and connected therewith.

Part II of the Act provides the General Duties to which the project promoter must comply with respect to health and safety in the workplace. Such duties include undertaking safety and health (S&H) risk assessments, S&H audits, notification of accidents, injuries and dangerous occurrences, etc. Several sections under this part shall be applicable to the proposed project.

Part IV deals with the enforcement provisions that Directorate of Occupational Safety and Health Services (DOSHS) has under the Act. It discusses the instances when Improvement and Prohibition Notices can be issued, as well as the powers of Occupational S&H officers. This part of the Act will be mandatory for the Contractors of the proposed project to comply with.

Part V of the Act requires all workplaces to be registered with the DOSHS. This part will be applicable for the proposed project as the main Contractor will have to apply for registration of their project with the DOSHS prior to commencement of construction activities.

Part VI of the Act lists the requirements for occupational health provisions which include cleanliness, ventilation, overcrowding, etc. This section of the Act will apply to the construction camps of the project.

Part VII of the Act contains provisions for the safe operation of machinery and includes all prime movers and transmission equipment. Additionally, this part includes the safe operation of cranes, chains, ropes, lifting tackles, pressure vessels and their statutory examination by DOSHS Approved Persons. This part of the Act will apply to the proposed project during the construction phase.

Part VIII of the Act contains provisions for general safety of a workplace especially fire safety. This part of the Act will apply to the proposed project during the design and construction phases.

Part X of the Act deals with the General Welfare conditions that must be present during the construction phase of the project. Such conditions include first aid facilities, supply of drinking water, accommodation for clothing and ergonomics at the project offices and campsites etc.

Part XI of the Act contains Special Provisions on the management of health, safety and welfare. These include work permit systems, PPE requirements and medical surveillance. Some sections of this part of the Act will be applicable to the proposed project during the construction phase.

Part XIII of the Act stipulates various fines and penalties associated with non-compliance of the Act. It includes those fines and penalties that are not included in other sections of the Act and will be important for the Developer and the Contractors to read and understand the penalties for non-compliance with S&H provisions.

Part XIV of the Act is the last section of the Act and contains miscellaneous provisions which are not covered elsewhere in the Act. Some sections under this part of the Act will apply to the proposed project and it is in the interest of the Developer to read, understand and ensure compliance with it.

The proposed project will be undertaken in compliance with the OSHA during the construction and operational phases.

During the construction phase, the Contractors will be required to fully comply with the requirements of Legal Notice 40 titled: Building Operations and Works of Engineering Construction Rules, 1984 (BOWEC). The project Contractor will develop and implement a formal construction health and safety plan for the entire construction phase duration in alignment with the OSHA and international health and safety best practices.

Some of the important subsidiary legislation which operationalizes the Act and is applicable to the proposed project is described below.

2.3.15.1 L.N. 31: THE SAFETY AND HEALTH COMMITTEE RULES, 2004

These rules came into effect on 28th April 2004 and require that the project promoter formalise a S&H Committee if there is a minimum of 20 persons employed in the workplace. The size of the S&H Committee will depend on the number of workers employed at the place of work.

For the Developer and Contractor, the OSHA and the S&H Committee Rules 2004 are important as they require compliance with the following measures:

- Posting of an Abstract of the Factories and Other Places of Work Act in key sections of each area of the workplace especially at the campsites;
- Provision of first aid boxes in accordance with Legal Notice No. 160 of 1977;
- Ensuring that there are an appropriate number of certified first aiders trained by an approved institution and that the certification of these first aiders is current;
- Provision of a General Register for recording amongst other things all incidents, accidents and occupational injuries;
- Appointment of a S&H Committee made up of an equal number of members from management and workers based on the total number of employees in the workplace;
- Training of the S&H Committee in accordance with these rules;

- Appointment of a S&H management representative for the Developer;
- The S&H Committee must meet at least quarterly, take minutes, circulate key action items on bulletin boards and may be required to send a copy of the minutes to the DOSHS provincial office.

Appropriate recordkeeping including maintenance of all current certificates related to inspection of critical equipment such as cranes, air compressors, lifts, pulleys, etc. Such inspections need to be undertaken by an approved person registered by the Director of the DOSHS.

2.3.15.2 L.N. 24: MEDICAL EXAMINATION RULES, 2005

These rules provide for Developers to mandatorily undertake pre-employment, periodic and termination medical evaluations of workers whose occupations are stipulated in the Second Schedule of the OSHA and the First Schedule of the above Regulation. Workers that fall under the above two schedules are required to undergo medical evaluations by a registered medical health practitioner duly registered by the DOSHS.

These regulations and OSHA prescribe the activities under which workers shall undergo medical examination. These include noisy workplaces exceeding threshold limits, and work involving exposure to tar pitch, bitumen and creosote.

It will be the responsibility of the Contractor to ensure that Material Safety Data Sheets (MSDSs) for chemicals used in the construction phase are studied for toxicological and epidemiological information and workers trained on their safe handling, use and disposal. If any of these products' present negative impacts to human health, the workers exposed to the chemicals will be required to undergo medical examinations in accordance with the above Rules.

2.3.15.3 L.N. 25: NOISE PREVENTION AND CONTROL RULES, 2005

These rules were promulgated on 10th March 2005 for occupational noise exposure and apply to workplaces in Kenya. The regulation is applicable to the project as noise potentially generated by construction equipment may exceed the permissible occupational noise levels given below.

The rules set the permissible level for occupational noise in any workplace (which includes construction sites) as follows:

- 90 dB(A) over an 8-hour time weighted average (TWA) period over 24-hours; and
- 140 dB(A) peak sound level at any given time.

Additionally, the rules set permissible limits for community noise levels emanating from a workplace as follows:

- 50 dB(A) during the day; and
- 45 dB(A) at night.

If noise levels exceed the above permissible levels, the project promoter is required to develop, rollout and implement a written hearing conservation program which should include the following sections as a minimum:

- Undertaking a Noise Level Survey;
- Education and training of persons affected by excessive noise;
- Engineering noise control methods;
- Hearing protection requirements;
- Posting of notices in noisy areas;

- Audiometric testing methods and frequencies for those exposed to high noises; and
- Annual program review.

The Developer is to ensure that any equipment brought to a site in Kenya for use shall be designed or have built-in noise reduction devices that do not exceed 90 dB(A). The Developer shall request the supplier of the machines or equipment to also indicate their noise characteristics.

There is also a requirement for a Developer to medically examine those employees that may be exposed to continuous noise levels of 85 dB(A) as indicated in Regulation 16. If found unfit, the occupational hearing loss to the worker will be compensated as an occupational disease.

It is expected that during the construction phase of the project, there may be plant and equipment that exceed the threshold levels of noise stipulated under the Rules. It will therefore be incumbent on the Contractor and his / her sub-contractors to ensure that their equipment is serviced properly and/or use equipment that complies with the threshold noise values given above. Alternatively, each Contractor will be required to develop and implement a written hearing conservation program during the construction phase.

2.3.15.4 L.N. 59: FIRE RISK REDUCTION RULES, 2007

These rules were promulgated by the Minister for Labour on 16th April 2007 and apply to all workplaces. Several sections of the rules apply to the proposed project as enumerated below.

- *Regulation 5* requires the main Contractor to ensure that fire resistant materials are used for construction of new buildings. A number of minimum specifications of materials are provided in this rule.
- *Regulation 6* requires that all flammable materials be stored in appropriately designed receptacles.
- *Regulation 7* requires that all flammable storage tanks or flammable liquid containers be labeled with the words “Highly Flammable” in English or Kiswahili. It is therefore practical for the Developer to use a system similar to the Hazardous Material Identification System (HMIS) of labeling their product containers. The regulation requires a Developer to consult the product’s MSDS for appropriate labeling requirements.
- *Regulation 8(3)* requires a Developer to have a Spill Prevention, Control and Countermeasures (SPCC) plan. This may be important if there will be chemicals stored at the construction campsites such as the fuels, lubricants etc.
- *Regulation 16* requires a Developer to ensure that electrical equipment is installed in accordance with the respective hazardous area classification system. It is also a requirement that all electrical equipment is inspected every 6 months by a competent person and the Developer is required to keep records of such inspections.
- *Regulation 22* provides a description of the functions of a fire-fighting team. *Regulation 23* requires the Developer to mandatorily undertake fire drills at least once a year.
- *Regulation 33* requires the Developer to have adequate fire water storage capacity. As a minimum this regulation requires the Developer to have at least 10 m^3 of dedicated fire water storage capacity.
- *Regulation 34* requires Developers to develop and implement a comprehensive written Fire Safety Policy. This policy should contain a Fire Safety Policy Statement signed by the CEO, a Fire Safety Policy Manual and a brief summary of the Fire Safety Policy of the company.
- *Regulation 35* requires a Developer to notify the nearest Occupational S&H area office of a fire incident within 24 hours of its occurrence and a written report sent to the Director of DOSHS within 7 days.

2.3.16 PUBLIC HEALTH ACT, CAP 242

The Public Health Act seeks to protect and promote the health of workers and communities working around projects. It came into force on 6th September 1921 and has been revised several times with the latest revision being done in 1986.

The operations and activities of the proposed project can be detrimental to human and environmental health and safety in the absence of appropriate measures. For example, waste, dust, noise and air emission generated from activities and processes of the proposed project can directly or indirectly have adverse impacts on humans and environment. The Act prohibits the Developer from engaging in activities that cause environmental nuisance or those that cause danger, discomfort or annoyance to inhabitants or is hazardous to human and environmental health and safety.

- *Part IV* on General Provisions of the Act deals with the prevention and suppression of infectious diseases and certain sections of this part will be applicable to the project;
- *Part IX* of the Act deals with the governance of sanitation and housing associated with a project. Certain sections of this part will be applicable to the proposed project during the construction phase of the project.

2.3.17 WATER ACT, 2016

The Water Act 2016 was enacted on 20th September 2018. The Act seeks to provide for the regulation, management and development of water resources, water and sewerage services; and for other connected purposes. The Act confirms that every water resource is vested in and held by the national government in trust for the people of Kenya.

Section 134 of the Act makes it an offence to throw or convey or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive or unwholesome matter or thing to water resources in such a manner to cause, or likely to cause pollution of the water resources.

The Water Act mandates that a permit is required for any of the following purposes: (a) any use of water from a water resource, except as provided by section 37; (b) the drainage of any swamp or other land; (c) the discharge of a pollutant into any water resource; and (d) any other purpose, to be carried out in or in relation to a water resource, which is prescribed by Regulations made under this Act to be a purpose for which a permit is required.

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

Water is significant to the general operation of the proposed project. The construction would mean that more water would be needed for various activities. Management of this resource is therefore significant for the success of the project.

The Road construction activities will need bulk supply of water for mixing and curing concrete, suppressing dust, cleaning and maintenance of equipment, among others. The Act promotes water resources management through soil and water conservation, protection, development and utilization of water resources. The construction of the project road will have to apply water resource management measures since the project area has several lakes and small streams.

Various permits from the Water Services Regulatory Board (WASREB) will be required for proposed water abstraction methods, whether surface or ground water.

2.3.18 THE FOREST CONSERVATION AND MANAGEMENT ACT, 2016

The Forests Conservation and Management Act 2016, in the context of its general principles, provides for the establishment, development and sustainable management, including conservation and rational utilization of forest resources for the socio-economic development of the country. The Act recognizes the importance of forests for the benefits of soil and ground water regulation, agriculture and their role in absorbing greenhouse gases.

The Act also recognizes Community Forest Associations (CFAs), which participate in forest conservation and management under the Kenya Forestry service (KFS). The Act has specific provisions related to access rights and benefit-sharing arrangements, which provide a role for communities in the utilization of forest resources and protection of forests. The Act has four priority areas related to the management of forests, including 1) reducing pressure to clear forests for agriculture and other uses 2) promoting the sustainable utilization of forests 3) improving governance in the forest sector and 4) the enhancement of carbon stocks and reforestation of degraded lands.

Community participation as provided for under Section 46 of the Act should be encouraged. The most appropriate would be initiation of participatory forest management in these forest reserves so that the local community and organizations can have significant input, with the KFS playing a coordinating and guiding role.

2.3.19 ENERGY ACT, 2019

The Energy Act, 2019 was enacted in response to calls to consolidate the laws relating to energy; promote renewable energy; promote exploration, recovery and commercial utilization of geothermal energy; regulate midstream and downstream petroleum and coal activities, among others. It is expected to create an enabling environment for the Government's Big Four Agenda.

It establishes the Energy and Petroleum Regulatory Authority (EPRA) in place of the Energy Regulatory Commission (ERC).

The Energy Act of 2019 deals with all matters relating to all forms of energy including the generation, transmission, distribution, supply and use of electrical energy as well as the legal basis for establishing the systems associated with these purposes.

The Developer will liaise with the Kenya Power and Lighting Company before installation of electric power to the site to ascertain the requirements required to ensure that the power to the site is adequate and doesn't affect other users in the area.

2.3.20 THE LAND ACQUISITION ACT, CHAPTER 295 LAWS OF KENYA, 2012

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

1 Area of land acquired;

2 The value of the property in the opinion of the Commissioner of land (after valuation);

3 Amount of the compensation payable;

4 Market value of the property;

5 Damages sustained from the severance of the land parcel from the land;

6 Damages to other property in the process of acquiring the said land parcel;

7 Consequences of changing residence or place of business by the landowners; and

8 Damages from diminution of profits of the land acquired.

Part II of the Act allows for the temporary acquisition of the land for utilization in promotion of the public good for periods not exceeding five years. At the expiry of the period, the Commissioner of Land shall vacate the land and undertake to restore the land to the condition it was before. Any damages or reduction of value shall be compensated to the landowners.

Construction activities for this project shall be conducted within the existing right-of-way. KeNHA is responsible for any resettlement activities required in the right-of-way.

2.3.21 WILDLIFE CONSERVATION AND MANAGEMENT ACT, 2013

The Wildlife Conservation and Management Act was enacted to regulate, conserve, and ensure sustainable management of wildlife resources in Kenya. Passed in 2013, the Act came into force in 2014 with several changes in the way wildlife resources are managed in the country. Section 4 of this Act states that its implementation shall be guided by the following principles:

- Wildlife conservation and management shall be devolved, wherever possible and appropriate, to owners and managers of land where wildlife occurs;
- Conservation and management of wildlife shall entail effective public participations;
- Wherever possible, conservation and management of wildlife shall be encouraged using an ecosystem approach;
- Wildlife conservation and management shall be encouraged and recognized as a form of land use on public, community and private land;
- Benefits of wildlife conservation shall be derived by the land user in order to offset costs and ensure the value and management of wildlife do not decline;
- Wildlife conservation and management shall be exercised in accordance with the principles of sustainable utilization to the benefit of present and future generations;
- Benefits accruing from wildlife conservation and management shall be enjoyed and equitably shared by the people of Kenya.

The Wildlife Conservation and Management Act consolidate the previous laws relating to the protection, conservation, and management of wildlife in Kenya. This Act is administered by the Government of Kenya through the Ministry responsible for the matters relating to wildlife in conjunction with other relevant government agencies – most importantly, the Kenya Wildlife Service (KWS).

2.3.22 EMPLOYMENT ACT, 2007

This Act applies to all employees employed by any employer under a contract of service. It requires that employee recruitment, contract and grievance management, disciplinary measures and retrenchment and termination of service should be rational, fair and just.

Employment of children is also regulated:

- Employment of children under thirteen years of age is prohibited, whether gainfully or otherwise in any undertaking (section 56 (1)).
- Children between thirteen and sixteen years of age may be employed to perform light work which is:
  - Not likely to be harmful to the child's health or development; and
  - Not such as to prejudice the child's attendance at school, their participation in vocational orientation or training programs or their capacity to benefit from the instructions received (article 56 (2)).

The Developer will need to follow the requirements of the Act during the Project.

2.3.23 WORK INJURY BENEFITS ACT (WIBA)

WIBA provides for compensation to workers for injuries suffered in the course of their employment.

It outlines the following:

- Employer's liability for compensation for death or incapacity resulting from accident;
- Compensation in fatal cases;
- Compensation in case of permanent partial incapacity;
- Compensation in case of temporary incapacity;
- Persons entitled to compensation and methods of calculating the earnings;
- No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury, and
- Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director.

The construction operations and activities may pose safety and health risks to construction workers. The Developer will need to abide by all the provisions of WIBA when handling injuries reported in the cause of implementation of the proposed project.

2.3.24 NATIONAL MUSEUMS AND HERITAGE ACT 6 OF 2006

The Act defines cultural heritage as:

- Monuments, architectural works, works of monumental sculpture and painting, elements or structures of an archaeological nature, inscriptions, cave dwellings and combinations of features, which are of universal value from the point of view of history, art or science;
- groups of separate or connected buildings which are of outstanding value from the point of view of history, art or science;
- works of humanity or the combined works of nature and humanity, and areas including archaeological sites which are of outstanding value from the historical, aesthetic, ethnological or anthropological point of view, and includes objects of archaeological or palaeontological interest, objects of historical interest and protected objects.

The National Museums of Kenya is mandated to identify, protect, conserve and transmit the cultural and natural heritage of Kenya; and promote cultural resources in the context of social and economic development.

The act under Section 30 requires notification of discovery within seven days where a person discovers a monument or object of archaeological or palaeontological interest indicating the precise site and circumstances of the discovery, to the National Museums. Objects shall be delivered to the National Museums or to the County Commissioner. All antiquities which are lying in or under the ground, or on the surface of any land already protected under any law as a monument or being objects of archaeological, palaeontological or cultural interest are discovered in a part of Kenya shall be the property of the Government.

In the event chance finds are encountered during excavation works, the Developer will be required to adhere to these requirements.

2.3.25 KENYA ROADS ACT OF 2007

This Act provides 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. In this Act, the Highways Authority (KeNHA) is mandated to be responsible for the management, development, rehabilitation and maintenance of national roads.

The first schedule of the Act classifies national roads as follows in Table 2-3:

Table 2-3 National Roads Classifications as per Kenya Roads Act

Class	Description
Class A	International trunk roads linking centres of international importance and crossing international boundaries or terminating at international ports
Class B	National trunk roads linking nationally important centres
Class C	Primary roads linking provincially important centres to each other or two higher class roads

The proposed project roads; Nairobi-Nakuru-Mau Summit Highway (A8) is a Class A road while Rironi-Mai Mahiu-Naivasha (A8 South) is a Class C road.

2.3.26 LAND AND ENVIRONMENT COURT ACT, 2012

A Land and Environment Court is established under Section 4 of the Act. The court has jurisdiction to hear any dispute relating to environment and land. The Court has original and appellate jurisdiction to hear and determine all disputes in accordance with Article 162(2)(b) of the Constitution and with the provisions of the Act or any other written law relating to environment and land. The court is also empowered to hear cases relating to public, private and community land and contracts, choices in action or other instruments granting any enforceable interests in land.

The court therefore has jurisdiction to deal with such disputes relating to environment or land administration and management that may arise during project implementation.

2.3.27 PHYSICAL PLANNING ACT, 2007

This is the main Act that governs land planning and it requires that all proposed developments be approved by the respective local authority and certificate of compliance issued accordingly. Section 30(1) requires a developer operating within jurisdiction of any local authority to be granted development permission by the respective local authority, failure to which heavy fines will ensue; and the land registrar shall decline to register such a document. No sub-division of private land shall take place within a local authority unless the sub-division is in accordance with the requirements of an approved local physical development plan.

Therefore, the Developer will need to seek approval for the construction of the temporary camp (s), while KeNHA will be required to discuss its development plans (road designs) with the respective County Physical Planning Officers and liaise with the local governments in development control along the corridor.

2.3.28 CLIMATE CHANGE ACT, 2016

This is an Act of Parliament enacted to provide for a regulatory framework for enhanced response to climate change, to provide for mechanism and measures to achieve low carbon development. Part IV Section 15 provides on how Climate change considerations should be integrated in every public-sector entity. A public entity is expected to observe the Act together with provisions of the National Climate Change Action Plan. The National Climate Change Action Plan Section 4.3.1 (d) has specified how the road infrastructure sector can contribute towards the achievement of low carbon climate resilient sustainable development.

2.3.29 URBAN AREAS AND CITIES ACT, NO. 13 OF 2011

In Sections 27 and 28, the Act empowers County Government to appoint a Manager to manage or prohibit all places of work that by reason of smoke, fumes, or chemical gases, dust, smell, noise or vibration or other cause that may be a source of danger, discomfort, or annoyance to the neighbourhood, and to prescribe the conditions subject to which businesses, factories and workshops shall be carried on.

The county governments of Nakuru, Nyandarua and Kiambu will thus be instrumental, with mandates derived from this Act, in monitoring works to ensure that environmental nuisances are controlled.

2.3.30 THE COMMUNITY LAND ACT 2016

This act brings into effect article 63 of the constitution of Kenya. It makes provision for the recognition, protection and registration of community land rights and provides for conversion of community land, special rights and entitlements with respect to community land, environment and natural resources management of community land, and settlement of disputes relating to community land.

This act limits acquisition by the state of any interest in, or right over community land only in the instance where the compulsory acquisition is; in accordance with the law, for a public purpose and upon prompt payment of compensation to the affected people in full or by negotiated settlement.

The project will ensure that indigenous communities (Maasai and the Ogiek) in the project area are freely and openly consulted in compliance with Section 36(1) of this Act and in respect to their regulations and customs of land management and administration.

2.4 INSTITUTIONAL FRAMEWORK

2.4.1 MINISTRY OF TRANSPORT, INFRASTRUCTURE, HOUSING AND URBAN DEVELOPMENT

The Ministry of Transport and Infrastructure (MOTI) has the overall responsibility for the provision of an efficient road network in Kenya. The Ministry provides the regulatory framework, co-ordination, oversight, supervision, liaison with other state agencies and any services necessary for the smooth functioning of the roads sub-sector.

In this project, MOTI does not have any direct responsibility with respect to environmental and social risk assessment, management and monitoring. The Ministry of Transport and Infrastructure will be responsible for requesting funds from the National Treasury for compensation of the Project Affected Households (PAHs) who will to be physically and economically displaced as a result of the Project.

2.4.2 KENYA NATIONAL HIGHWAYS AUTHORITY (KENHA)

The Kenya National Highways Authority (KeNHA) is a statutory body established by the Kenya Roads Act, 2007. KeNHA is responsible for the management, development, rehabilitation and maintenance of National trunk roads comprising Classes A, B, and C roads. KeNHA is the client for the Nairobi-Mau Summit Highway Project. KeNHA is a fully independent and autonomous organization and has no relationship with MOTI in terms of reporting or accountability.

For the purposes of discharging its responsibility under the Kenya Roads Act of 2007, KeNHA has the following functions and duties:

1. constructing, upgrading, rehabilitating and maintaining roads under its control;
2. controlling national roads and road reserves and access to roadside developments;
3. implementing road policies in relation to national roads;
4. ensuring adherence to the rules and guidelines on axle load control prescribed under the Traffic Act and under any regulations under this Act;
5. ensuring that the quality of road works is in accordance with such standards as may be prescribed by the Minister;

6 in collaboration with the Ministry responsible for transport and the Police Department, overseeing the management of traffic and road safety on national roads;

7 collecting and collating all such data related to the use of national roads as may be necessary for efficient forward planning under this Act;

8 monitoring and evaluating the use of national roads;

9 planning the development and maintenance of national roads;

10 advising the Minister on all Issues relating to national roads;

11 preparing the road works programs for all national roads;

12 liaising and co-ordinating with other road authorities in planning and on operations in respect to roads, and

13 performing such other functions related to the implementation of this Act as may be directed by the Minister.

2.4.3 RIFT VALLEY HIGHWAYS LIMITED

Rift Valley Highways limited (RVH) is the private party mandated under a PPP agreement with the Kenya National Highway Authority to undertake dualling, improvement, operation and maintenance of the Nairobi-Nakuru-Mau Summit Highway project on a Design, Build, Finance, Operate, Maintain and Transfer (DBFOMT) basis. RVH has mandated the present ESIA report. Its main environmental and social responsibilities related to the Project are to:

- Develop detailed design for the project and ensure that environment and social aspects related to minimizing adverse impacts are integrated in the final detailed design;
- Develop the Project's final ESIA document based on the detailed design;
- Establish and maintain an Environmental and Social Management System (ESMS) to cover environmental and social issues identified in this ESIA;
- Incorporate mitigation measures, as needed, into the Project design, construction and operation.

2.4.4 THE NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

The role of National Environment Management Authority (NEMA) Kenya is stipulated in the Environmental Management and Coordination Act (EMCA), 1999 including ensuring environmental protection and enforcing the requirements of the EMCA.

An EIA license has already been awarded by NEMA to KeNHA, based on an RFP-stage ESIA produced by KeNHA in 2018. The principal expected role for NEMA at the present stage of the Project will be to determine whether the EIA license remains valid considering potential Project design changes made in the final Project design currently being developed by RVH. This assessment will be performed following analysis of a request for variation to be submitted by RVH.

NEMA will also be responsible for environmental supervision and monitoring during Project implementation (construction and operation phase), to ensure that the mitigation measures as specified in the ESIA are being followed and adhered to.

NEMA will issue improvement orders to Contractors in the event that non-compliance to the ESMS is observed.

NEMA will review Environmental Audit reports submitted by private concessionaire during project implementation as required by the EIA/EA regulations (2003).

2.4.5 WATER RESOURCES REGULATORY BOARD (WASREB)

The Water Services Regulatory Board (WASREB) is a regulatory state corporation operating under the Water Act, 2016. Its main objective is to protect the interests and rights of consumers in the provision of water services, while ensuring other stakeholders' interests are also safeguarded.

WASREB's statutory mandate is to monitor and review rules and regulations to ensure water services provision is affordable, efficient, effective, and equitable.

Various permits from Water Services Regulatory Board (WASREB) will be required for proposed water abstraction methods, whether surface or ground water.

2.4.6 KENYA WILDLIFE SERVICE

Kenya Wildlife Service (KWS) is a state corporation operating under the Wildlife Conservation and Management Act (WCMA 2013), with the mandate to Conserve and manage national parks, wildlife conservation areas, and sanctuaries under its jurisdiction.

The project area of influence is known to have wildlife resources along the project routing. KWS is therefore expected to review the designs of wildlife crossings prepared by RVH and coordinate the undertaking of wildlife populations monitoring in the project corridor during Project construction and operation.

2.4.7 KENYA FOREST SERVICE

Kenya Forest Service (KFS) is a corporate body established under the Forest Conservation and Management Act no 34 of 2016. The Act gives the Service mandate "to provide for the development and sustainable management, including conservation and rational utilization of all forest resources for the socio-economic development of the country and for connected purposes". There are a number of forest ecosystems located within the project area of influence.

KFS is therefore expected to review biodiversity management plans prepared by RVH to conserve the forest ecosystems within the vicinity of the road alignment that would be directly or indirectly affected by the project.

2.4.8 THE TREASURY

Ministry of Finance (MoF) is spearheading the development of PPPs in Kenya and is responsible for developing the legal, institutional, and regulatory framework for PPP programs. MoF is also responsible for the issuing of standardized PPP provisions and PPP Manual/Guidelines for effective management of PPP Projects.

In this project, MoF does not have any direct responsibility with respect to environmental and social risk assessment, management and monitoring. The only role will be to make available financial resources for the compensations of Project Affected Households (PAHs) who are going to be physically and economically displaced as a result of the project.

2.4.9 NAKURU, NYANDARUA AND KIAMBU COUNTY GOVERNMENTS

The Constitution of Kenya, 2010 under chapter one article 6 has provided for the creation of a decentralized system of government that has devolved the Legislature and the Executive arms of government into 47 Political and Administrative Counties. The primary objective of decentralization is to devolve power, resources and representation down to the local level. To this end, various laws have been enacted by Parliament to create strategies for the implementation framework and the adoption on which objectives of devolution can be achieved including, but not limited to the County Government act No.17 of 2012, Urban Areas and Cities Act, No. 13 of 2011, National Government Co-ordination Act, No. 1 of 2013,and National Government Co-ordination Act, No. 1 of 2013.

The Fourth Schedule of the Constitution of Kenya 2010 Part 2 (3) provides for devolved environmental functions to be undertaken by the County Governments and includes; control of air pollution, noise pollution, and other public nuisances.

The Nakuru, Nyandarua and Kiambu County Governments will be responsible for the issuance of trade licenses needed for the project, issuance of temporary facilities construction plan approvals, monitoring environment protection within the project, and general development control along the road.

2.4.10 DIRECTORATE OF OCCUPATIONAL SAFETY AND HEALTH SERVICES (DOSHS)

DOSHS is responsible for the enforcement of Occupational Safety and Health Act (OSHA),2007 and associated regulations. DOSHS undertakes workers’ safety and health inspections at its own initiative or upon receiving reports on any associated issues and requires that all Construction sites be registered with the Directorate.

The project construction site will be registered with this authority as workplaces before the commencement of the construction works and the safety management plans, training and emergency preparedness, done in accordance with the relevant guidelines issued by DOSHS.

2.4.11 NATIONAL TRANSPORT AND SAFETY AUTHORITY

The National Transport and safety Authority (NTSA) was established in 2012 with the objective of harmonizing the operations of the key road transport departments and help in effectively managing the road transport sub-sector and minimizing loss of lives through road accidents. Some of its key mandates are the development of road safety strategies and facilitating education of the general public on road safety.

The project will adhere to NTSA’s road safety rules, standards, and motor vehicle licensing requirements. In addition, all vehicles using the road will be required to adhere to these set rules and regulations.

2.5 APPLICABLE INTERNATIONAL STANDARDS

Standards from two main organisation were considered for the preparation of the ESIA that is the ones developed by the International Finance Corporation (IFC) and by the African Development Bank (AfDB) as well as the latest revision of the Equator Principle (2020).

2.5.1 INTERNATIONAL FINANCE CORPORATION PERFOMANCE STANDARDS

The project corresponds to an IFC Category A project and as such the ESIA is developed and implemented according to the environmental and social performance standards set forth in the *Performance Standards on Environmental and Social Sustainability* of the International Finance Corporation (IFC Performance Standards). In compliance with the IFC requirements, the project will also follow the established public disclosure expectations which, for a Category A project implies a 60 days disclosure period prior to consideration by IFC's Board of Directors.

The project was initially presented to the IFC by KeNHA and RVH and it was clearly established that the ESIA to be completed for the updated design will ensure implementing all IFC Performance Standards requirements. The IFC Performance Standards[1] that were considered during the ESIA include:

- **Performance Standards 1: Assessment and Management of Social and Environmental Risks and Impacts** underscores the importance of managing environmental and social performance throughout the life of a project. It requires the client to conduct a process of environmental and social assessment and to establish and maintain an Environmental and Social Management System (ESMS), appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts. The concept of mitigation hierarchy is central to PS1, whereas it requires projects to anticipate and avoid, or where avoidance is not possible, minimize, and, where residual impacts remain, compensate/offset for risks and impacts to workers, Affected Communities, and the environment. In this report, avoidance measures are presented in chapters 3 and 4, minimization (mitigation) measures are in chapters 8 and 10 and compensations, if and where required, will be presented in standalone sectoral management plans such as a Biodiversity Action Plan;
- **Performance Standards 2: Labour and Working Conditions** recognizes that the pursuit of economic growth through employment creation and income generation should be accompanied by protection of the fundamental rights of workers;
- **Performance Standards 3: Resource Efficiency and Pollution Prevention** recognizes that increased economic activity and urbanization often generate increased levels of pollution to air, water, and land, and consume finite resources in a manner that may threaten people and the environment at the local, regional, and global levels;
- **Performance Standards 4: Community Health, Safety and Security** recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts;
- **Performance Standards 5: Land Acquisition and Involuntary Resettlement** recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. Although Performance Standard 5 applies to this project, all land acquisition and resettlement actions are not covered under this ESIA as it remains the full responsibility of KeNHA to prepare and apply the project's resettlement action plan and to compensate the project affected people;
- **Performance Standards 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources** recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainable management of living natural resources are fundamental to sustainable development;
- **Performance Standards 7: Indigenous Peoples** seeks to ensure business activities minimize negative impacts, foster respect for human rights, dignity, and culture of indigenous populations, and promote development benefits in culturally appropriate ways. For the current project, two communities are recognized as indigenous people, the Ogiek and the Maasai;
- **Performance Standards 8: Cultural Heritage** recognizes the importance of cultural heritage for current and future generations.

1 Information on these standards is available at https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/performance-standards/performance-standards.

In addition to the Performance Standards, the IFC's General Environmental, Health, and Safety (EHS) Guidelines, the **EHS Guidelines for Toll Roads** are technical reference documents with general and industry-specific examples of Good International Industry Practices (GIIP). The EHS guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs. When host country regulations differ from the levels and measures presented in the EHS guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS guidelines are appropriate, in view of specific Project circumstances, a full and detailed justification for any presented alternative is needed as part of the site-specific environmental assessment.

The EHS Guidelines for Toll Roads include information relevant to construction, operation and maintenance of large, sealed road projects including associated bridges and overpasses. They provide information and guidance on industry-Specific Impacts and Management, namely:

- Habitat alteration and fragmentation (road construction and RoW maintenance);
- Stormwater (general stormwater management, road paving, road deicing);
- Waste (construction phase, road resurfacing, miscellaneous waste, painting activities);
- Noise;
- Air emissions;
- Wastewater;
- Occupational health and safety;
- Community health and safety.

The General EHS and Sectoral Guidelines[2] that were considered during the ESIA include:

- Environmental;
- Community Health and Safety;
- Occupational Health and Safety;
- Construction and Decommissioning;
- IFC Environmental, Health, and Safety Guidelines for Toll Roads.

2.5.2 AFRICAN DEVELOPMENT BANK OPERATIONAL SAFEGUARDS

The environmental and social standards set forth in the Operational Safeguards (OS 1-5) of the African Development Bank (AfDB) were taken into consideration for the preparation of this ESIA, They include:

- **Operational Safeguard 1: *Environmental and Social Assessment*** which aims to mainstream environmental and social considerations- including those related to climate change vulnerability-into bank operations and thereby contribute to sustainable development.
- **Operational Safeguard 2: *Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation*** which seeks to ensure that when people must be displaced they are treated fairly, equitably, and in a socially and culturally sensitive manner; that they receive compensation and resettlement assistance so that their standards of living, income-earning capacity, production levels and overall means of livelihood are improved; and that they share in the benefits of the project that involves their resettlement. Note that for the Project, all land acquisition and resettlement aspects are under KeNHA responsibility and management.

2 These guidelines are available on-line: www.ifc.org/ehsguidelines.

- **Operational Safeguard 3: *Biodiversity, Renewable Resources and Ecosystem Services*** which aims to identify and implement opportunities to conserve and sustainably use biodiversity and natural habitats, and observe, implement, and respond to requirements for the conservation and sustainable management of priority ecosystem services.
- **Operational Safeguard 4: *Pollution Prevention and Control, Hazardous Materials and Resource Efficiency*** which outlines the main pollution prevention and control requirements for borrowers or clients to achieve high quality environmental performance, and efficient and sustainable use of natural resources, over the life of a project.
- **Operational Safeguard 5: *Labour Conditions, Health and Safety*** which outlines the main requirements for borrowers or clients to protect the rights of workers and provide for their basic needs

2.5.3 EQUATOR PRINCIPLES

The Equator Principles (EP) is a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in project finance. It is primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The Equator Principles were formally launched in Washington DC on 4 June 2003 and have subsequently been revised periodically. The fourth iteration of the Equator Principles were published in July 2020 and applies to transactions mandated on/after 1 October 2020[3]. The ESIA is developed in consideration with iteration no. 4 of Equator Principles which include:

- **Principle 1: Review and Categorisation** requires project categorization based on the magnitude of its potential environmental and social risks and impacts, using the environmental and social categorisation process of the International Finance Corporation (IFC). The required environmental and social due diligence is then commensurate with the nature, scale and stage of the Project, and with the categorised level of environmental and social risks and impacts. The Nairobi – Mau Summit Project corresponds to an EP Category A project.
- **Principle 2: Environmental and Social Assessment** requires to conduct an appropriate Assessment process to address environmental and social risks, including measures to minimise, mitigate, and where residual impacts remain, to compensate/offset/remedy for risks and impacts, in a manner relevant and appropriate to the nature and scale of the proposed Project. An ESIA is required for Category A projects, and one or more specialised studies may also need to be undertaken:
  - An assessment of potential adverse Human Rights impacts, referring to the United Nations Guiding Principles – to be prepared as a separate document;
  - For projects with annual scope 1 and scope 2 GHG emissions expected to be more than 100,000 tonnes of CO2 equivalent, an alternatives analysis to evaluate less GHG intensive alternatives, as well as an assessment of climate change risks aligned with Climate Physical Risk and Climate Transition Risk categories of the Task Force on Climate-Related Disclosures – to be prepared as a separate document.
- **Principle 3: Applicable Environmental and Social Standards** requires compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues, but also, for all Category A and Category B Projects globally, review and confirmation of how the Project and transaction meet each of the Principles. For Projects located in Kenya, compliance with the applicable IFC Performance Standards and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) provide this confirmation.
- **Principle 4: Environmental and Social Management System** requires all Category A and Category B Projects to develop and / or maintain an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards.

3 Equator Principles are available on-line: https://equator-principles.com/resources/

- **Principle 5: Stakeholder Engagement** requires all Category A and Category B Projects to demonstrate effective Stakeholder Engagement, as an ongoing process in a structured and culturally appropriate manner, with Affected Communities, Workers and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, an Informed Consultation and Participation process is also required. All Projects affecting Indigenous Peoples will also be subject to a process of Informed Consultation and Participation as per IFC Performance Standard 7, and will need to comply with the rights and protections contained in relevant national law for Indigenous Peoples.
- **Principle 6: Grievance Mechanism** requires all Category A and some Category B Projects to establish effective grievance mechanisms as part of the ESMS, which are designed for use by Affected Communities and workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. Affected Communities and Workers also need to be informed about the grievance mechanisms during the Stakeholder Engagement process.
- **Principle 7: Independent Review** requires that an independent environmental and social consultant carries out an independent review of the ESIA process including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the financial institution's due diligence and determination of Equator Principles compliance.
- **Principle 8: Covenants** incorporates covenants linked to compliance. Where a project is not in compliance with its environmental and social covenants, remedial actions are requested to be implemented to bring the Project back into compliance.
- **Principle 9: Independent Monitoring and Reporting** – in order to assess project compliance with the Equator Principles after financial close and over the life of the loan, independent monitoring and reporting will be required by the financial institution. Monitoring and reporting should be provided by an Independent Environmental and Social Consultant to be hired either by the financial institution or the borrower. Additionally, any monitoring performed by a multilateral or bilateral financial institution or an OECD Export Credit Agency may be taken into account.
- **Principle 10: Reporting and Transparency** requires borrowers to ensure that, at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of Human Rights and climate change risks and impacts when relevant. Yearly public reporting on GHG emission levels (combined Scope 1 and Scope 2 Emissions, and, if appropriate, the GHG efficiency ratio) during the operational phase for projects emitting over 100,000 tonnes of CO^2 equivalent annually, is also required. Sharing of commercially non-sensitive project-specific biodiversity data with the Global Biodiversity Information Facility (GBIF) and relevant national and global data repositories is encouraged.

2.6 INTERNATIONAL AGREEMENTS

Kenya is party to various international environmental and social development agreements that advocate for environmental conservation and better working conditions. Tables 2-4 and 2-5 identify relevant international environmental and social development agreements to which Kenya is a party. Kenya is also signatory to a range of International Labour Organization (ILO) fundamental (and other) conventions, which are summarized in Table 2-5 below.

Table 2-4 International Environmental Agreements Relevant to Kenya

Theme	Convention and Objective	Summary
Biodiversity	International Plant Protection Convention - new revised text approved by Resolution 12/97 of the 29th Session of the FAO Conference in November 1997 – Declaration	To prevent the spread and introduction of pests of plants and plant products and to promote measures for their control.
	Convention on Biological Diversity	To ensure the conservation of biological diversity; the sustainable use of its components and the fair and equitable sharing of the benefits.
	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	To protect migratory species of wild animals and their habitat.
	Convention on International Trade in Endangered Species of Wild Flora and Fauna	To ensure that international trade in specimens of wild animals and plants does not threaten their survival.
Climate Change	Kyoto Protocol to the United Nations Framework Convention on Climate Change	To reduce or limit the emission of gases contributing to the "greenhouse effect" and causing climate change in the industrialized countries
	United Nations Framework Convention on Climate Change (UNFCCC)	To achieve stabilization of greenhouse gas concentrations.
	The Paris climate change agreement- UNFCCC	Its goal is to limit global warming to well below 2, preferably to 1.5 degree Celsius, compared to pre-industrial levels.
Cultural Heritage	UNESCO Convention concerning the Protection of the World Cultural and Natural Heritage	To ensure that effective and active measures are taken for the protection, conservation and presentation of the “cultural and natural heritage" on its territories.
	UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage	To safeguard and ensure respect for the world’s Intangible Cultural Heritage, including raising awareness of the importance of intangible heritage and encouraging international cooperation and assistance.
Democracy	Partnership agreement between the members of the African, Caribbean and Pacific Group of States of the one part, and the European Community and its Member States, of the other part, signed on 23 June 2000 - Protocols - Final Act - Declarations	To promote and expedite economic growth with a view to contributing to peace and security and to promoting a stable and democratic political environment.
Desertification	United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa	To combat desertification and mitigate the effects of drought with a view to achieving sustainable development.
Ozone Layer Depletion	Amendment to the Montreal Protocol on substances that deplete the ozone layer, adopted at the ninth meeting of the Parties	To ensure effective protection of the ozone layer by regulating trade in substances that deplete it.
Waste Management	Basel Convention on the control of trans boundary movements of hazardous wastes and their disposal	To lay down obligations with regard to ensuring that the trans-boundary movement of wastes is reduced to the minimum consistent with the environmentally sound and efficient management of such wastes.

Table 2-5 International Labour Organization Fundamentals and Other Conventions

Theme	Convention	Summary	Application in Kenya
Women's Rights	International Labour Organisation Convention No. 89 on Women's Rights and Working Conditions	These conventions set out basic principles and rights at work in regard to gender equality.	The principles and rights set out in these conventions are generally adopted in the 2010 Constitution and in Kenya's Employment Law, 2007, plus the Industrial Relations Act, 2007, the Workers' Injury Benefit Act, 2007; and the Occupational Safety and Health Act, 2007.
	ILO Discrimination (Employment and Occupation) Convention 1958 (No. 111)		
	United Nations Convention on the Elimination of all Forms of Discrimination Against Women		
	ILO Worst Forms of Child Labour Convention, 1999 (No. 182)		
	ILO Child Rights and Working Conditions Convention No. 90		
	ILO Forced Labour Convention, 1930 (no. 29)		
	ILO Abolition of Forced Labour Convention, 1957 (No. 105)		
Labour Rights	ILO Right to Organize and Collective Bargaining Convention, 1949 (No. 98)	These conventions set out basic principles and rights at work in regard to representation.	
	ILO Freedom of Association and Protection of the Right to Organize Convention, 1948 (no. 87)		
Occupational Health and Safety	ILO Occupational Safety and Health Convention, 1981 (No. 155)	This convention sets out basic principles and rights at work in regard to workplace health and safety management.	

2.7 GAP ANALYSIS

This section aims to meet the ToR requirement to provide a gap analysis which investigates where gaps exist between domestic requirements and the IFC Performance Standards.

Table 2-6 below provides a comparison of Government policies and regulations related to environmental and social safeguards against the IFC Performance standards. It further provides recommendations on how the project will fill any gaps.

Table 2-6 Gap Analysis

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
PS1: Assessment and management of environmental and social risks and impacts: It underscores the importance of managing environmental and social performance throughout the life of a project through an effective Environmental and Social Management System (ESMS). The ESMS entails a methodological approach to managing environmental and social risks and impacts in a structured way on an ongoing basis. The ESMS incorporates the following elements: (i) policy; (ii) identification of risks and impacts; (iii) management programs; (iv) organizational capacity and competency; (v) emergency preparedness and response; (vi) stakeholder engagement; and (vii) monitoring and review. It provides for an informed consultation and participation (ICP) process with the affected communities to ensure their meaningful participation and informed decision making on matters that affect them and for projects with adverse impacts to Indigenous Peoples, in addition to ICP, it is required to obtain their Free, Prior, and Informed Consent (FPIC). The requirements related to Indigenous Peoples and the definition of the special circumstances requiring FPIC are described in Performance Standard 7.	Article 10, 42 and 69 – of the 2010 constitution recognizes public participation as a principle of governance, safeguards the rights to a clean and healthy environment and gives the state responsibilities to encourage participation in the planning, management, conservation and protection of the environment; National Environment Policy, 2013; EMCA, Water Act 2016 and Water Regulations 2006 provide a framework for an integrated approach to planning and sustainable management of Kenya's environment and natural resources. Environmental Management and Coordination Act. EMCA requires screening of project investments in order to determine if further environmental assessments (ESIAs) are needed. An ESIA (which also includes assessing for social impacts) should be carried out before detailed project design and prior to implementation. EMCA requires stakeholder's consultation during planning, implementation and operational phases of the project.	The aspect of meaningful consultation of Indigenous communities is lacking in the domestic regulations. The proponent will conduct adequate and effective consultation with the indigenous communities affected by the project (The Ogiek and the Maasai) to ensure they have given their free, prior and informed consent for the project to be carried out in their territories. The public consultation process as per the Kenyan EIA regulations gives provision for collection and documentation of comments from the public but does not guarantee consideration and incorporation of those opinions of the public in decision making regarding the EIA/ESIA. To address that, the project will take into consideration and incorporates the public and indigenous communities' concerns in project design, planning, implementation and decommissioning as per the IFC PS1 guidelines. The EIA regulations and EMCA put more focus on the environmental effects of the proposed projects plans and programs but the social impacts have not been delved into adequately. To bridge this gap, an effective Environmental and Social Management System (ESMS) is to be used to ensure meaningful and efficient engagement between the client, its workers, local communities directly affected by the project and, where appropriate, other stakeholders.

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
PS2: Labor and working conditions: Provides for the protection of the fundamental rights of workers. These conditions aim; i. To promote the fair treatment, non-discrimination, and equal opportunity of workers. ii. To establish, maintain, and improve the worker-management relationship. iii. To promote compliance with national employment and labor laws. iv. To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain. v. To promote safe and healthy working conditions, and the health of workers and, vi. To avoid the use of forced labor.	OSHA 2007 This is an Act of Parliament to provide for the safety, health and welfare of all workers and all persons lawfully present at workplaces, to provide for the establishment of the National Council for Occupational Safety and Health and for connected purposes. It applies to all workplaces where any person is at work, whether temporarily or permanently. The purpose of this Act is to secure the safety, health and welfare of persons at work and protect persons other than persons at work against safety and health arising out of, or in connection with the activities of persons at work. EMPLOYMENT ACT, 2007 This is an Act of Parliament that applies to all employees employed by any employer under a contract of service. It requires that employee recruitment, contract and grievance management, disciplinary measures and retrenchment and termination of service should be rational, fair and just. Employment of children in the following forms is also prohibited in the following sections of the Act 53. (1), 56. (1) and (2) WORK INJURY BENEFITS ACT (WIBA) It is an act of Parliament to provide for compensation to workmen for injuries suffered during their employment. It outlines the following: – Employer's liability for compensation for death or incapacity resulting from accident; – Compensation in fatal cases; – Compensation in case of permanent partial incapacity; – Compensation in case of temporary incapacity; – Persons entitled to compensation and methods of calculating the earnings;	The local labor laws and regulations are up to par with international labor organization standards but since they are fragmented, there is overlap in jurisdiction between line ministries and unharmonized interpretation of labor laws, especially in addressing work benefits and compensation grievances. For efficiency and easier coordination, the project will apply the IFC PS2 regulations since they provide a well-structured and clear management and coordination methodology.

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
	– No compensation shall be payable under this Act in respect of any incapacity or death resulting from a deliberate self-injury & – Notice of an accident, causing injury to a workman, of such a nature as would entitle him for compensation shall be given in the prescribed form to the director	
PS3: Resource efficiency and pollution prevention: This Performance Standard outlines a project-level approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices. It is established during the environmental and social risks and impacts identification process and aims: i. To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities. ii. To promote more sustainable use of resources, including energy and water. iii. To reduce project related GHG emissions.	WATER ACT 2016 The Water Act 2016 provides for the regulation, management and development of water resources, water and sewerage services; and for other connected purposes. Section 21 of this Act provides for national monitoring and geo referenced information systems on water resources. Following on this, sub-Section 2 mandates the Water Resources Authority to demand from any person or institution, specified information, documents, samples or materials on water resources. Under these rules, specific records may require to be kept by a site operator and the information thereof furnished to the authority. Section 63 of this Act makes it a right of every person in Kenya to clean and safe water in adequate quantities and to reasonable standards of sanitation as stipulated in Article 43 of the Constitution. CLIMATE CHANGE ACT 2016: The act provides for mechanism and measures to achieve low carbon development. Part IV section 15 provides on how Climate change considerations should be integrated in every public-sector entity. The National climate change action plan (NCCAP) as the action tool of the climate change act provides for climate-proofing of energy and transport infrastructure, and development of sustainable transport systems as a strategy to reduce emissions of GHG from the transport sector.	Domestic pollution prevention Regulations on related GHG emissions, ozone depleting substances and cleaner production mechanisms are being continuously strengthened and there may be potential gaps in their implementation. To cover this, the project will examine IFC's PS3 and EHS guidelines alongside national regulations. Baseline sections covering those subjects (see chapter 5) identify the most stringent applicable requirements.

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
PS4: Community health, safety and security: This Performance Standard addresses the client's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related activities, with attention to vulnerable groups. These guidelines aim to; – To anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances. – To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities.	PENAL CODE Cap 63 Section 191 of the Penal Code states that any person or institution that voluntarily corrupts or foils water for public springs or reservoirs, rendering it less fit for its ordinary use is guilty of an offence. Section 192 of the same act says any person who voluntarily vitiates the atmosphere in any place so as to make it noxious to the health of persons in general dwelling or carrying on business in the neighborhood or passing along a public way is guilty of a misdemeanor. PUBLIC HEALTH ACT, CAP 242 The operations and activities of the proposed project can be detrimental to human and environmental health and safety in the absence of appropriate measures. For example, waste, dust, noise and air emission generated from activities and process of the proposed project can directly or indirectly have adverse impacts on humans and environment. The Act prohibits the Developer from engaging in activities that cause environmental nuisance or those that cause danger, discomfort or annoyance to inhabitants or is hazardous to human and environmental health and safety. EMCA REGULATIONS (Air quality regulations, water quality regulations, noise and excessive vibrations control regulations, waste management regulations); These Regulations provide thresholds within specified environments for noise and excessive vibrations, cover air quality standards that are requisite to protect human health and allow an adequate margin of safety, provides for sustainable management of water resources, including prevention of water pollution and protection of water sources and management of all categories of wastes including; solid waste, Industrial waste, hazardous waste,	There are gaps in availability, access, coordination and custody of baseline data on air pollution, water pollution and noise pollution as there is no clear laws providing guidance on these aspects. The laws are not stringent on monitoring, follow up and enforcement of these regulations, as they don't provide guidelines for inspection and continuous audit of projects to ensure they comply with licensing conditions. To cover this, the project will use the IFC PS4 since it provides for continuous monitoring and audits throughout the project life cycle ensuring anticipation and early avoidance and /or mitigation of adverse impacts on the health and safety of workers and the Affected Community.

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
	toxic substances and waste, biomedical waste and radio-active substances. Project proponents must provide appropriate mitigation strategies that ensure the minimum permissible levels of pollution are not exceeded in their Environmental Management Plans in order to be issued relevant licenses and permits.	
PS5: Land acquisition and involuntary resettlement: This performance standard recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons that use this land. They apply to economic and /or physical displacements related to; – Land rights or land use rights acquired through expropriation or other compulsory procedures in accordance with the legal system of the host country; – Land rights or land use rights acquired through negotiated settlements with property owners or those with legal rights to the land if failure to reach settlement would have resulted in expropriation or other compulsory procedures; – Project situations where involuntary restrictions on land use and access to natural resources cause a community or groups within a community to lose access to resource usage where they have traditional or recognizable usage rights; – Certain project situations requiring evictions of people occupying land without formal, traditional, or recognizable usage rights; or – Restriction on access to land or use of other resources including communal property and natural resources such as marine and aquatic resources, timber and non-timber forest products, freshwater, medicinal plants, hunting and gathering grounds and grazing and cropping areas.	THE LAND TITLES ACT CAP 282 The Land Titles Act Cap 282 section 10 (1) states that there shall be appointed and attached to the Land Registration Court a qualified surveyor who, with such assistants as may be necessary, shall survey land, make a plan or plans thereof and define and mark the boundaries of any areas therein as, when and where directed by the Recorder of Titles, either before, during or after the termination of any question concerning land or any interest connected therewith, and every area so defined and marked shall be further marked with a number of other distinctive symbol to be shown upon the plan or plans for the purposes of complete identification and registration thereof as is herein after prescribed. In developing plans and designs for implementation of the project, the project Developer will take into account the roles of qualified surveyors as stipulated in the Act. Also addressing issue relating to ownership of the land slated for the development before the commencement of the project is necessary. THE LAND ACQUISITION ACT, CHAPTER 295 LAWS OF KENYA, 2012 The Act provides for the compulsory or otherwise acquisition of land from private ownership for the benefit of the general public. Section 3 states that when the Minister is satisfied of the need for acquisition, notice will be issued through the Kenya Gazette and copies delivered	Preparation and implementation of the Project Resettlement Action Plan is under the responsibility of KeNHA. The ESIA will not address this issue.

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
– The guidelines require the client to collaborate with the responsible government agency to permissible levels as provided for by the agency in cases where land acquisition and resettlement is the responsibility of the government and help the responsible government in identifying resettlement measures and where applicable prepare a Supplemental Resettlement plan to compliment government prepared documents.	to all the persons affected. Full compensation for any damage resulting from the entry onto land to do things such as survey upon necessary authorization will be undertaken in accordance with Section 5 of the Act. Likewise, where land is acquired compulsorily, full compensation shall be paid promptly to all persons affected in accordance to Sections 8 and 10 along the following parameters: – Area of land acquired; – The value of the property in the opinion of the Commissioner of land (after valuation); – Amount of the compensation payable; – Market value of the property; – Damages sustained from the severance of the land parcel from the land; – Damages to other property in the process of acquiring the said land parcel; – Consequences of changing residence or place of business by the landowners; and – Damages from diminution of profits of the land acquired.	

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
PS6: Biodiversity conservation and sustainable management of living natural resources: Performance Standard 6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and sustainably managing living natural resources are fundamental to sustainable development. This Performance Standard are applied to projects that; i. Are located in modified, natural, and critical habitats; ii. Potentially impact on or are dependent on ecosystem services over which the client has direct management control or significant influence; or ii. (iii) Include the production of living natural resources (e.g., agriculture, animal husbandry, fisheries, forestry).	EMCA (CONSERVATION OF BIOLOGICAL DIVERSITY AND RESOURCES, ACCESS TO GENETIC RESOURCE AND BENEFITS SHARING) REGULATION, 2006 This regulation aims at enhancing the preservation of biodiversity as well as safeguarding the endangered and rare species of plants and animals existing within a project area. Part II on conservation of biological diversity stipulates the prohibitions on the extraction and use of biological resources. The regulations also empower lead agencies in the conservation and natural resource management to keep and update an inventory on the endangered species in the country.	Biodiversity baseline data is incomplete and not up to date, and is unavailable in some regions, regulations on biosafety and invasive species are a work in progress, and critical habitats protection guidelines and modified habitat guidelines are unclear therefore, to ensure that all relevant valued ecosystem components are taken into consideration and an effective Environmental and Social Management System is developed, the project will apply IFC PS6 guidelines.
PS7: Indigenous peoples: The client will prepare a plan that, together with the documents prepared by the responsible government agency, will address the relevant requirements of this Performance Standard. The client may need to include (i) the plan, implementation, and documentation of the process of ICP and engagement and FPIC where relevant; (ii) a description of the government-provided entitlements of affected Indigenous Peoples; (iii) the measures proposed to bridge any gaps between such entitlements, and the requirements of this Performance Standard; and (iv) the financial and implementation responsibilities of the government agency and/or the client.	Although the Constitution of Kenya (CoK) does not specifically use the term Indigenous Peoples, it is robust in articles that define vulnerability and marginalization, including issues that IP/VMGs cite as the reasons for their self-identification. Articles 56 and 260 of the Constitution outline clear demonstration of the intentions of the country to deal with the concerns of minority and marginalized groups. The definition of marginalized communities and groups by the CoK and the provisions for affirmative action programs targeting these groups present the range of efforts to provide a legal framework for their inclusion into mainstream development of the country. These articles present the minority and marginalized groups as a unique category of the Kenyan population that deserves special attention in order to bring the members at par with the rest of the country in development terms. The CoK requires the State to address the needs of vulnerable groups, including “minority or marginalized” and “particular ethnic, religious or cultural communities” (Article 21.3). The specific provisions of the Constitution include: affirmative action programs and policies for	The community land rights implementation is a challenge as the majority of the communal land is unregistered therefore the communities do not have exclusive rights to access, use and benefit sharing. Also, the current arrangement in the regulations on arrangement for trustee ownership of community lands is confusing as the constitution confirms constitutional limitation on the disposal of community land until registration and on the other hand, provides that any transactions in relation to unregistered community land within the county shall be in accordance with the provisions of the community land act and other applicable law. This is not clear as it and does not specify the powers of the county governments as trustees. There is also imbalance in the powers of elected committee members and community members in community land management, and the regulations do not provide clear guidelines in

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
	minorities and marginalized groups (Articles 27.6 and 56); rights of “cultural or linguistic” communities to maintain their culture and language (Articles 7, 44.2 and 56); protection of community land, including land that is “lawfully held, managed or used by specific communities as community forests, grazing areas or shrines,” and “ancestral lands and lands traditionally occupied by hunter-gatherer communities” (Article 63); promotion of representation in Parliament of “…(d) ethnic and other minorities; and (e) marginalized communities” (Article 100); and an equalization fund to provide basic services to marginalized areas (Article 204). THE COMMUNITY LAND ACT 2016 This act provides for the recognition, protection, and registration of community land rights, management and administration of community land. This act limits acquisition of by the state of any interest in, or right over community land only in the instance where the compulsory acquisition is; in accordance with the law, for a public purpose and upon prompt payment of compensation to the affected people in full or by negotiated settlement. Section 37 gives the right to registered communities to make rules or by-laws regulating the management and administration of their land and provide for: – The regulation of investments on the land; – The determination of terms of any leases granted for purposes of investment; – The conservation and rehabilitation of the land and; – Land use and physical planning.	terms of the scope and criteria of adequate consultation of indigenous communities. To avoid a potential gap of coverage the project will conservatively treat all vulnerable and marginalized groups through the measures of the PS7 on Indigenous Peoples. Therefore, during the planning process at local level it will be checked whether all ethnic groups have the same chance to benefit from the project and voice their concern if their rights, interests, needs, livelihoods or culture are affected by the project. For Indigenous Peoples, in addition to ICP, their Free, Prior, and Informed Consent (FPIC) will be sought.

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
PS08: Cultural Heritage; This performance standard aims to protect and support preservation of cultural heritage from adverse impacts of project activities. It also promotes equitable sharing of benefits from the use of cultural heritage. The client will consider potential impacts of the project to cultural heritage and apply the provisions of this standard throughout the project's life cycle. The client will Comply with defined national and local cultural heritage regulations, promote and enhance the conservation aims of the protected areas and consult key stakeholders. The client will apply this performance standard to both legally protected and unprotected cultural heritage and regardless of any previous disturbances.	The administration of Kenya's cultural heritage is informed by the Kenya National Policy on Culture and Heritage (NPCH) and by the provisions of Articles 11, 40, and 69 of the Kenya Constitution (Republic of Kenya 2010). THE KENYA CONSTITUTION (2010) Cultural heritage protection and preservation is enshrined in the constitution under articles 11, 40, 69 and 260 of the Kenya Constitution (2010). Under Article 11(1), the Constitution recognizes culture as the foundation of the nation and as the cumulative civilization of the Kenyan people and nation. It mandates the state to promote all forms of national and cultural expression through literature, the arts, traditional celebrations, science, communication, information, mass media, publications, libraries and other cultural heritage; recognizes the role of science and indigenous technologies in the development of the nation; and promotes the intellectual property rights of the people of Kenya. The National Museums and Heritage (NMH) Act, Cap 216 (2006) and less importantly both the Environmental Management and Coordination Act, Cap 8 (2015) and the Land Act (2012) operationalize the management of Kenya's cultural heritage. Others include Cap 19 (the Public Archives and Documentation Service Act of 1991) and Cap 509 (Kenya's Industrial Property Act of 2001). Cap 216 extends authority for the management of Kenya's cultural heritage only to the National Museums of Kenya (NMK). THE NATIONAL MUSEUMS AND CULTURAL HERITAGE ACT (2006) CAP 216 In accordance with Cap 216, archaeological sites may not be destroyed, excavated or altered without an	There is a lack of Harmonization of the different sections of the law has leading to duplication of roles and conflicts of ownership or custody. Several areas of other legislations have the same custodianship mandate to act as the NMH act in the matter of the same heritage objects. Possible conflict areas exist in terms of ownership mandate of such objects should they be the subject of litigation. For example, while the Public Archives and Documentation Service Act, Cap 19, Sections 2 and 4, provides for the preservation of public archives and public and historical records, it also duplicates and conflicts with the Cap 216 of NMH act and with the National Parks Ordinance of 1945, which provides for 'the preservation of wildlife and flora and objects of aesthetic beauty, geological, prehistoric, archaeological or scientific interest'. The Records Disposal Act (Cap 14) provides for the disposal of records in the custody of the High Court or the Registrar General without recourse to any other body. When taken in tandem with Cap 19, these acts limit the general public and the NMK to access objects that may, despite the definition limitations of Cap 216, qualify as national cultural heritage. The National regulations are not clear on the rights of community cultural heritage ownership, use and compensation of exploitation of cultural heritage, and only apply to legally protected cultural heritage. Cap 216 is non-committal, and silent about the sustainability of cultural heritage management beyond curation, especially the relevance of heritage such as archaeological or paleontological material, or the transformation

IFC Performance Standards	Kenyan Legal Framework	Gaps and recommendations for gap closure
	exploration/excavation permit issued by the cabinet secretary or designate.	of cultural heritage to sustainable income generating enterprises. To address these possible limitations, the project will apply provisions to IFC performance Standard 8 which ensures that the rights of the communities whose cultural heritage resources utilized in the project are protected and fair and equitable benefit sharing according to PS1 is applied. PS8 also applies to all cultural heritage regardless of it being protected legally or not.

3 PROJECT ALTERNATIVES

This chapter describes the various alternatives considered for the conceptual design stage and those associated with the construction activities.

3.1 CONCEPTUAL DESIGN ALTERNATIVES

At the conceptual design stage, various alternatives were reviewed including:

- the no project alternative;
- the development and use of alternative transportation;
- the construction of a new distinct road corridor,
- the development of alternate route alignments, and the crossing or bypass of the Nakuru City area.

The following sections describe the conceptual design stage alternatives studied.

3.1.1 NO PROJECT ALTERNATIVE

The overall objective of the Project is to improve the movement of goods and people along highways A8 and A8 South. In addition, the project would enhance connectivity between other parts of Kenya and the larger East and Central Africa as they are part of the Trans-African Highway (TAH) Network.

The Project involves:

- The dualling of 175 km of the A8 Highway between Rironi and Mau Summit, subdivided into 4 sections; and
- The strengthening of 57.2 km of the A8-South Highway between Rironi and Naivasha, subdivided into 2 sections.

A portion of the A8 Highway is part of the Trans-African Highway (TAH) Network. The TAH Network comprises a system of strategic roads liaison aiming to promote trade and alleviate poverty through highway infrastructure development and the management of road-based trade corridors. The Lagos–Mombasa Highway known as TAH 8, is the principal road between West and East Africa. The A8 Highway is part of the Northern Corridor which is one of the busiest and most important transport corridors in East and Central Africa. It provides a gateway through Kenya to the landlocked economies of Uganda, Rwanda, Burundi, Southern Sudan and Eastern DR Congo. It serves as a transportation link for approximately 6 million Kenyans.

Increased traffic and congestion are problematic and upgrading the road for better safety and movement is an urgent priority. The enhanced A8 and A8 South Highways infrastructure will contribute to the economic and social development of the entire country and the region's connectivity. Expanding the road capacity and improving the road quality between Nairobi and Mau Summit will allow to accommodate the increasing traffic in a safe and sustainable manner.

The Northern corridor is facing considerable congestion along its route due to average traffic increases of 5% to 7.5% per year for the past 20 years. This rate is expected in the years to come and needs to be addressed immediately to maintain the Northern Corridor's international and port-connecting functions. Current infrastructures are not able to accommodate the increasing traffic, which leads to extended travel times and worsens road safety (575 people were killed between 2012 and 2014 according to police statistics). In fact, based on the World Health Organization's global status report on world safety for 2013, the Project Highway was among the top 22 most dangerous highways in the world. Therefore, the Kenya National Highway

Authority (KeNHA) has undertaken measures to improve road safety and quality through the current PPP scheme.

The possibility of not realizing the Project would:

- Eliminate all temporary impacts related to construction such as work site management, occupational and community health and safety, shifting of utilities, dust, noise, and vibration from construction equipment;
- Foresee operational impacts associated with the new dualled and strengthened highways.

However, the no project alternative means the current situation described above is maintained and the associated adverse effects would continue and inevitably be aggravated in the years to come. Furthermore, current installations along the existing road offers limited crossing opportunities for wild fauna thus increasing potential mortality and dangerous accidents for road users. Also, many of the existing underpasses are not dimensioned in a way to allow for the crossing of modern agricultural machinery which is forced to cross the road at grade. Finally, increase in traffic and congestion will increase air emissions creating local air pollution, which will be detrimental to the adjacent population and road users. For all these reasons, it was concluded that the no project alternative was not to be retained.

3.1.2 ALTERNATIVE LINEAR TRANSPORT MEANS

The movement of people, goods and services along this corridor could also be achieved through other linear transport means, especially through the construction of railway lines from Nairobi-to Mau-Summit instead of the expansion of the proposed highway. This alternative would entail a totally new Greenfield development which would require land Right of Ways (ROW) and would lead to displacement of communities due to acquisition.

The railway line, similar to a new highway would also likely traverse close to or through/along some of the environmental sensitive areas like Lake Naivasha, Lake Nakuru, Lake Elmenteita, and Wildlife Conservancies (i.e., Kigio Wildlife Conservancies, Soysambu Ranch, Nakuru National Park, and some escarpment forest zones like Kikuyu escarpment zone). As a result, this will lead to significant adverse impacts and risks compared to the expansion of the current highway within the ROW.

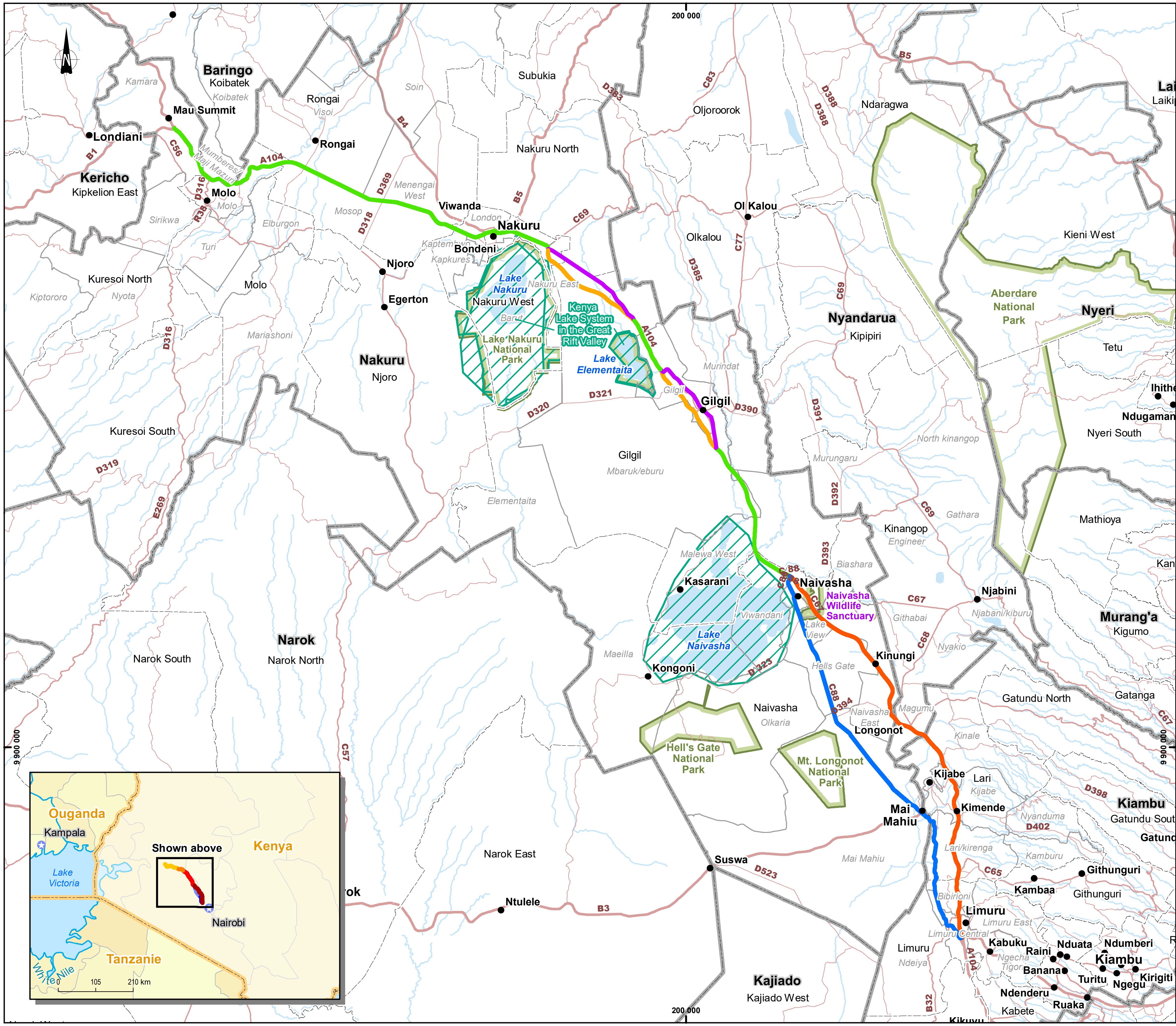
This option was rejected from an environmental and social point of view in line with an impact avoidance philosophy, with respect to displacement and environmental and social risks, as well as economic reasons.

3.1.3 ALTERNATIVE ALIGNMENT OPTIONS

In the initial conceptual design stage of the Project, five alignment options were considered for the upgrade (dualling) of the existing A104 Road into the A8 Highway. They are presented in the following sections and Options 1 to 4 are illustrated on Map 3-1. As for Option 5, it relates to a greenfield alignment for which no specific design was completed but a conceptual schematic is presented in Figure 3-1.

3.1.3.1 ALIGNMENT OPTION 1: DEVELOPMENT OF EXISTING A104 (ROAD-NAIROBI –MAU SUMMIT)

The improvement proposal of Option 1 consists in doubling the number of lanes of the existing A104 from 2 to 4 while following its existing geometry. This option starts from Rironi and follows along the A104 right-of-way passing through Naivasha – Gilgil – Nakuru – Molo – Mau summit. For the Nakuru section, various options were considered which are presented in more detail in section 3.1.5. The total length of this alignment option 1 is approximately 176 km.



Administrative Limits

International Boundary

County (**Nakuru**)

Sub-County (Gilgil)

City (**Njoro**)

Road Network

Primary

Secondary

Tertiary

Protected Areas

International Level

Ramsar Site / World Heritage Site

National Level

National Park / Sanctuary

Proposed Alignment Initially Considered

Sections Common to all

Sections Common to Alignments 1 and 2

Sections Common to Alignments 1 and 3

Sections Common to Alignments 2 and 4

Sections Common to Alignments 3 and 4

VINCI meridiam

Nairobi-Nakuru-Mau Summit Highway Project - Rift Valley Highway Limited

Environmental and Social Impact Assessment

Map 3-1
Proposed Alignment Initially Considered for the Project

Sources :
ESRI World Topographic Map
Open Street Map, hydrography and roads
American Red Cross, Administrative boundaries, 2019
Protected Planet, Ramsar and World Heritage Site, 2020-12

0 5 10 Km

WGS84, UTM 37S

03 mai 2021

Preparation: C. Le Page
Drawing: C. Thériault
Validation: G. Pothier

201_10312_00_ESIA_M3_1_Prop_Alignement_015_210503.mxd

wsp

Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

3.1.3.2 ALIGNMENT OPTION 2: DEVELOPMENT OF EXISTING B3, C88 AND EXISTING A104 SOUTH ROAD (RIRONI-MAI MAHIU- MAU SUMMIT)

The improvement proposal of Option 2 consists of doubling the number of lanes for sections B3, C88, and the existing A104 Road. More specifically, it includes the development of a section of alignment through the B3 Road (length of 19.750 km) and the C88 Road (length of 37.430 km) from Rironi to Mai Mahiu and then Naivasha, for a total of 57.180 km. The alignment then continues following the existing A104 ROW and geometry from Naivasha to Mau Summit for a total of 115.94 km. For the Nakuru section, various options were considered which are presented in more detail in section 3.1.5. The total length of this alignment in option 2 is approximately 173 km.

3.1.3.3 ALIGNMENT OPTION 3: DEVELOPMENT OF SECTIONS OF EXISTING A104, OLD A104 AND MBARUK ROAD

The improvement proposal of Option 3 consists of doubling the number of lanes of existing roads, which starts from Rironi and follows the existing A104 right-of-way passing through Naivasha until it reaches the railway overpass near Gilgil (length of 80.100 km). The alignment then takes off towards east of existing highway onto old A104 which passes through Gilgil City, joining back existing A104 at Lake Elmenteita. It then takes off North West through Mbaruk Road and joins back with the existing A104 right-of-way just before entering Nakuru (length of 36.600 km). The last segment follows the existing A104 right-of way for 58.840 km until reaching Mau Summit. For the Nakuru section, various options were considered which are presented in more detail in section 3.1.5. The total length of the alignment in option 3 is approximately 175.500 km.

3.1.3.4 ALIGNMENT OPTION 4: DEVELOPMENT OF SECTIONS OF EXISTING B3 AND C88, OLD A104 AND EXISTING A104

The improvement proposal of Option 4 consists in doubling the number of lanes of a section of the B3 and C88 roads from Rironi to Mai Mahiu and then Naivasha as in Option 2 (length of 57.180 km). From Naivasha it follows the existing A104 right-of-way until the railway overpass near Gilgil (length of 21.100 km). From this point, the alignment takes off towards the east of the existing highway onto old A104, which passes through Gilgil City joining back existing A104 at Lake Elmenteita. It then takes off north-west through Mbaruk Road and joins back with the existing A104 right-of-way just before entering Nakuru as in Option 3 (length of 36.600 km). The last segment follows the existing A104 right-of way for 58.840 km until reaching Mau Summit. For the Nakuru section, various options were considered which are presented in more detail in section 3.1.5. The total length of this alignment option is approximately 174 km.

3.1.3.5 ALIGNMENT OPTION 5: GREENFIELD ALIGNMENT

The improvement proposal of Option 5 is a completely distinct expressway parallel to the existing A104 from Rironi to Mau Summit, bypassing all major urban and settlement sections like Naivasha, Gilgil, Nakuru, Salgaa and Molo. The parallel alignment considered would cross the existing A104 at 4 locations from west to east and vice versa to avoid environmental sensitive areas like escarpment forests and rift valleys. The alignment also crosses the existing railway lines at 7 locations for which new road over bridge (ROB) structures are to be proposed. Spur alignments also need to be designed and provisions made to connect all the major towns/settlements to attract traffic over the new parallel expressway. The total length of the entire alignment option is approximately 189 km. Figure 3-1 below shows a conceptual illustration of this option.

Figure 3-1 Conceptual Illustration of the Proposed Alignment Option 5

3.1.3.6 OPTION SELECTED

The various options presented above were compared through a multicriteria analysis based on aspects such as capacity to reduce congestion and accommodate future demands, economic viability, financial attractiveness, complexity of land acquisition, environmental impact, road safety and engineering challenges. Overall, Option 1 was selected for the construction of the proposed four lanes A8 Highway. This option scored highest on economic viability, financial attractiveness, land acquisition requirements and road safety aspect and amongst the highest for all other criteria. Indeed, this option reduces environmental impact as it will be essentially realized within an existing right-of-way which has been already cleared from natural and human components. It does not imply any additional encroachment onto natural components or sensitive areas and the cleared human component has already been evaluated and is in the process of being compensated under KeNHA supervision. Although it is not the shortest option, length difference is low and all compensation costs have already been taken into consideration, which makes it the most economical option. In conclusion, Option 1 is the best from environment and social perspectives.

The main factor for the elimination of Options 2 to 4 is associated with the need to acquire additional right-of-way for significant sections of the alignment. This would implicate encroachment into various natural habitats, perturbation of existing human activities and important costs for compensating these losses. Finally, Option 5 being constituted as an entirely new alignment will generate the same impacts as for Options 2 to 4, not only for sections of its alignment but for its entire length, thus increasing encroachment impacts and costs. Options 2 to 5 were therefore not found desirable in a perspective where impact avoidance needs to be prioritized as required by PS1 mitigation hierarchy.

In addition to the selection of Option 1 as the most favourable alignment for the dualling of road A104 to become the A8 Highway, it was also decided to complete some general improvements (pavement and drainage improvements, erosion risk reduction, etc.) on the first 57.180 km of Options 2 and 4 during the project. No dualling of this segment is considered.

3.1.4 ALTERNATIVE DESIGN FOR CONGESTED URBAN AREAS (NAKURU CITY)

Nakuru City is the largest urban area intersected by the highway, and several alternatives were considered by both KeNHA and RVH to minimize the potential effects of enlarging the existing infrastructure from four to six lanes. The enlargement could namely include land acquisition and displacement, disruption of urban connectivity and increased nuisances for adjacent population and activities.

A total of 6 options were considered for either passing through, bypassing or detouring the City. These options are presented in the following sections.

3.1.4.1 WIDENING OF EXISTING ROAD THROUGH NAKURU CITY

This option involves widening the existing road from 4 lanes into 6 lanes within Nakuru City. The option was not considered socially sound due to the significant displacement risks and impacts it would bring with it. Land acquisition along this section would be very difficult because of the presence of important structures such as:

- Jomo Kenyatta Institute of Technology and Science at CH 125+100 on left Highway side (LHS);
- Railway Godown at CH 125+200 on right Highway side (RHS);
- Westside Mall/Nakumat, including the Aga Khan University Hospital at Second roundabout (CH 125+500);
- County Assembly of Nakuru at CH 125+700 on RHS;
- KCB Bank at CH 125+900 on LHS, and;
- Eveready industries at fourth Roundabout (CH 127+850).

In addition to these, there are several densely distributed commercial establishments, industrial setups, educational institutes, government offices, vehicle showrooms, and banks and hotels, on both sides of the existing road.

The removal of buildings and structures and land acquisition would lead to displacement and disruption of socio-economic activities including connectivity within Nakuru City. Thus, this was rejected from a socio-economic perspective.

3.1.4.2 BYPASS OPTIONS FOR NAKURU CITY

The option of bypassing Nakuru City completely was considered by evaluating potential southern and northern bypass alignments.

SOUTHERN BYPASS

The proposed southern bypass (see Figure 3-2) takes off from existing A104 at CH 115+600 and joins back at CH 129+400 for a total length of 16.480 km. This bypass would have the highway transit within the Nakuru National Park and relatively close to a section of Lake Nakuru which are, from an environmental point of view, very sensitive areas. This alignment would also cross two sets of basins composing the Nakuru sewage treatment plant which represent a significant technical challenge. Furthermore, there is also a legal case currently present against any bypass options entering the National Park limits. This bypass option was strongly rejected because of the sensitivity of the National Park and the complications associated with the presence of key municipal infrastructures. Also, some pending litigations related to land ownerships and orders to stay from competent courts limited the consideration of a southern bypass.

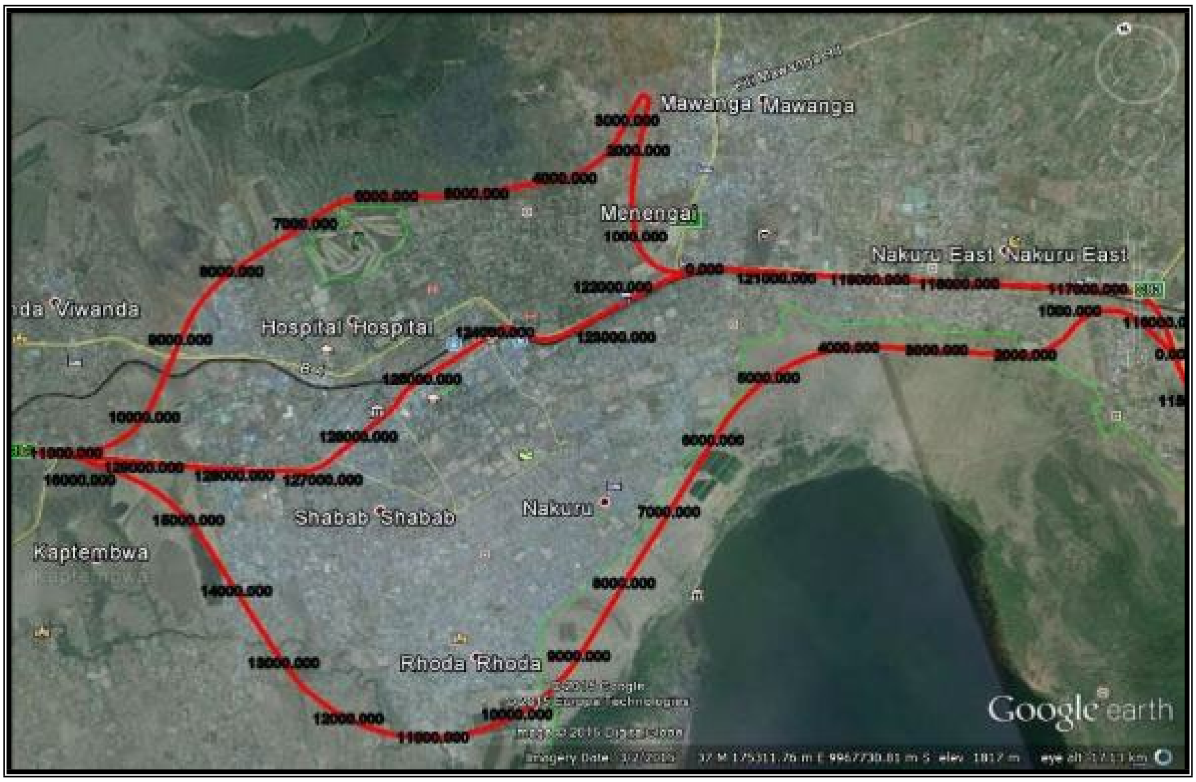


Figure 3-2 General overview of considered southern and northern bypasses

NORTHERN BYPASSES

The initial bypass considered by KeNHA during early design stages is illustrated in Figure 3-2 above. In addition to this proposal, RVH considered other high-level options (See Figure 3-3) which are essentially variations around the initial proposal of Figure 3-2. The length of these various options varies from 10 km to 17 km. Although all options could be feasible, they face significant potential environmental, social and technical challenges including but not limited to:

- Difficult topography resulting in major earthworks and steep slopes for some road segments (between 12% and 14%);
- Perturbation of wooded natural habitat;
- Major land and property acquisition into privately owned lands with variable density occupation;
- Various existing road crossings to re-establish or relocate;
- Disruption of existing urban setting included within dense residential areas.

Considering the expected major environmental and social impacts and the significant technical difficulties to be resolved for all the proposed options, the northern bypass was finally rejected.

Figure 3-3 Variations considered for a northern bypass of Nakuru

3.1.4.3 DETOURING AWAY FROM NAKURU CITY

As mentioned in section 3.1.4.1 on the widening of the existing road, Nakuru City is highly congested and has many prominent structures. These include administrative buildings, educational institutions, industrial setups, banks, hotels, automobile showrooms and service centres, and various other commercial establishments along the Project highway. Also, as demonstrated in section 3.1.4.2 on bypasses, the presence of the National Park, the Nakuru Lake, the Menengai mountain, and significant human occupancy towards the proximate north, result in the rejection of the bypass option. One other potential solution was to consider a large detour towards the north and south of the Nakuru City. These options are explored in this section.

NORTHERN DETOUR OPTION

This northern detour option (see Figure 3-4) takes off at CH 121+700 of the existing A104 road and follows the B5 road till CH 13+100 (which will need to be widened to a 4-lane divided carriageway). At this point, it transits towards the Northwest around the volcanic crater of Mount Menengai through the Greenfield new alignment for 34.500 km. It then joins onto the B4 road for 1 km before heading southwest until reaching back onto the existing A104 at CH 137+600. The total length of the detouring option is approximately 42 km while the avoided section of the A104 represents approximately 16 km. The main problem associated with this detour is the length of additional new highway it requires. Also, the following aspects must be considered:

— The need to widen 13 km of the existing B5 road and 1 km of the B4 road which will imply important land acquisition from private owners and cause significant disturbance to local human activities;

For all these reasons, this option was rejected as it would lead to significant land acquisition and displacement impacts, therefore not socio-economically feasible.

Figure 3-4 **Northern Detour around Mount Menengai**

SOUTHERN DETOUR OPTION

This southern detour option (see Figure 3-5) takes off at CH 111+300 of the existing A104 through a Greenfield new alignment parallel to Lake Elmenteita Road for approximately 19 km. It would then follow Lake Elmenteita Road towards the southwest for 5 km, and transit for approximately 20 km around the southern limit of Lake Nakuru and Nakuru National Park through a Greenfield new alignment until merging with the C57 road towards the northwest for 3.5 km. It would follow another Greenfield alignment towards the north for 5.5 km, bypassing Njoro Town and finally merging onto Njoro Road towards the northeast for approximately 10 km. Finally, it would join back onto the existing A104 at km 129.600 at the Njoro turnoff interchange. The total length of the detour option is approximately 63 km while the avoided section of the A104 represents approximately 18.3 km. The main problem associated with this detour is the length of an additional new highway it requires. Also, the following aspects must be considered:

- The potential encroachment within the Soysambu Conservancy property for the first 19 km;
- The need to widen 5 km of Elmenteita Road, 3.5 km of the C57 road and 10 km of the Njoro road, would imply important land acquisition from private owners (including the Soysambu Conservancy) and cause significant disturbance to local human activities (mainly agricultural);
- The fact that approximately 45 km of the proposed alignment will go through a Greenfield area showing extensive agricultural activities.

For all these reasons, this option was rejected as it would lead to significant land acquisition and displacement impacts as well as conservancy land loss. Thus, would not be considered as environmentally and socio-economically feasible.

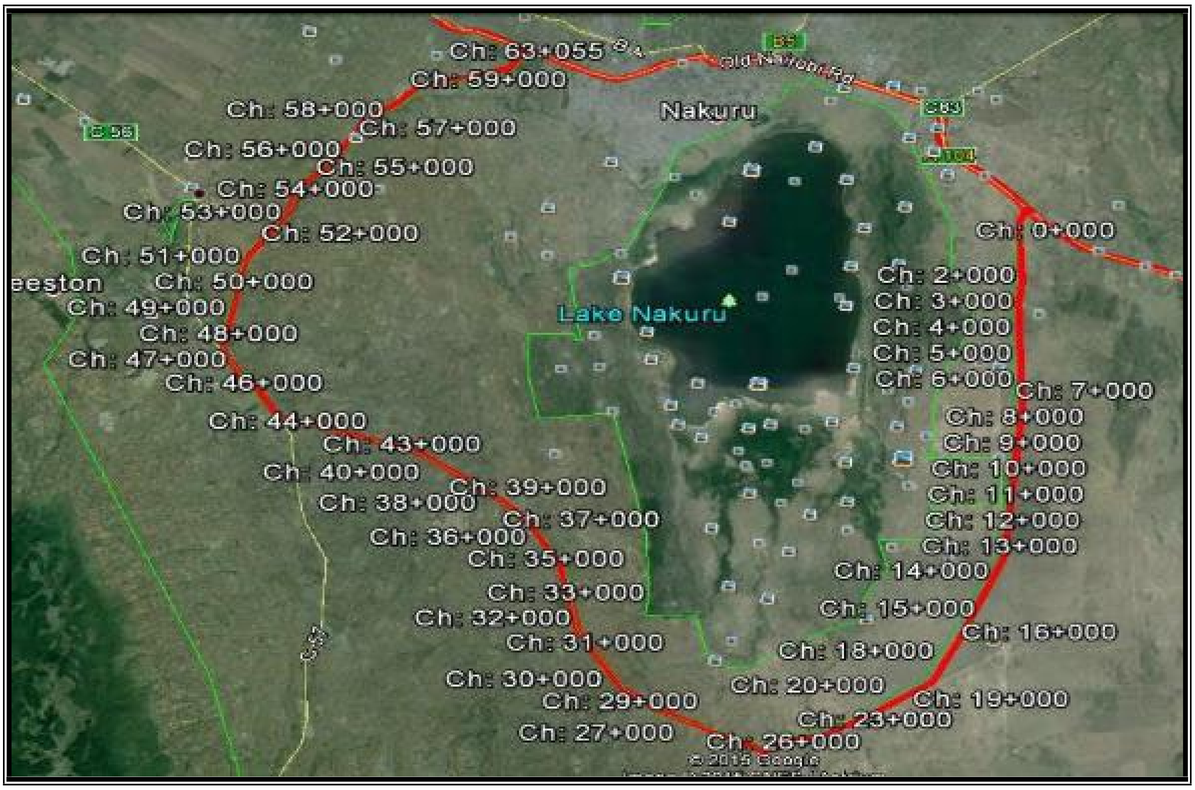


Figure 3-5 **Southern Detour around the Nakuru Lake and National Park**

3.1.4.4 INTEGRATION OF ELEVATED SECTIONS

Another possibility considered for the highway section crossing Nakuru City is the insertion of elevated sections for some parts of the highway. Proposed types of elevated structures included:

- Flyover, which would include a 6-lanes wide elevated structure (see figure 3-6);
- A duplex type structure composed of two 3-lanes axes built one over the other (see figure 3-7);
- Underpasses, which would be located at roundabout 3 and roundabout 4 (see figure 3-8).

These structures can be used individually or in combination. Amongst the options envisioned were:

- The use of a 6-lanes flyover for a variable length between the railway crossing and the third roundabout;
- The use of the duplex type structure for a variable length between the railway crossing and the third roundabout;
- The combination of flyover sections and underpasses;
- The combination of the duplex type structure and underpasses.

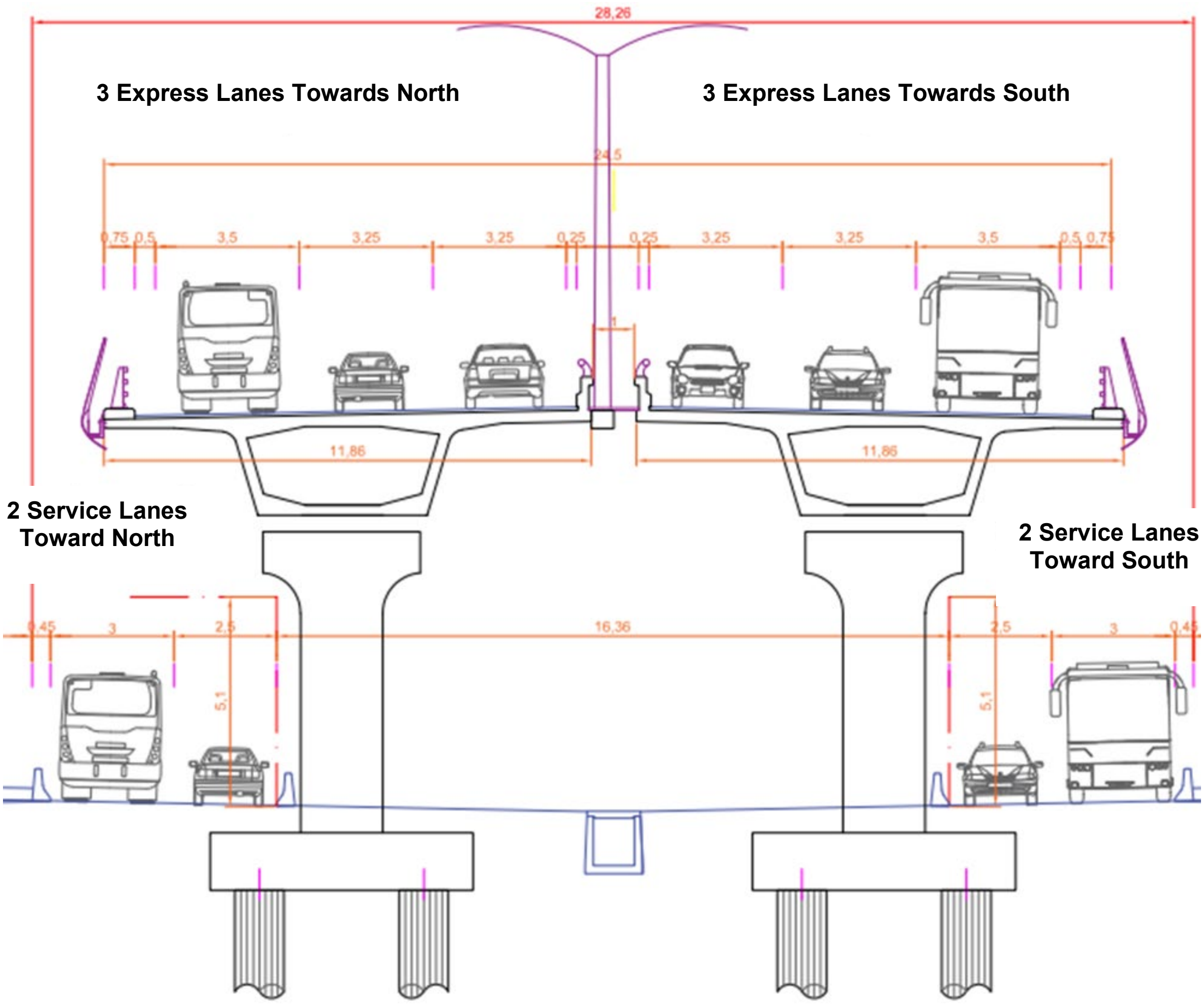


Figure 3-6 Typical Cross Section of a 6-Lanes Flyover

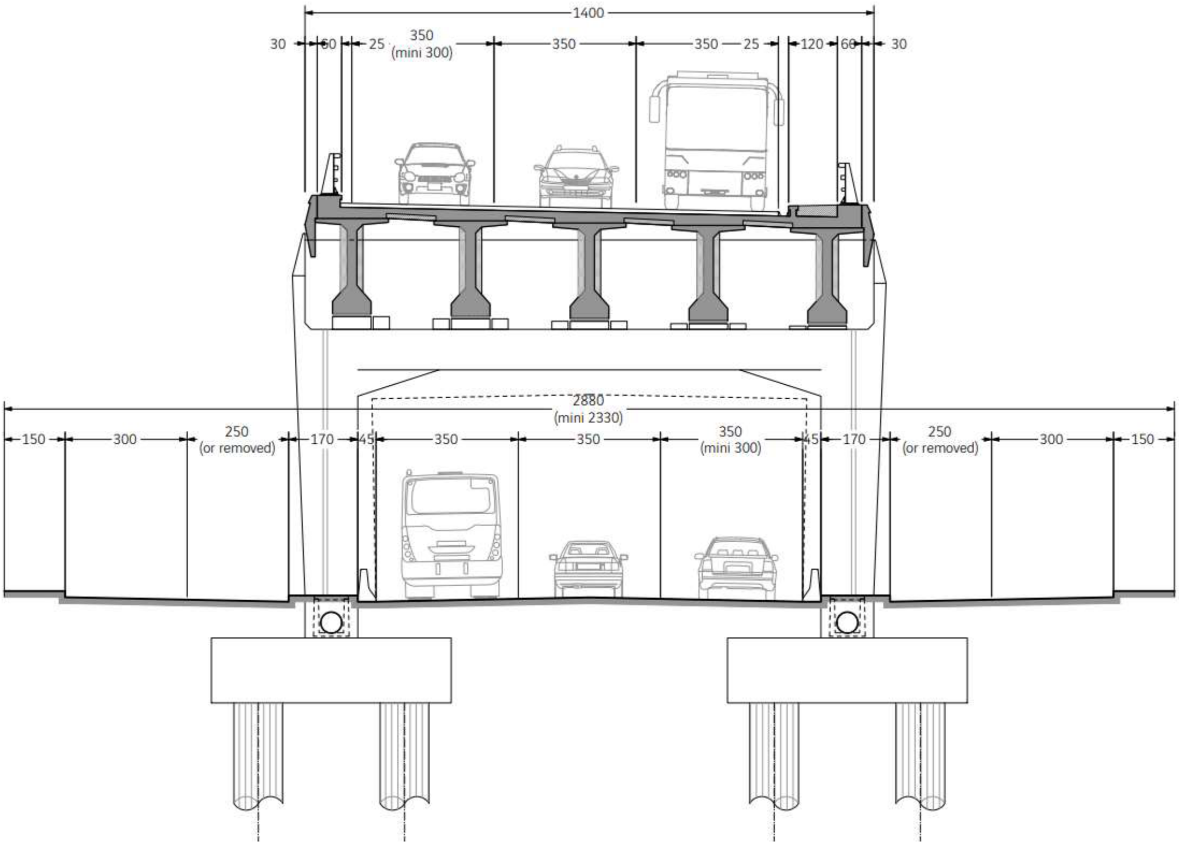


Figure 3-7 Typical Cross Section of a Duplex Type Structure

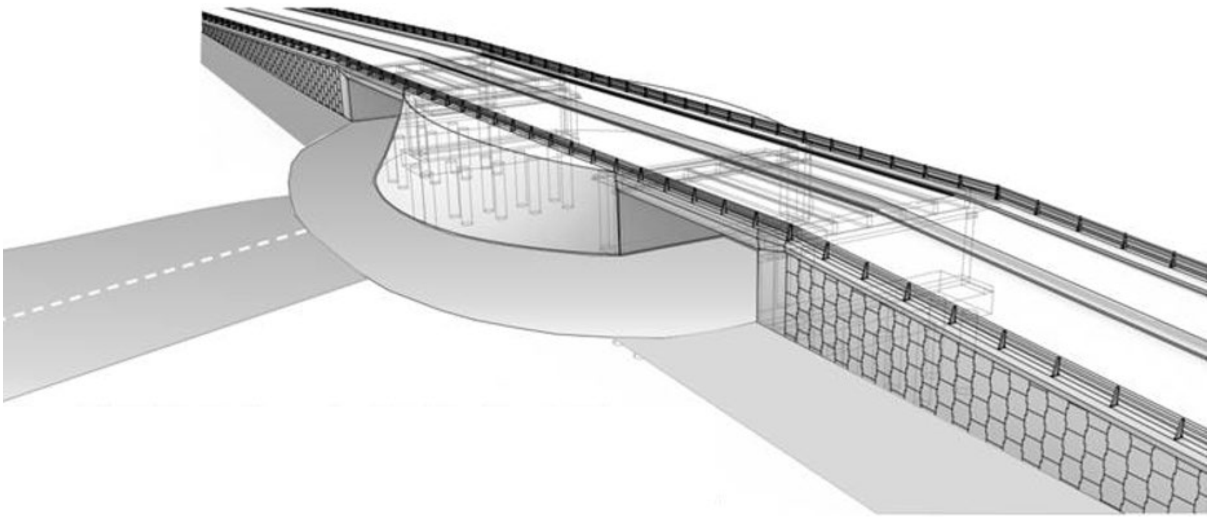


Figure 3-8 Typical view (in 3D) of an underpass above roundabout 3 and roundabout 4

Prior to the current RVH mandate, KeNHA only considered the use of a 6-lanes flyover of 3 to 4 km in length. RVH, while keeping this option in hand, has considered the following additional options:

- The duplex type structure (See figure 3-7) which would span for approximately 2.5 km (including access ramps) from before the railway crossing (eastern part of Nakuru) to the second existing roundabout (center part of Nakuru. The ground level part of the duplex would go below ground at the level of the existing roundabouts 1 and 2. After the second round about, the highway would be 6-lanes wide at ground level and a underpass would be constructed to cross the third and fourth roundabout.
- A combination of flyover, at grade and underpasses sections (see figure 3-9 below) including:
  - A 6-lanes flyover from before the railway crossing to after the first roundabout;
  - A 6-lanes at-grade road between the first and second roundabout;
  - From approximately 200 meters before the second roundabout, a second 6-lanes flyover would be constructed to avoid this roundabout;
  - An underpass (highway going over the roundabout) would be erected to cross the third and the fourth roundabout.

The selected option was finally the combination of underpass, at-grade and viaduct sections. The main reasons were:

- To improve the transparency to pedestrian flows (compared to the Duplex solution);
- To reduce the risk of flooding of the highway (low points in cut and cover sections would likely become flood prone areas);
- To optimize the reuse of existing structures (Railway bridge, pedestrian footbridge, road structure) in order to minimize the impact on user during construction);
- To minimize construction costs.

A combination of underpass, at-grade and viaduct sections was therefore found to be the best from environment and social perspectives as it allows to avoid many impacts of other alternative designs. Details of this design's components are presented in section 4.4.5 of Chapter 4 – Project Description.

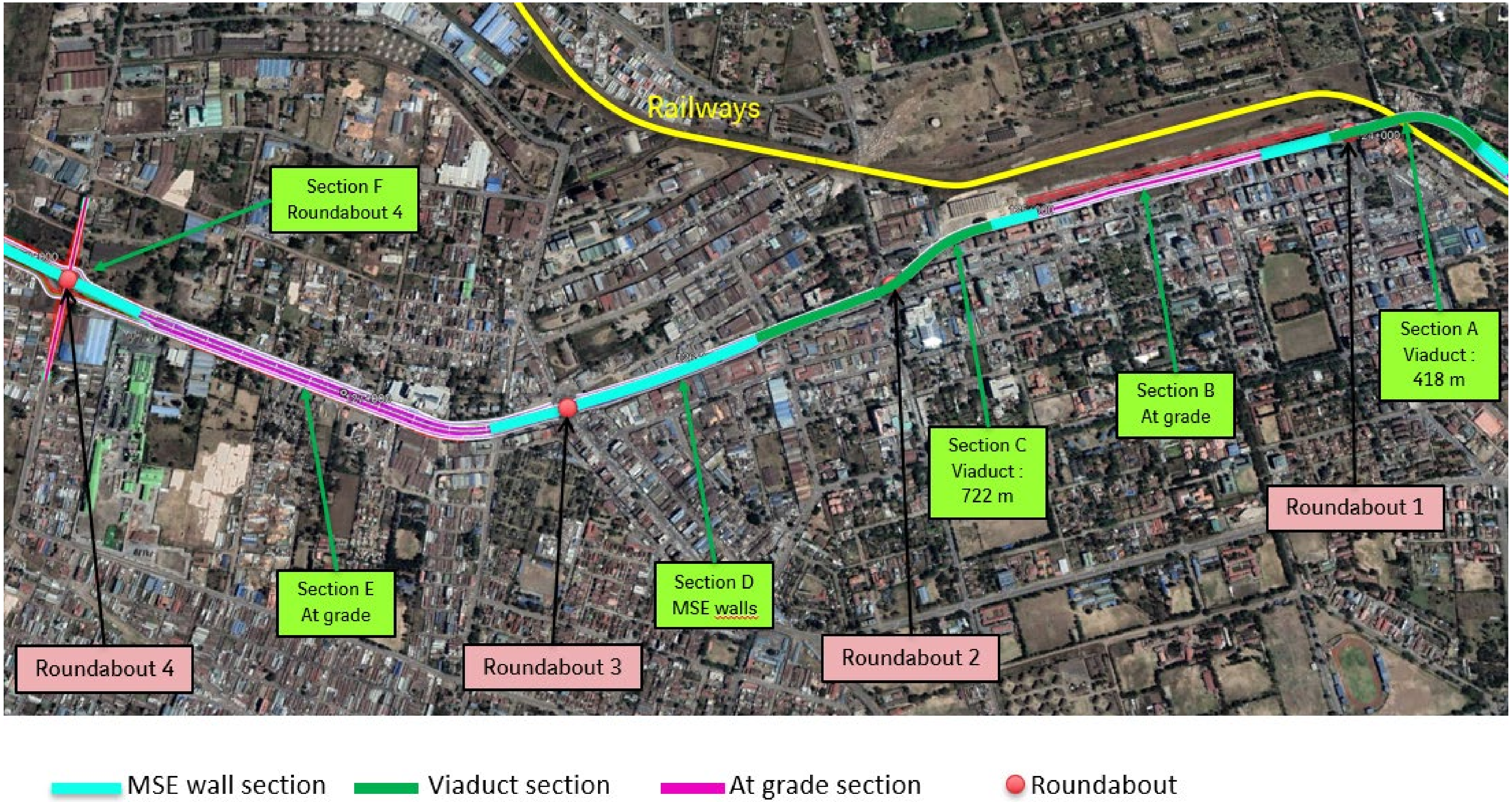


Figure 3-9 Combination Design Schematic Representation

3.2 GENERAL CONSTRUCTION-RELATED ALTERNATIVES

The main construction aspects associated with the Project that could generate the need for alternatives include:

- Various work sites selection, including office spaces, workshops, storage areas and sites for the production of asphalt, and crushing raw granular material and precasting activities. However, it was determined that all office space will be part of existing buildings or composed of mobile offices (construction trailer) located within the quarry sites or precasting yards. Similar with workshops and storage areas, existing yards and buildings will be used along with retained quarry sites (mainly for workshops). Asphalt production and crushing activities will also be installed within the retained quarry sites. Finally, precasting yards will be using existing inactive industrial yards. Apart from the quarry sites, which are discussed below, all other sites will be selected based on available space, location from work sites and rental or acquisition costs.
- Material sourcing concerns, essentially the selection of sites that will supply granular material for the road construction activities. Various sites were considered as presented in section 3.2.1 below;
- Traffic management on the A8 and A8 South during construction activities is a concern and alternatives were considered as presented in section 3.2.2 below;
- Construction approaches for the type of work to be done is quite standard and does not really require the consideration of alternatives. The construction activities considered are presented in Chapter 4. However, although no alternatives were considered, some technical adjustment may be realized to optimise work as construction progresses.

It is important to specify that no workers base camp with living quarters and facilities will be constructed for this project. Some of the impacts related to such worker camps will therefore be avoided.

3.2.1 MATERIAL SOURCING SITES

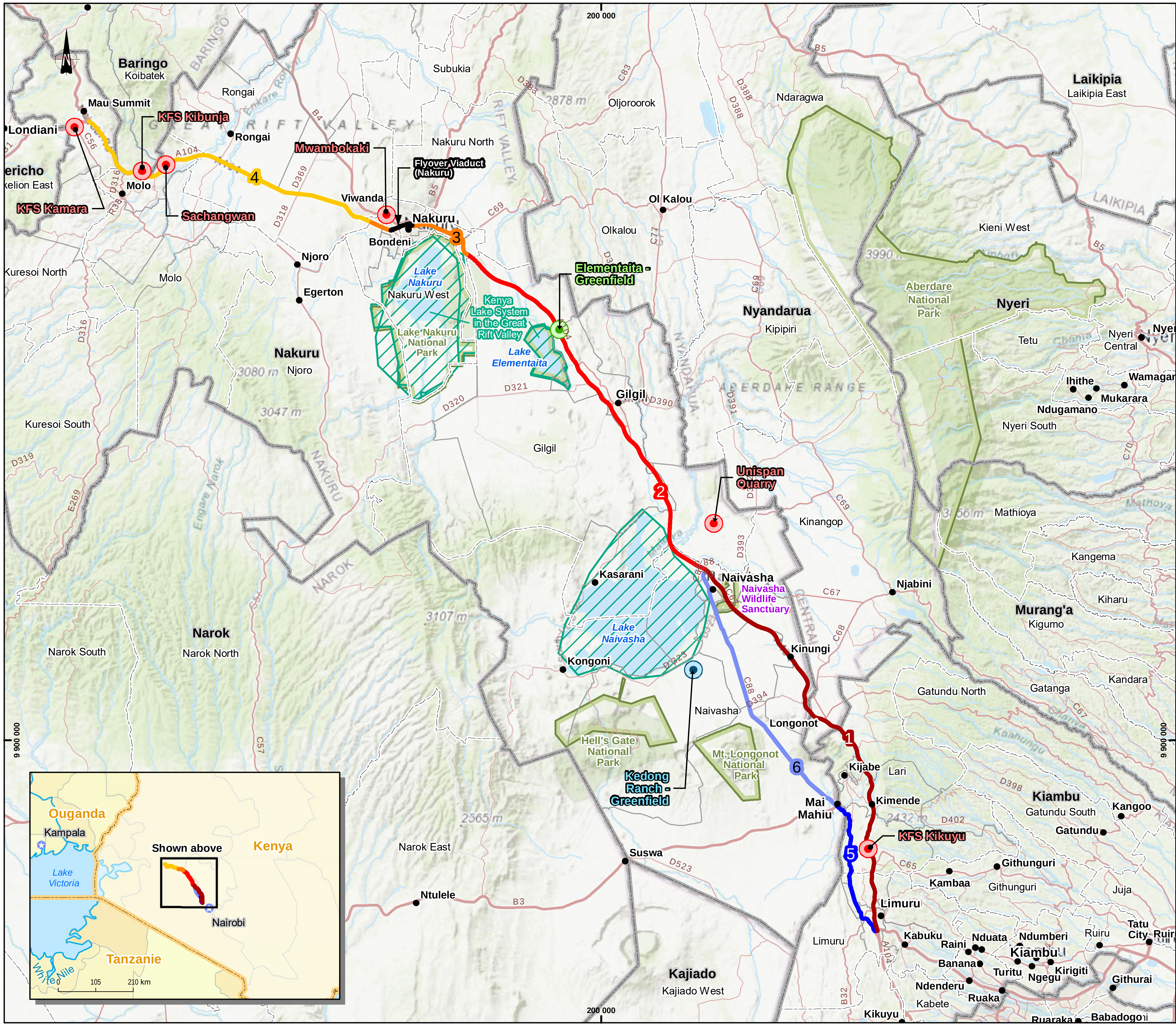
Material sourcing essentially relates to available granular material and sand required for the preparation of road foundation and the production of asphalt and concrete. A total of 8 quarry sites located near the highway alignment (see Map 3-2) were initially considered. Some of these sites are in operation (3) while others would be new sites opened for the Project's use (5). The quarry sites were evaluated based on the following criteria:

- Type of material available (geological characteristics);
- Potential volume available;
- Distance from work area;
- Production installation capacity and price per ton (for those in operation);
- Investment cost for initiating operation (for those currently not in operation);
- Nature of activities close to the quarry site.

Of the 8 quarries initially identified, one has been selected so far as it meets all or most of the selection criteria outlined above (in green on Map 3-2). Another site is under study to determine its suitability and investigations are ongoing to identify a third quarry. The other six sites were discarded as they did not meet the selection criteria. The selected and investigated quarry sites are:

- The Elmenteita site located at CH 98+000, which is a greenfield site: pre-selected;
- The Kedong site located South of lake Naivasha, which is a greenfield site: currently under study.

Investigations are ongoing for a third quarry between CH120 and CH175.



Administrative Limits

- International Boundary
- County (Nakuru)
- Sub-County (Gilgil)
- City (Njoro)

Quarries considered

- Retained
- Rejected
- Under Study

Road Network

- Primary
- Secondary
- Tertiary

Protected Areas

International Level

- Ramsar Site / World Heritage Site

National Level

- National Park / Sanctuary

Project Components

Segment 1 : Dualling of A8 Highway (Rironi - Mau Summit)

- 1 - Rironi – Naivasha
- 2 - Naivasha – Elementaita Road
- 3 - Elementaita Road – Njoro Turnoff (Nakuru Town)
- 4 - Njoro Turnoff – Mau Summit
- Flyover Viaduct (Nakuru)

Segment 2 : Strengthening of A8-South Highway (Rironi - Naivasha)

- 5 - Rironi – Mai Mahiu
- 6 - Mai Mahiu - Naivasha

VINCI meridiam

Nairobi-Nakuru-Mau Summit Highway Project - Rift Valley Highway Limited

Environmental and Social Impact Assessment

Map 3-2
Location of the Quarries considered

Sources :
ESRI World Topographic Map
Open Street Map, hydrography and roads
American Red Cross, Administrative boundaries, 2019
Protected Planet, Ramsar and World Heritage Site, 2020-12

0 5 10 Km
WGS84, UTM 37S

2022-01-14

Preparation: G. Pothier
Drawing: A. Monnard
Validation: G. Pothier
201_10312_00_ESIA_M3_2_LocQuarries_021_220114.mxd

wsp

Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

3.2.2 TRAFFIC MANAGEMENT

The construction of the highway will lead to increased traffic associated with construction activities and will disrupt traffic flow, movement of goods, services and people, hence causing adverse effects. The following alternatives were considered:

1. Rerouting the traffic first from Nairobi to Mai-Mahiu and then west to Narok (see Figure 3-10). Finally, to the north and east through Bomet and Kericho before reconnecting to the highway at the northern extremity of the segment. This option was quickly discarded as it was considered economically unviable to travel distance, existing roads unfit to cope with increase traffic, and cutting off road users whose destinations include towns and settlements between Rironi and Mau Summit.
2. Creation of diversions within the existing road corridor. This option was considered the best from a social and economic perspective because it allows road users interested to travel from Nairobi-Mau Summit to have continuous access without restrictions and maintains social connectivity.

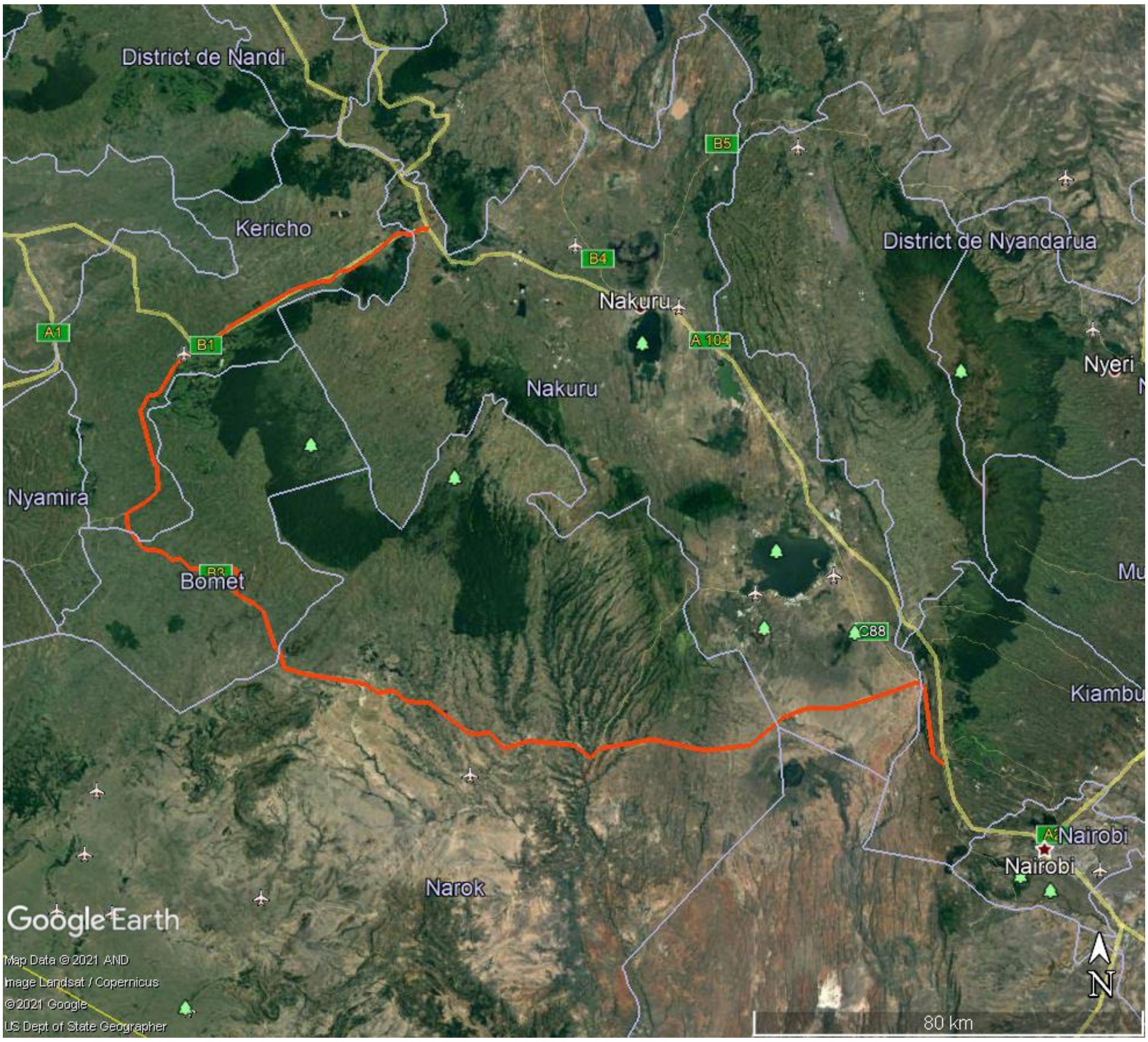


Figure 3-10 Proposed rerouting through Narok, Bomet and Kericho Counties

The overall diversion approach for the A8 Highway, considering that it will be doubled, will be implemented through a two-step staging strategy:

- Stage 1: maintaining traffic on the existing road while constructing the new road axis;
- Stage 2: switching traffic to the new road axis to allow for the rehabilitation of the existing road.

This approach is best to reduce nuisance for users during construction. However, for the section of the A8 Highway passing through Nakuru a specific traffic management approach was design which aims to mitigate as much as possible impact during construction putting in place the 2X2 service lanes within Nakuru crossing at the early beginning of the construction to maintain, as much as possible, current flow all along the construction. This approach is further described below:

1 Between Entry of Nakuru (southern extremity) and roundabout 1

The current 2X2 lanes will be maintained at a central RoW location (i.e. roughly where they are currently located) and construct the fly-over on each side. The space between piers of the viaduct 1 (more than 12 m) allows this arrangement which will in fact corresponds to the definitive configuration.

2 Between roundabouts 1 to 4 (exit of Nakuru Mau Summit side)

Construction will be undertaken by creating 2X2 service lanes on each side of the motorway (At grade or fly-over), divert and maintain the traffic on it since it corresponds to the location of the definitive service lanes. The construction of the motorway (at grade and fly-over) will be done within the remaining central part of RoW. Impact to the current traffic will be minimized because the erection of the piers only has to be done from the ground level.

3 Existing crossings:

Existing roundabouts will be maintained where they are. Provisory diversion and alternatives will be organized as soon as the circulation cannot be maintained during construction.

For the A8 South Highway, the strategy is slightly different as the road will not be doubled but simply rehabilitated. In this case, work will be conducted on a section of one of the road's lanes while traffic will be concentrated on the other. If in some areas, this is not possible because of space constraints, the possibility of implementing localized detours will be considered for example vehicles travelling form Nairobi to Naivasha could be rerouted from the A8 South to the A8. If required, such detours will be discussed with KeNHA and others concerned road operators to get their approval.

The solutions presented above will be further clarified through construction phases schematic and later on through detailed phasing which will be presented in a Traffic Management Plan (TMP) which will also include:

The temporary traffic management proposals required for the safe and efficient construction of the Project.

- Clarifications on how proposals have been developed over time, the agreements that are currently in place and those areas that are the subject of ongoing detailed assessment.
- A detailed phasing of works defined by zones and including all measures to ensure safety for all work duration, such as:
  - Vertical and horizontal signage
  - Definition of narrow lanes with transition zones.
  - Diversion route
  - Speed limit
  - lighting

- Lateral protection barrier
- Specific measures ensuring flexibility (e.g. temporary vehicle restraint system)
- Transition from one phase to the other

The phasing of works will:

- be specified according to time within day and week: Day, night, peak hours, week-end, etc.;
- covers Emergency situation in case of accident or incident;
- be approved by both local and national Road authorities prior undertaking works.

4 PROJECT DESCRIPTION

This chapter of the ESIA provides a description of the Project's key components and features as well as the main construction and operation requirements in terms of input and material, output and wastes, equipment and machinery, workforce, schedule, investments, and lifespan.

4.1 PROJECT CONTEXT AND JUSTIFICATION

The Organisation for Economic Co-operation and Development (OECD) reports that deficiencies in road transport connectivity infrastructure in Africa have greatly contributed to the low trade levels of the continent (OECD, 2018[1]). Thus, many African countries are now investing in transport infrastructure to increase regional integration and intra-regional trade (AUC, 2015)[2].

Facing similar difficulties, the Government of the Republic of Kenya (GoK) is engaged in infrastructure development as a key pillar to stimulate the economy and transform Kenya Road connectivity. To achieve this, the GoK is soliciting private investors in the financing, construction, development, operation, or maintenance of infrastructure under Public Private Partnerships (PPP). Through the Kenya National Highways Authority (KeNHA) as the Contracting Authority (CA), the Kenyan Government has received recent funding to expand parts of the global road infrastructures. One of the projects selected by the KeNHA is the Nairobi-Nakuru-Mau Summit Highway Project (the Project) which involves:

- The dualling, into a four-lane dual carriageway of a portion of A8 Highway between Rironi and Mau Summit, including operation and maintenance; and
- The strengthening of A8-South Highway between Rironi and Naivasha, including operation and maintenance.

A portion of A8 Highway is part of the Trans-African Highway (TAH) Network (Figure 4-1). The TAH Network comprises a system of strategic roads liaison, aiming to promote trade and alleviate poverty through highway infrastructure development and the management of road-based trade corridors. The Lagos–Mombasa Highway known as TAH 8, is the principal road between West and East Africa. The A8 Highway is part of the Northern Corridor which is one of the busiest and most important transport corridors in East and Central Africa, providing a gateway through Kenya to the landlocked economies of Uganda, Rwanda, Burundi, Southern Sudan and Eastern DR Congo. It serves as a transportation link for approximately 6 million Kenyans.

According to the RFP-Stage Environmental and Social Impact Assessment (ESIA) Report (KeNHA, 2018) and traffic projection Studies (SETEC, 2018):

- The vehicular traffic on A8 Highway presented an average of 14 450 vehicle per day in 2017 or 5.3 million per year;
- The current traffic is projected to increase by 7% from 2017 to 2025, then by 6% until 2035 and by 5% until 2045 to reach an average number of vehicles per day of 60 000 in 2045. The current road design already leads to accidents for people, livestock and wildlife a situation expected to worsen with gradual traffic increases;
- The A8 and A8 South Road connections are unable to accommodate the ever-increasing traffic leading to extended travel times and worsening of road safety;

---

1 OCDE (2018), Enhancing Connectivity through Transport Infrastructure: The Role of Official Development Finance and Private Investment, The Development Dimension, Éditions OCDE, Paris, https://doi.org/10.1787/9789264304505-en.

2 AUC (2015), Agenda 2063: The Africa We Want, https://au.int/sites/default/files/pages/3657-file-agenda2063_popular_version_en.pdf.

– The slow-moving heavy goods vehicles that do not have the power to maintain their speed in the hilly terrain, slows down the traffic which leads to dangerous situations upon overtaking. The average speed is rarely more than 50 to 60 km/hr which is below the desired level for an international standard highway;

– Between 2012 and 2014, 575 people were killed on the highway according to police statistics.

Increased traffic and congestion are problematic and upgrading the road for better safety and movement is an urgent priority. The enhanced A8 and A8 South Highways infrastructure will contribute to the economic and social development of the entire country and the region's connectivity. Expanding the road capacity and improving the road quality between Nairobi and Mau Summit will allow to accommodate the increasing traffic in a safe and sustainable manner.

Figure 4-1 Overview of TAH Network

4.2 ANTICIPATED BENEFITS

The overall objective of the Nairobi-Nakuru-Mau Summit Highway Project is to improve the movement of goods and people along Highways A8 and A8 South. In addition, to enhance the connectivity between other parts of Kenya and the larger East and Central Africa areas of the TAH Network, there are six key benefits of the proposed road upgrades:

- **Reduced Travel times**: Improved highway conditions will lead to a considerable time saved for travelling and freight shipping. Time savings are estimated to 2 hours on A8 by relieving congestion and upgrading standards (SETEC, 2018[3]). This could also result in a positive environmental impact from reduced time/emissions.
- **Enhanced safety:** The NNM road has been categorised as one of the most dangerous roads globally due to accidents/fatalities, and the Project will help rehabilitate and increase standards. The proposed road upgrades include provision of 4 lanes separated carriageway (A8) that will reduce likelihood of head-on collision of vehicles. Other proposed measures such as major and minor junction improvements, enhancement of road surface (A8 South) and provision of adequate lighting and trains, vehicles, cattle, wildlife and pedestrian overpass and underpass crossings, will help reduce the number of accidents. Thus, reduction in the number of fatal and severe injuries will add to the benefits likely generated by the proposed improvement of the Nairobi-Nakuru- Mau Summit Highway. The 30-year Concession will assist in creating strong operations and maintenance long term.
- **Economic Impacts for individual drivers**: Savings are anticipated in vehicle operating cost, as deteriorated roads are known to cause more damage to vehicles, which lead to frequent break down and higher wear and tear of tires as well as the higher probability of accidents.
- **Economic Impacts for regional and country wide development**: The Project will result in reduced transaction costs in transportation for enterprises and create more certainty in using the Project road for transport, given the elevated standard. Furthermore, availability of reliable transport infrastructure and efficient transportation services is an essential requirement for achieving goals of any development plan. The proposed highway’s improvement will facilitate efficient and reliable transportation of freight to and from Mombasa Port.
- **Employment Generation:** Road upgrades and maintenance activities provide good direct and indirect employment opportunities to skilled and unskilled manpower. The Project is expected to generate 1,500 jobs during construction and 200 jobs during operation, all primarily local. The enhanced income of the local skilled and unskilled workforce will also bring out a multiplier effect to other sectors of the economy.
- **Local Content:** The Project will have at least 40% of labour by value and 40% of materials by value (excluding petroleum and petroleum products) for construction sourced in Kenya.

Other secondary Project benefits include:

- **Enhanced Tourism Experience:** Kenya is a recognized touristic destination and hosts several places of interest for domestic and international tourists. The proposed highway’s improvement will provide reliable and convenient transport infrastructure for domestic and foreign tourists. As a result, this would boost the tourism industry in general and also establish additional hotels and resorts, along with other facilities of tourist attraction.
- **Channelling the Government of Kenya’s resources to other priority projects**: As the construction is financed via private funds, the Government will be able to support other key investment projects.

[3] SETEC International. 2018. *PPP Competition Nairobi-Nakuru-Mau Summit Highway in Kenya – Traffic Study*. 173 p.

4.3 PROJECT LOCATION

The Project is located in the south west portion of Kenya along the existing Limuru-Naivasha-Nakuru-Mau Summit Highway system. The works will be distributed along two paths, one follows the existing corridors of Highway A104 from Rironi north to Mau Summit and the second Highways C88 and B3 from Rironi north to Naivasha. Please see Map 1-1 for the general location of the works. Details on the planned roads sections are presented in Table 4-1 below.

Table 4-1 Road Sections Included in the Nairobi-Nakuru-Mau Summit Highway Project

Segment	Road	Road Section	Nature of work	Section No.	Start-End Points	CH	Existing Number of Lanes	Planned No of Lanes	Approx. length (km)
1	A8	Rironi to Mau Summit	Dualling	1	Rironi – Naivasha	0 – 58+700	2	4	58.7
				2	Naivasha – Elmenteita Road	58+700 – 114+000	2	4	55.3
				3	Elmenteita Road – Njoro Turnoff (Nakuru City)	114+000 – 129+540	4	4 and 6 from 123+500 to 127+700	15.5
				4	Njoro Turnoff – Mau Summit	129+540 – 175+ 000	2	4	45.5
								Sub-Total	**175**
2	A8-South	Rironi Interchange to Naivasha Interchange	Strengthening	5	Rironi – Mai Mahiu	0 – 19+870	2	2	19.9
				6	Mai Mahiu - Naivasha	19+870 – 57+180	2	2	37.3
								Sub-Total	**57.2**
								Total Length (km)	**232.2**

The A8 Highway crosses three counties (Kiambu (≈29.3km); Kayandarua (≈4.8 km); Nakuru (≈140.9 km) and partly encroaches (northern half of right-of-way) in a fourth (Baringo (≈5 km). As for the A8 South Highway, it crosses two counties that is Kiambu (≈17.9 km) and Nakuru (≈39.3 km).

The Project's delimitation coordinates are as follow:

- from (x) 236820.65, (y) 9874606.05 (Arc_1960_UTM _zone_37S) in the Limuru area;
- to (x) 799767.25 (y) 9982461.45 (Arc_1960_UTM _zone_36S) in the Mau Summit area.

4.4 PRESENTATION OF PROJECT COMPONENTS AND FEATURES

4.4.1 OVERVIEW

As previously mentioned, the Nairobi-Nakuru-Mau Summit Highway Project involves the following two primary components:

- The dualling of a portion of A8 Highway between Rironi and Mau Summit, including operation and maintenance; and
- The strengthening of A8-South Highway between Rironi and Naivasha, including operation and maintenance.

In addition, the following list of components are included in the Project:

- Provision of a combination of elevated structures, at grade section and viaducts in Nakuru City;
- Improvements of major and minor roads junctions and U-Turn facilities;
- Grade separated interchanges;
- Provision of service lanes near town and urban stretch as well as in other areas to connect some minor roads in rural parts;
- Provision of climbing lane at steep gradient locations based on prevalent standards;
- Construction of bridges;
- Extension of existing culverts under the 2 newly created lanes and replacement of undersized ones where required;
- Construction of underpasses and overpasses (trains, vehicles, pedestrian);
- Construction of wildlife and livestock crossing points;
- Construction of bus bays and shelters;
- Construction of truck lay-byes;
- Reinforcement of embankments and cuts and construction of retaining walls where required;
- Construction of street lighting and high mast lighting facilities;
- Construction of gantries and road furniture (Delineator, departure terminal, safety barrier, vertical road signs, …);
- Landscaping, etc.

In addition, construction of the project components will be supported by ancillary facilities such as:

- Establishment of construction sites and material sites;
- Establishment of material sites / laydown areas;
- Quarries, borrow pits;
- Etc.

A brief description of the Project Components, ancillary facilities and associated facilities is presented hereafter. Detailed justification for classification of each of them is provided in section 4.4.21 below. The Project Atlas, which is presented as a separate document, illustrates location of many project components along Highway A8 and Highway A8 South.

4.4.2 TEMPORARY CONSTRUCTION FACILITIES

Temporary facilities will be necessary during construction. These temporary facilities will be located on existing industrial or commercial sites which will be bought or rented and located adjacent to the road sections. The main installations will include quarries, plants, road works area, concrete work areas, offices, workshops and laboratories for material control. These installations will be concentrated in five main areas, as presented in Figure 4-2. The location and number of these site may change as the Project development progresses.

4.4.2.1 QUARRIES

As presented in section 3.2.1 and on Map 3-2, at present time and in order to supply required granular material in sufficient volumes, one quarry has been pre-selected, one is under study to determine its suitability and investigations are ongoing to identify a third quarry. Those quarries are:

- The Elementaita site has been pre-selected. It is a greenfield area located at the level of CH98. It is estimated to supply 1,900,000 tons of crushed stones over a 37 months period;
- The Kedong site is currently under study. It is a greenfield area located at the level of CH52 (A8 South), near Naivasha. It is estimated to supply 2,600,000 tons of crushed stones over a 34 months period;
- Investigations are ongoing for a third quarry between CH120 and CH175. It is estimated to supply 1,300,000 tons of crushed stones over an 18 months period.

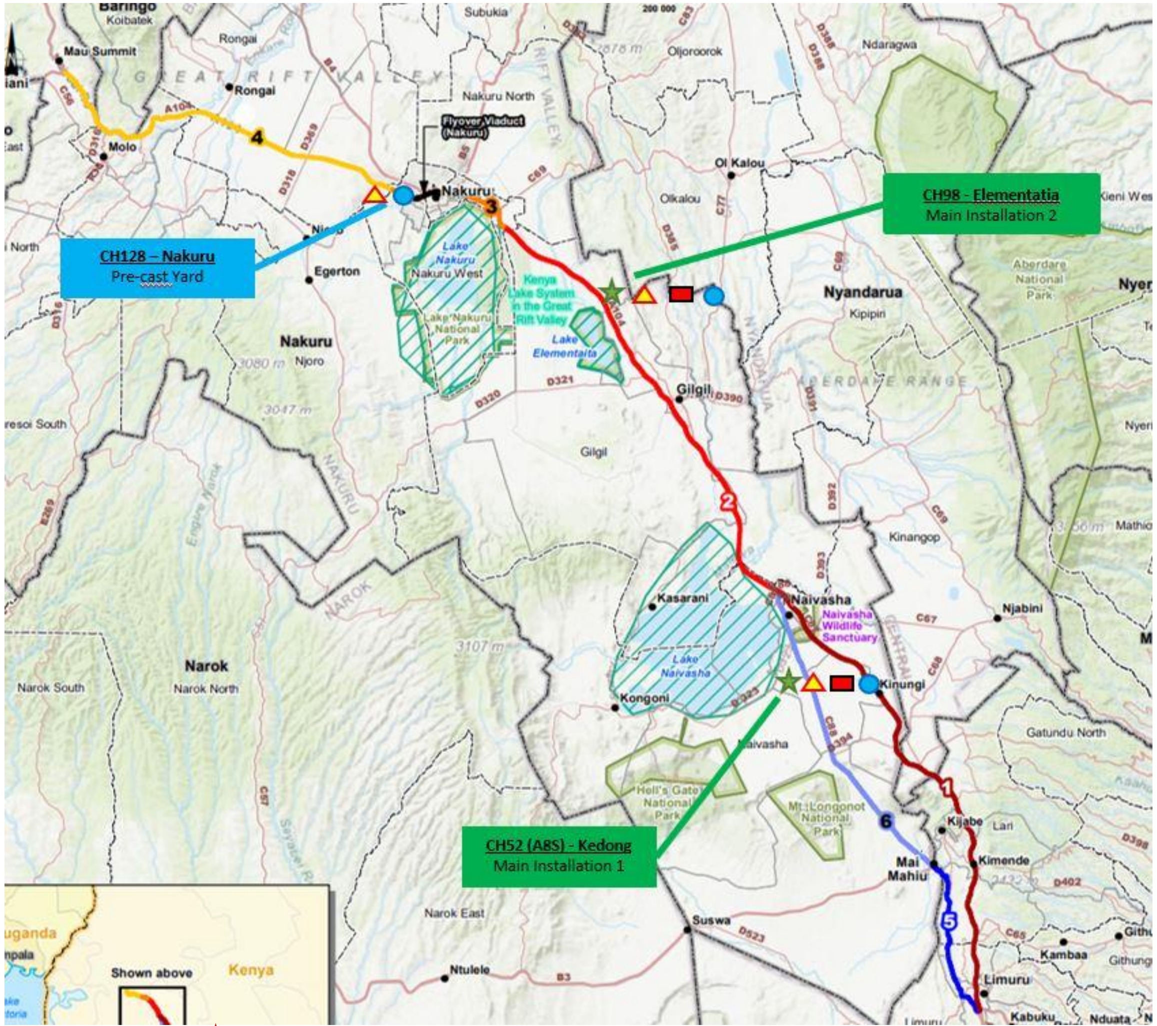
Each quarry site will include storage space for mining activities, a crushing plant and aggregate storage areas. The crushing plant is a one-stop crushing installation, which can be used for rock crushing, building materials crushing and other similar operations. Crushing plants may be either fixed or mobile.

Quarry sites will be acquired on a willing buyer / willing seller basis and written agreements will be made with the landowners. All the commitments agreed on will be achieved and closed. National NEMA requirements will be met (ESIA/ESMP). Specifically, the opening and operating of new quarries will be covered by specific environmental assessments and a license will be obtained from NEMA for each site, as required by the Kenyan legislation for the emission of operation permits. However, note that general impacts associated with the opening and operating of such sites have been taken into consideration within the current ESIA.

4.4.2.2 ROAD WORKS AREA

These include the installations to produce asphalt including an asphalt plant, an emulsion plant and a mixing plant illustrated in Figure 4-3.

Asphalt mixing plants will be required to mix the dry warm aggregate, padding and asphalt into a homogeneous mixture at the required temperature. Three 150-200 Ton/hour Asphalt Mixing Plants will be required for the project. They will be installed within the retained quarry sites mentioned in section 4.4.2.1. This will allow the concentration of industrial equipment and will limit transport of the aggregates.



Note: Offices; Quarries; Precast Yards; Asphalt Plants

Figure 4-2 Location of Temporary Construction Facilities

Main Installation 3 (to be determined)	
Type	Number
Quarry	1
Storage for mining	1
Crusher	2
Aggregate storage	2
Asphalt plant	1
Emulsion plant	1
Offices	1
Total Surface =	251 400 m2

Precast Yard - CH128 - Nakuru	
Type	Number
Precast (beams)	2
Precast (small items)	1
Concrete plant	1
Offices	1
Total Surface =	49 900 m2

Main Installation 2 - CH98 - Elementaita	
Type	Number
Quarry	1
Storage for mining	1
Crusher	2
Aggregate storage	2
Asphalt plant	1
Emulsion plant	1
Mixing plant	1
Concrete plant	1
Precast (small items)	1
Workshops	1
Offices	1
Total Surface =	281 000 m2

Main Installation 1 - CH52 - Kedong	
Type	Number
Quarry	1
Storage for mining	1
Crusher	2
Aggregate storage	2
Asphalt plant	1
Emulsion plant	1
Mixing plant	1
Concrete plant	1
Precast (small items)	1
Workshops	1
Offices	1
Total Surface =	294 200 m2

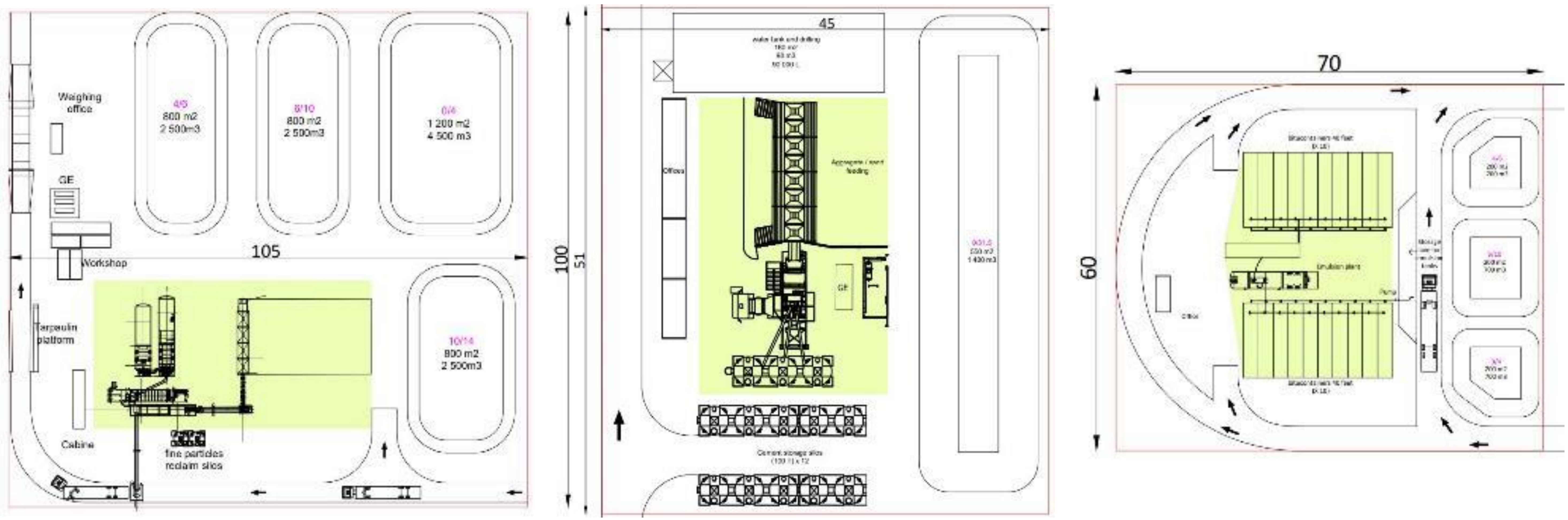


Figure 4-3 **Schematic of a Typical Asphalt Production (left image), Mixing (central image) and Emulsion Production (right image) Plants**

4.4.2.3 CONCRETE WORKS AREAS

The concrete works areas will be dedicated to the production of precast elements required for the construction of the road such as culverts, viaducts and pile sections, etc. There will be two such sites along the Project's alignment, that is:

- One installed within the quarry site located near Naivasha (the Kedong quarry site);
- One located at Maina Yard in Nakuru at the level of CH128+400.

These sites will include a concrete batching plant and a precasting yard for large and small concrete units. The concrete plant, also known as a batching plant or concrete batching plant, will be required to combine water, admixtures, sand, aggregate (rocks, gravel, etc.), fly ash, silica fume, slag, and cement to form concrete. The precasting yard will be used to mold, manipulate and store the concrete units required for the construction of viaducts, bridges, footbridges, etc.

All selected sites were existing industrial or large commercial property available for rental. They are located within commercial and industrial areas.

4.4.2.4 OFFICES AND WORKSHOPS

Offices will be present at each of the quarry and precasting sites mentioned above.

As for workshops, two are currently foreseen. They would be installed on the quarry sites of Elementaita (north of Gilgil) and Kedong (near Naivasha). These workshops will be used for all mechanical work, storage of fuel and of other parts and products required for ensuring maintenance of the construction equipment.

4.4.3 DUALLING OF A8 HIGHWAY BETWEEN RIRONI AND MAU SUMMIT

The dualling of the existing two-Lane A8 Highway to a four-Lane Highway will be executed in Sections numbered from 1 to 4 and starting from km 0+700 to km at the level of Rironi to km 174+500 in Mau Summit. The first 700 meters were already dualled by previous work recently completed (inherited section). Also, a 4.2 km section, within Nakuru and corresponding to km 123+5 to km 127+7, will be expanded to a 6-Lane Highway. The existing Road Reserve and Carriageway are presented respectively in Table 4-2 and 4-3.

Table 4-2 Existing Road Reserve Highway A8

Chainage (km)		Existing Road reserve width (m) – Left1	Existing Road Reserve width (m) - Right2
From	To		
0.000	9+000	25	45
9+000	32+000	30	50
32+000	35+100	50	30
35+100	36+400	80	20
36+400	113+000	35	25
113+000	122.530	Existing 4 lane dual carriageway to be operated and maintained	
122+530	126+540	Available width should allow for at least 28.85 m cross section.	
126+540	175+000	30	30

Notes: 1 Left of the existing centreline of the Project Road considering the travel direction from Rironi to Mau Summit.
2 Right of the existing centreline of the Project Road considering the travel direction from Rironi to Mau Summit

Source: Nairobi-Nakuru-Mau-Summit Highway PPP Project – Schedule 9 Project Site

Table 4-3 Existing Carriageway for Highway A8

Chainage		Length (km)	Roadway Configuration	Planned by the project
From	To			
0+000	114+300	114.300	2 lane carriageway width of 7.5 m + 1.5m paved shoulders on both sides	Widening to 4 lanes
114+300	121+500	7.200	4 Lane dual carriageway width of (7.5m+7.5m) + median (varies from 40 m to 10 m in open areas and turnarounds)	Strengthening.
121+500	131+800	10.300	4 Lane dual carriageway Width of (7.5m+7.5m) + Median (varies from 8 m to 4 m)	Strengthening, and widening to 6 lanes from km 123+5 to 127+7
131+800	136+200	4.400	2 lane carriageway width of 7.5 m + climbing lane of 3.75 m on RHS + 1.5 m paved shoulders on both sides	Widening to 4 lanes.
136+200	175+000	38.700	2 lane carriageway width of 7.5 m + 1.5 m paved shoulders on both sides	Widening to 4 lanes

Source: Nairobi-Nakuru-Mau-Summit Highway PPP Project – Schedule 9 Project Site

The proposed improvement involves 7 m large dual lanes in each direction. A 2 m paved shoulder and a 0.5 m earthen shoulder will be present to the left of traffic lanes. The dual lanes will be separated by a jersey barrier and 0.5 m paved shoulders on each side of the jersey barrier to the right of the traffic lanes. Depending on the topography and on the space available on either side of the existing road, the widening would be done in an eccentric manner. The eccentric widening is the best construction methodology and allows better management of traffic during works. Figure 4-4 below show a typical cross section of the road for the eccentric widening of the existing carriageway.

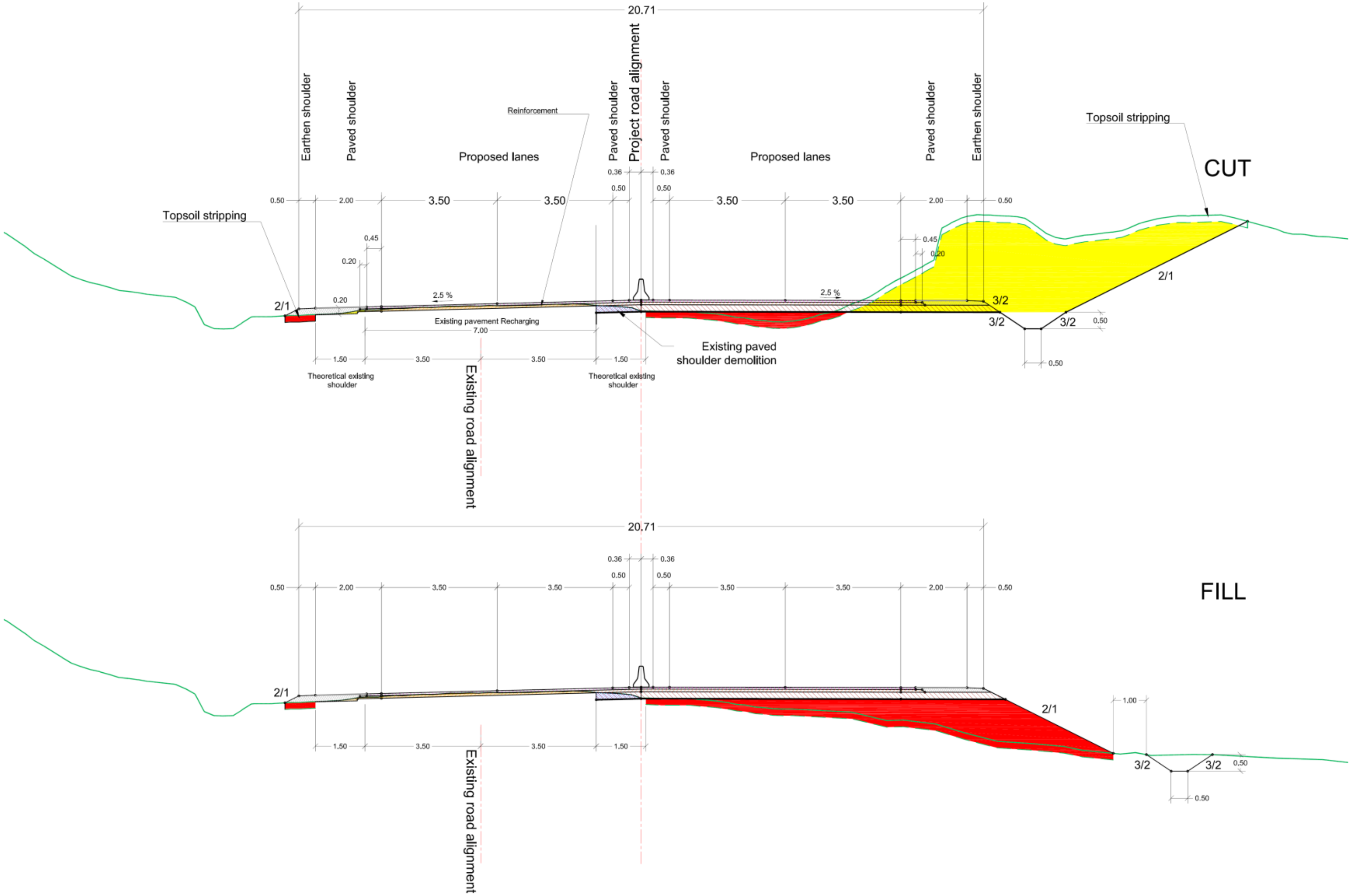


Figure 4-4 Typical Cross Section for Eccentric Widening of Existing 2-Lane Section to 4-Lane Divided Carriageway

4.4.4 STRENGTHENING OF A8-SOUTH HIGHWAY BETWEEN RIRONI AND NAIVASHA

The strengthening of the A8-South Highway between Rironi and Naivasha will be completed in two sections (sections 5 and 6) that are respectively from km 0.000 to 19+751 and from 19+870 to 57+180. The details of the existing Carriageway of the Project Road are given in Table 4-4.

4.4.4.1 EXISTING ROAD RESERVE

The proposed strengthening works will include restoration and reinforcing of existing pavement, structures, drainage and road safety features within the original road footprint. The existing road geometry will be maintained. A service lane will be added on each side of the road in the urban area, as described in section 4.4.9 as well as in other areas to connect minor roads to the highway in rural parts.

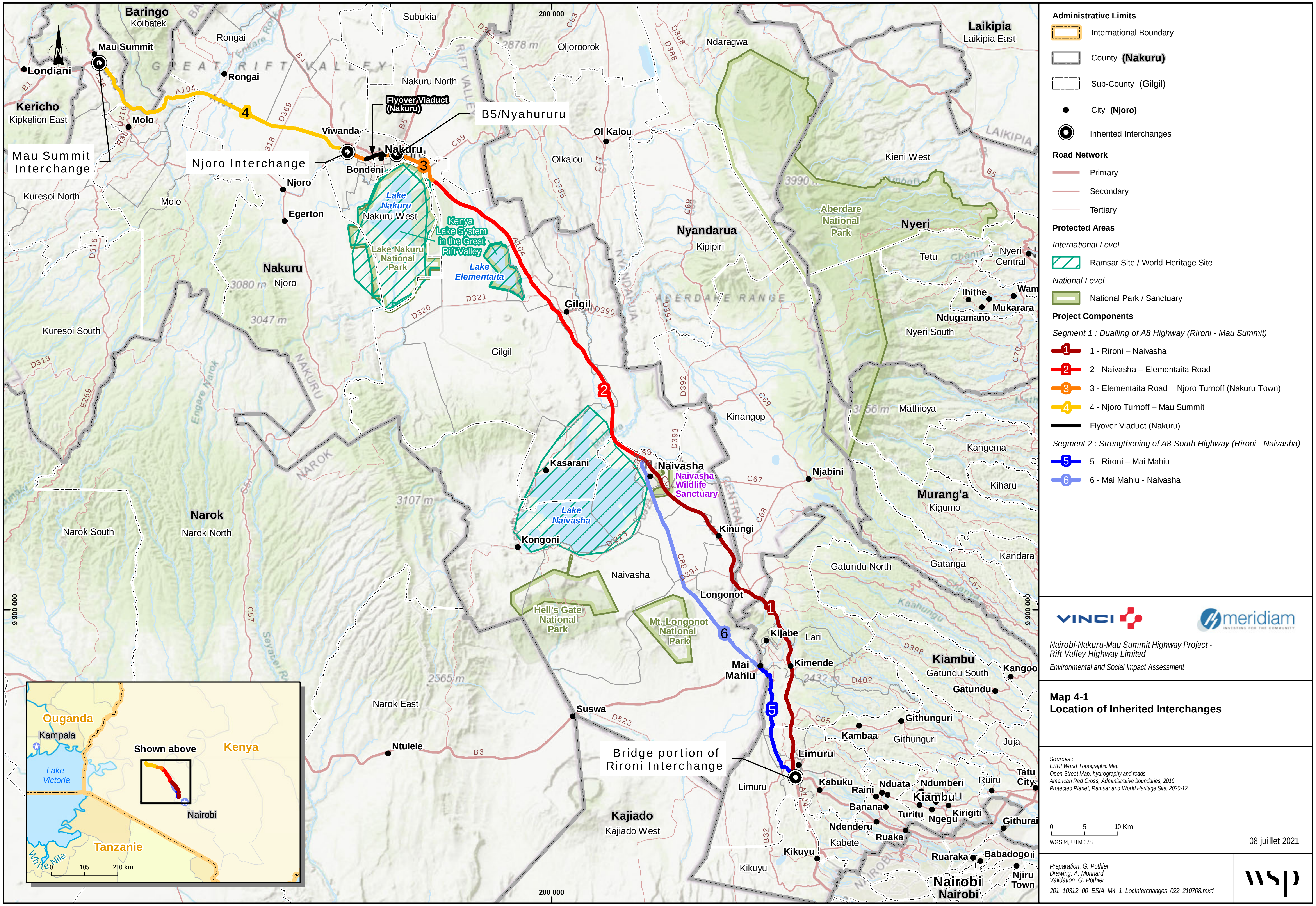
Table 4-4 Details of the Existing Carriageway for Highway A8 South

Chainage (km)		Length (km)	Roadway Configuration
From	To		
0.000	18.750	18.750	2 lane carriageway width of 6.5 m + 1.0m paved shoulders on both sides
18.750	41.500	22.750	2 lane carriageway width of 6.5 m + 1.0m paved shoulders on both sides
41.500	42.000	0.500	2 lane carriageway width of 6.5 m + 1.0m paved shoulders on both sides
42.000	54.200	12.200	2 lane carriageway width of 6.5 m + 1.0m paved shoulders on both sides
54.200	54.800	0.600	4 Lane dual carriageway width of (7.5m+7.5m) + median of 0.5 m + 3.5m wide footpath on both sides
54.800	55.800	1.000	4 Lane dual carriageway width of (7.5m+7.5m) + median of 0.5 m
55.800	57.200	1.400	4 Lane dual carriageway width of (7.5m+7.5m) + median (varying from 5 m to 10 m)

Source: Nairobi-Nakuru-Mau-Summit Highway PPP Project – Schedule 9 Project Site

Four inherited interchanges are to be operated and maintained as part of the Project. These interchanges have been or are being constructed by KeNHA as presented on Map 4-1 and described in Table 4-5 below. No construction work is planned at these locations.

A joint inspection of Inherited Stretched was carried out in 2020. A due diligence review of the stretches will be done by RVHL by reviewing the Defect Report and the as-built documentation.



Map 4-1
Location of Inherited Interchanges

Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

Table 4-5 Description of Inherited Interchanges

Sr No.	Description of Inherited Interchange	Coordinates	Expected construction completion date	Expected end of Defects Liability Period
1.	B5/ Nyahururu Interchange	Latitude 0º16’37”S/ 0º17’02”S and Longitude 36o05’08”E/ 36º06’02”E	Completed in April 2018	April 2019
2.	Njoro Interchange	Latitude 0º16’32”S/ 0º17’06.5”S and Longitude 36o01’15”E/ 36º01’52.5”E	Completed in January 2017	January 2019
3.	Mau Summit Interchange	Latitude 0º08’48”S/ 0º09’43.5”S and Longitude 35º40’49”E/ 35º42’08”E	Completed in January 2017	January 2019
4.	Bridge portion of Rironi Interchange	Latitude 1º07’58.93”S/ 1º07’58.17” S and Longitude 36º38’05.91”E/ 36º38’05.78”E	Bridge portion - 2020 Entire Road – February 2021	12 months following completion of the road

Source: Nairobi-Nakuru-Mau-Summit Highway PPP Project – Schedule 20 Inherited Stretches

4.4.5 6-LANES HIGHWAY IN NAKURU CITY

In the Nakuru City area, the Highway is to be widened to a 6-lane carriage way for a section of approximately 3 km. In order to limit the footprint in this densely populated area within the existing right-of way, a combination of flyover, at-ground and viaduct sections will be used as presented in Table 4-6 and illustrated on Figure 4-5. It should be noted that chainages presented in the table below could vary slightly, following detailed design of the structures to be conducted in agreement with KeNHA.

Table 4-6 Location of Key Features of the Nakuru City Crossing Strategy

Km (approx.)	Feature
First Flyover Section including ramps (length: 795 m)	
123+570	Start Ramp 5%
123+760	Flyover Start
123+950	Rail Overpass (2)
124+100	Roundabout 1 Overpass
124+170	Flyover End
124+365	End Ramp 5%
At Grade section (length: 650 m)	
124+365	Start of at Grade Section
125+015	End of at Grade Section
Second Flyover Section including ramps (length: 1,010 m)	
125+015	Start Ramp 5%
125+140	Flyover Start
125+500	Roudabout 2 Overpass
125+880	Flyover End
126+025	End Ramp 3.5%

Km (approx.)	Feature
Embanked section (+3.5 m) (length: 270 m)	
126+025	Start of Embanked Section
126+295	End of Embanked Section
Viaduct including ramps (length: 315 m)	
126+295	Start Ramp 3.5%
126+380	Viaduct Start
126+415	Roundabout 3 Overpass
126+460	Viaduct End
126+610	End Ramp 5%

Source: NNM-VEP-TWO VIADUCTS SOLUTION-29-06-2021 (RVH, 2021)

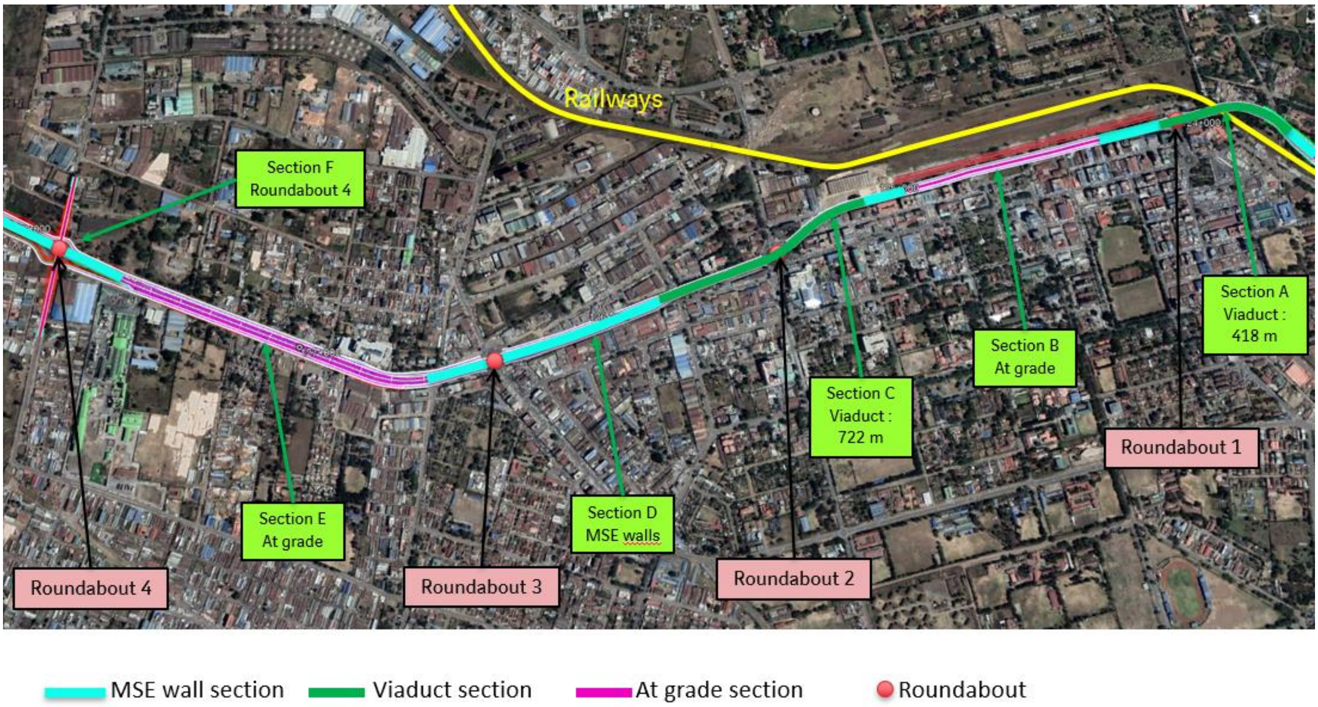


Figure 4-5 Schematic of the Nakuru City Crossing (in blue access ramps)

Figures 4-6 illustrates typical cross sections of the flyover while Figures 4-7 to 4-9 show 3D views of, respectively, the first flyover and the at grade section, the second flyover and the viaduct. These Figures also illustrate the fact that double lanes service roads will also be present on each side of the proposed new highway and this for the entire length of Nakuru City.

As illustrated on Figure 4-6, the flyovers will be composed of two distinct platforms of almost 12 m in width supported by piles. The total width of the flyover will be of approximately 25 m. Each pair of piles will be spaced from the next one by 38 m. Ramps and the embanked section will be built using reinforced retention walls to limit land occupation.

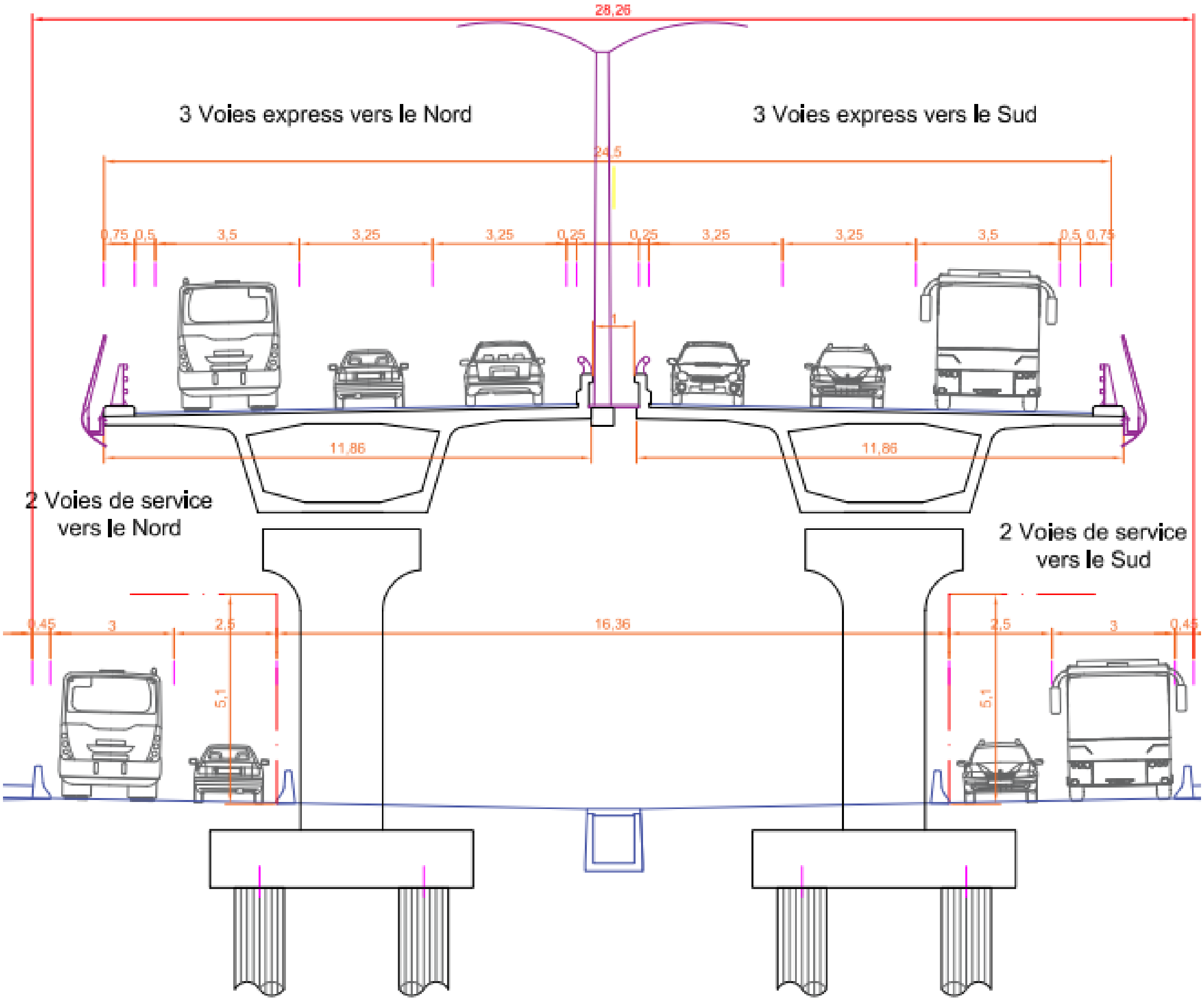


Figure 4-6 Typical Cross-Section of the Flyover

Figure 4-7 3D Representation of the First Flyover Section over Nakuru's 1st Roundabout with a view on the at Grade section

Figure 4-8 3D Representation of the Second Flyover Section over Nakuru's 2nd Roundabout with a View on the Embanked Section

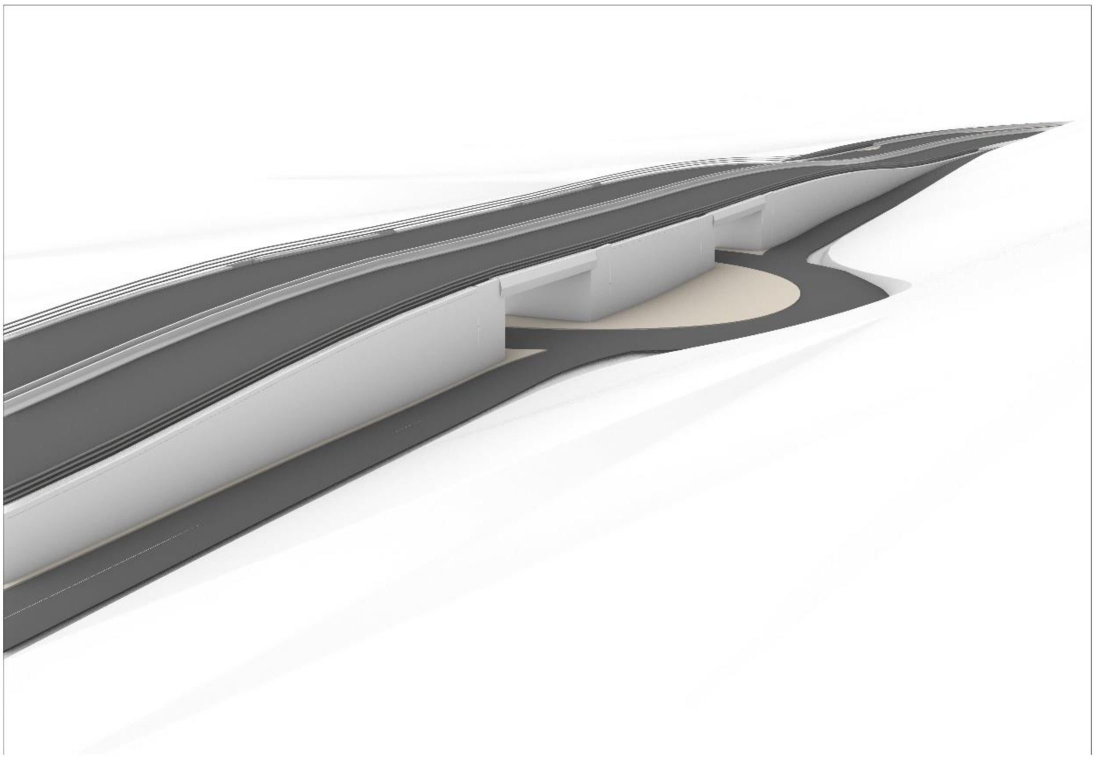


Figure 4-9 3D Representation of the Viaduct over Nakuru's 3rd Roundabout

4.4.6 IMPROVEMENT OF ROAD JUNCTIONS AND U-TURN FACILITIES

Improvement to major and minor junctions are planned upon the traffic projections, turning movement counts and recognition of requirements by site inspection. All existing roads of class A, B and C (in accordance with the gazetted road register) and other strategic secondary roads that join A8 Highways shall be connected using grade-separation. These junctions will be done through grade separated structures. All other classes of crossroads are to be given access only through Service Lane/slip roads. Table 4-7 summarize the locations of existing crossroads with approximate chainages.

Existing junctions along the A8 South Highway are to be improved at-grade. Possible resurfacing shall be planned at these junctions.

Table 4-7 Locations of Crossroads with Approximate Chainages

No.	Chainage (Km)	Location	Intersecting Road	Category and Number	Type of structure (indicative may be subject to modification)
Highway A8					
1	0+000	Rironi	Kamandura - Mai Mahiu - Narok Road	B3	Underpass (inherited stretch)
2	2+900	Limuru	Kiambu Road	-	Overpass (existing)
3	6+020	Ngarariga	Ngarariga Road	-	Underpass (existing)
4	9+190	Uplands	Uplands Intersection	C65	Overpass (new)
5	22+500	Kijabe	Kijabe Road	-	Overpass (new)
6	31+960	Flyover Area	Thika - Mangu Flyover Road	C66	Overpass (existing)
7	53+815	Naivasha	Kenyatta Avenue	C67	Overpass (new)
8	58+715	Naivasha	Naivasha-Maai Mahiu Road	C88	Overpass (existing)
9	85+625	Gilgil	Gilgil Intersection	C77	Underpass
10	114+400	-	Elmenteita Road	-	Underpass
11	121+675	Nakuru	Nakuru-Nyahururu-Nyeri Road	B5	Underpass (inherited stretch)
12	129+535	Nakuru	Njoro Intersection	C56	Overpass (inherited stretch)
13	166+430	Molo	Molo Turnoff	-	Underpass
14	175+000	Mau Summit	Mau Summit-Kisumu-Busia Road	B1	Overpass (inherited stretch)
Highway A8 South					
1	0+000	Rironi	Mai Mahiu - Narok Road	A8 South	No structure, all crossings will be at-grade.
2	2+450	Rironi	Mutarakwa-Limuru Rd	-	
3	2+600	Rironi	D402	D402	
4	19+800	Mai Mahiu	B3 (Mai Mahiu - Narok Road)	A8 South	
5	51+100	Naivasha	Moi South Lake Rd	-	
9	57+200	Naivasha	Nairobi Nakuru Highway	A8	

Source: Nairobi-Nakuru-Mau-Summit Highway PPP Project – Schedule 1 General Scope of Work and Project Description

Furthermore, according to the Project Specifications, no road user should have to travel more than 7 km on plain/rolling terrain and 15 km on hilly/mountainous terrain of the A8 Highway before benefitting from a U-turn facility. U-turn facility will be provided through a grade separated structure, except in section 3 where at grade installations are authorized. These facilities will accommodate all types of vehicles. No specific U-Turn facilities are part of the Project's scope for A8 South Highway, but U-turns are still possible at every crossing point since junctions are all at grade.

A total of 29 separated grade U -turns, 1 at grade U-turns and 1 at grade half U-turns are planned on A8, as presented in Table 4-8.

Table 4-8 U-turns in the Different Sections of Highway A8 and Highway A8 South

Road	Section	U-turn at grade	U-turn Grade-separated structure
Highway A8	Section 1	0	11
	Section 2	0	8
	Section 3	1,5	3
	Section 4	0	7
Highway A8 South	Section 5	0	0
	Section 6	0	0

Source: NNMS Kenya bridges breakdown by counties

4.4.7 VEHICLE OVERPASSES (VOP) AND VEHICLE UNDERPASSES (VUP)

A total of 26 vehicle overpasses and 13 vehicle underpasses are implemented along the A8 Highway. None are required for the A8 South as all road junction will be improved at grade (Table 4-9 and 4-10). Most of these structures are also counted as U-turn facilities (see section 4.4.7 above).

As for railway crossing the current type of crossing (underpass or overpass) will be maintained. However, all overpass structures will need to be demolished and rebuilt to accommodate the new highway lanes. As for underpasses, priority will be given to keep the existing structures and to duplicate them for the new lanes. Nonetheless, if the existing structure of an underpass does not offer enough horizontal and vertical clearances or if its general condition does not allow for its reuse, the existing structure will be demolished and rebuilt.

Figures 4-10 and 4-11 show typical cross-section of vehicle underpasses (VUPs) and vehicle overpasses (VOPs) planned for the highway.

Table 4-9 Vehicular Overpasses in the Different Sections of Highway A8 and Highway A8 South

Road	Section	Vehicular overpass	Chainage
Highway A8	Section 1	9	2+900, 6+585, 9+190, 22+500, 31+960, 41+720*, 53+815, 57+180 and 58+715
	Section 2	7	73+240*, 79+560*, 85+625*, 92+830, 100+315 and 107+015*
	Section 3	4	114+400* and 129+535
	Section 4	6	135+150*, 140+760*, 145+475*, 152+120, 158+570*, 166+430* and 174+800
Highway A8 South	Section 5	0	--
	Section 6	0	--

Source: RVH Plan views, 2021
* These VOPs are still under study and may become VUPs.

Figure 4-10 3D picture of a Vehicle overpass

Table 4-10 Vehicular Underpasses in the Different Sections of Highway A8 and Highway A8 South

Road	Section	Vehicular underpass	Chainage
Highway A8	Section 1	9	0+000, 5+065, 6+020, 15+130, 16+960, 18+820, 35+410, 48+275, 50+090
	Section 2	1	65+460 and 84+700
	Section 3	2	125+400, 125+450, 126+350, 126+410 and 127+825
	Section 4	1	132+160
Highway A8 South	Section 5	0	--
	Section 6	0	--

Source: RVH Plan views, 2021

Figure 4-11 3D of a vehicle underpass

4.4.8 SERVICE LANES

As per the specified requirements of the tendered Project, service lanes are not required for the full length of the proposed new highways but in targeted areas along Highway A8 and A8 South, specifically in urban areas along the Project Road. This is particularly true for the A8 South as it is not planned to enlarge the road.

Nevertheless, during design development, an effort was made to ensure implementation of sufficient service lanes to maintain access with existing local roads and properties that have direct access to the current A104 (future A8 Highway). Furthermore, the proposed locations and length of service lanes were presented to the population during the three public consultation rounds, which has led to adjustments and the provision of additional service lanes. Furthermore, if some difficult situations have not been identified, nor brought to RVH's attention during the public consultation rounds, RVH will coordinate with KeNHA and the proper local authorities to define adequate solutions at detailed design stage.

Unidirectional service lanes will have a width of 4 m (including 2 paved shoulder of 0,5m), whereas bidirectional lanes will have a 7 m width (including 2 paved shoulder of 0,5m), except along the 3 km crossing Nakuru, where the bidirectional service lane bordering the viaduct will be reduced to 5.50 m. Once constructed, the service lanes in Nakuru will be maintained by the Government road agency.

A cumulated total of 127 km of services lanes are planned along Highway A8 and are distributed throughout the various Counties, Subcounties and Wards crossed. As for the A8 South, since it is not being enlarged, service lanes are only planned in built-up areas. Thus, a total of 13 km of service lanes will be built along the A8 South, that is in Mai Maihu, Longonot and when entering Navaisha. Typical cross sections of service lanes in rural and urban areas are illustrated in Figures 4-12 and 4-13. In rural areas, an earth shoulder is planned on the outer edge of the service lane. In urban/built-up areas, in consistency with the available road reserve and when it will be possible, a larger 3 m cycle track/footpath is planned except along the Nakuru crossing where the footpath width is planned to be reduced to 1,50m to minimise the impact on parcels & buildings.

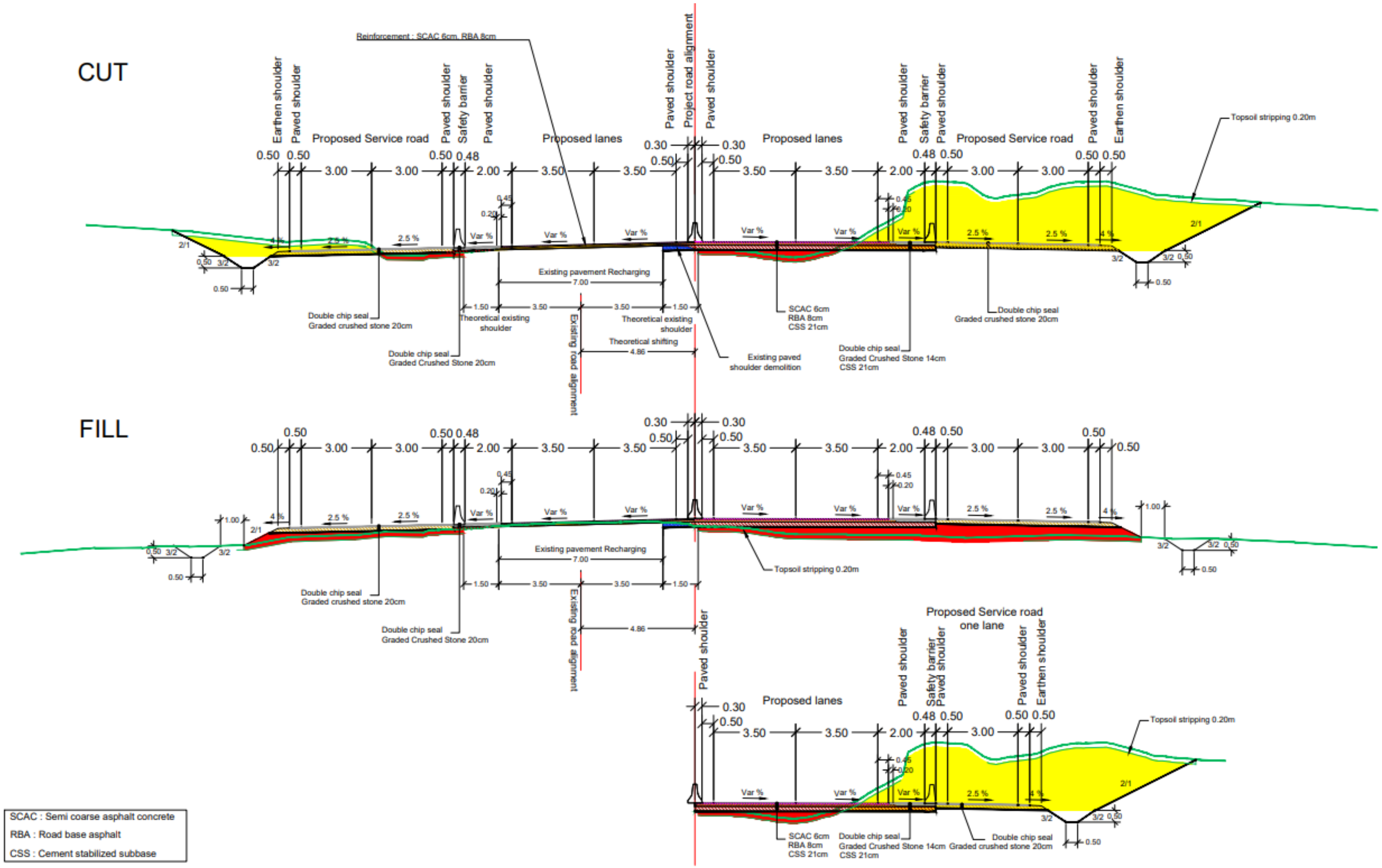


Figure 4-12 **Typical Cross Section for Eccentric Widening of Existing 2-Lane Section to 4-Lane Divided Carriageway with Service Road in Rural Area and hilly terrain.**

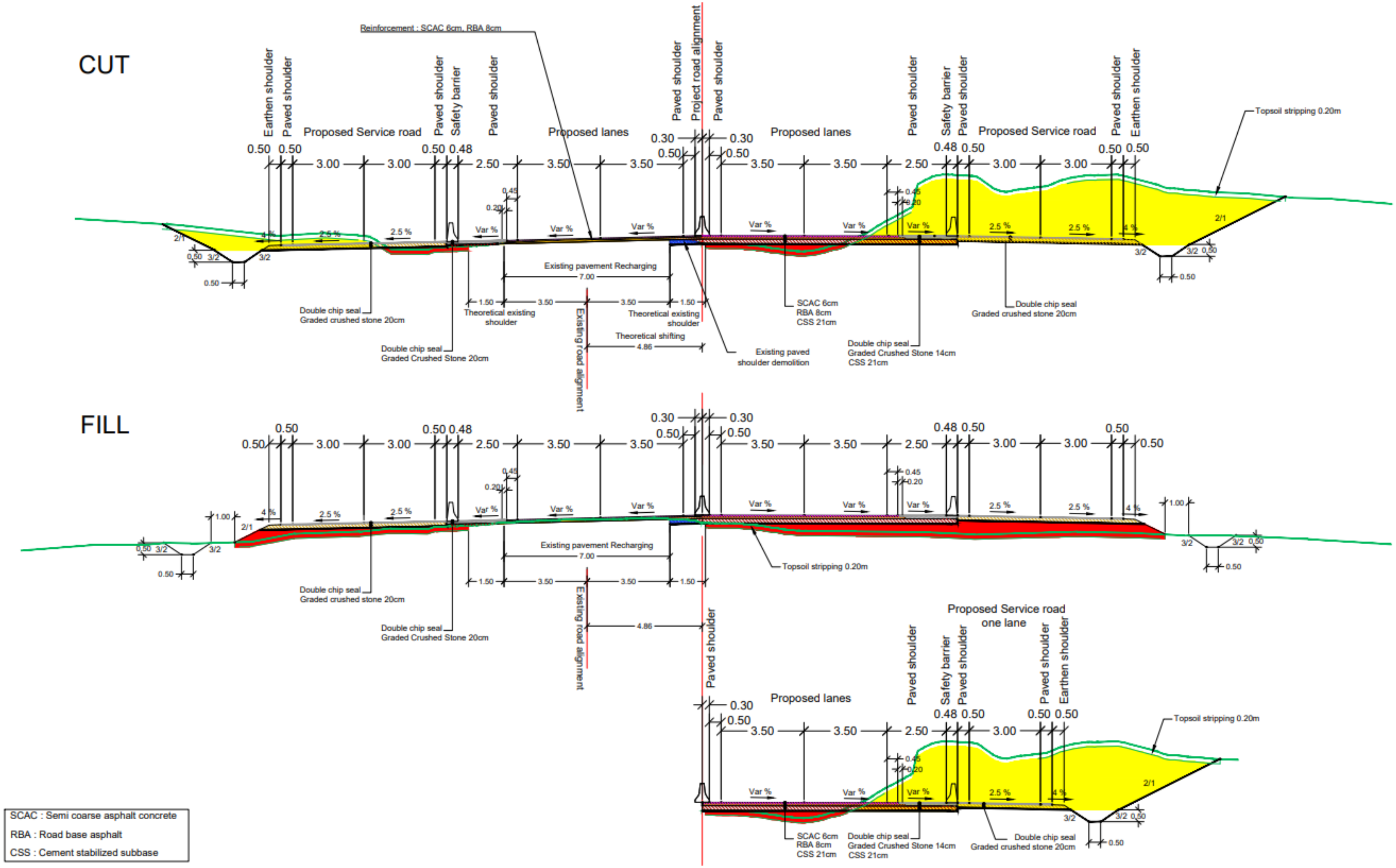


Figure 4-13 Typical Cross Section for Eccentric Widening of Existing 2-Lane Section to 4-Lane Divided Carriageway with Service Road in Rural Area and rolling terrain

4.4.9 CLIMBING LANE AT STEEP GRADIENT LOCATIONS

Climbing lanes will be implemented at steep gradient locations based on prevalent Kenyan standards. None are required on A8 South, whereas 41 kms of climbing lanes are planned on A8.

Table 4-11 Proposed Climbing Lane Locations

Climbing lane	Approximate CH beginning	Approximate CH End	Direction
CL n°1	4+300	6+400	Northbound
CL n°2	12+450	13+400	Northbound
CL n°3	19+450	21+310	Northbound
CL n°4	33+400	35+750	Southbound
CL n°5	38+200	47+500	Southbound
CL n°6	71+450	73+300	Northbound
CL n°7	85+550	87+800	Southbound
CL n°8	90+200	91+600	Southbound
CL n°9	95+200	96+000	Southbound
CL n°10	131+750	136+150	Northbound
CL n°11	154+050	164+700	Northbound
CL n°12	169+700	172+600	Northbound

The climbing lane will be an additional third lane dedicated to heavy goods vehicles, contiguous of the two-lane carriageway. In areas where climbing lanes would be required, all three lanes would be 3.25 m wide and the adjoining paved shoulder would be reduced to 0.5 m, as illustrated in Figure 4-14 below.

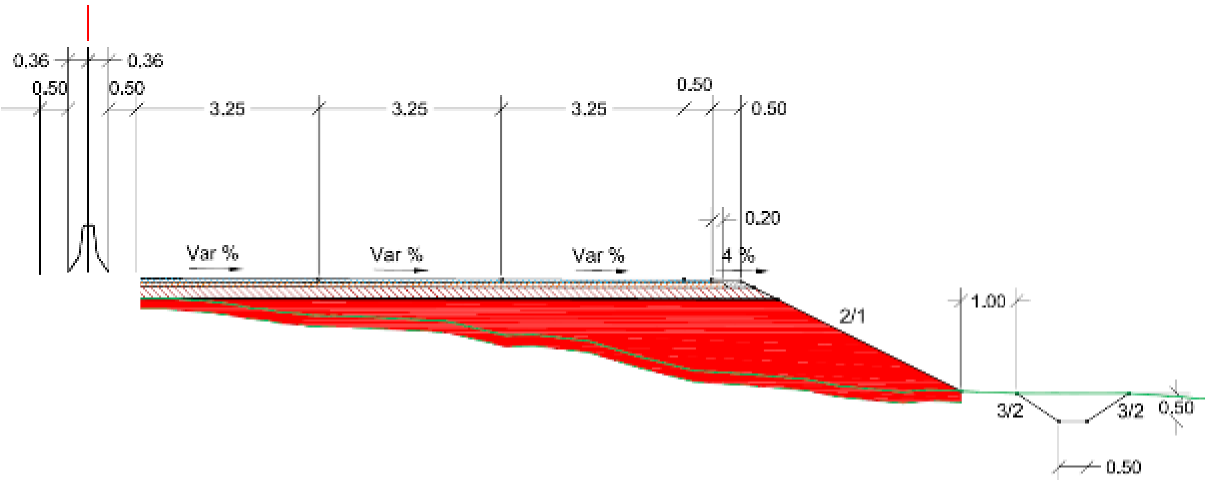


Figure 4-14 Typical Highway Cross Section with a Climbing Lane

4.4.10 BRIDGES

There are no major bridges (any structure built over or under river, road or rail of an overall length of more than 60 m) foreseen as part of the Project Development; except for the Nakuru crossing.

Minor structures mean any structure built as an underpass or overpass with an overall length of more than 6 m and less than 60 m. These are described and listed in respective sections on VOPs and VUPs (section 4.4.8) and on Pedestrian and Cattle Crossing Facilities (section 4.4.12).

4.4.11 RAILWAY UNDER/OVER BRIDGE

Highway A8 crosses a railway at 5 different locations and there are 3 such crossing for Highway A8 South counts (Table 4-12).

Table 4-12 Railway Overpasses and Underpasses in the Different Sections of Highway A8 and Highway A8 South

Road	Section	Number of Railway Overpasses	Number of Railway Underpasses
Highway A8	Section 1	-	1 (CH 12+270)
	Section 2	1 (CH 80+040)	-
	Section 3	1 (CH 129+960)*	1 (2 lanes: CH 116+175/116+225)
	Section 4	-	1 (CH 132+160)
Highway A8 South	Section 5	-	-
	Section 6	-	3 (CH 33+950, 48+600 and 54+100)**

* The railway overpass located at CH 123+960 in Nakuru could also be considered as an underpass (Duplex).
** The 3 existing bridges are not impacted by the rehabilitation works foreseen on A8 south.
Source: Plan views

The existing crossing type will be preserved (underpass or overpass). Railway overpasses will need to be demolished and rebuilt. For underpasses, priority will be given to keep the existing railway structures and to extend them along Highway A8. However, if the existing railway structures do not offer enough horizontal and vertical clearance or if their condition does not allow their reuse, the existing structures will be demolished and rebuilt.

The railway overpasses will be designed to be compatible with a future widening to 2x3 lanes of the motorway. The underpasses will be designed for 4 lanes (and widened later when the third lane will be necessary).

RVH shall be responsible for design, construction, and operation and maintenance of the structural components of the existing rail overpass/underpass. however, construction, operation and maintenance of rail components shall remain with the Kenya Railway Corporation. RVH shall carry out design, construction, operation and maintenance of the structural components in coordination with the Kenya Railway Corporation.

4.4.12 PEDESTRIAN AND CATTLE CROSSING FACILITIES

4.4.12.1 PEDESTRIAN CROSSING

A total of 25 foot-over-bridges (FOB) are planned along Highway A8 and A8 South for pedestrian crossing. The number of FOBs in each Highway A8 and A8 South sections is provided in Table 4-13 and visual representation of a typical FOB is illustrated on Figure 4-15. In urban areas, the feasibility of designing pedestrian passages to accommodate physically challenged persons will be examined. Otherwise, there will be access with stairs. In addition to these infrastructures which are specific to pedestrian, it must be noted that all cattle underpasses will also be designed to allow for pedestrian crossings.

Figure 4-15 Typical FOB with (below) and without (above) ramps for low mobility people.

Table 4-13 Foot-over-bridge Facilities in the Different Sections of Highway A8 and A8 South

Road	Section	FOB	Chainage (km)
Highway A8	Section 1	5	0+700, 23+885, 31+000, 51+290 and 52+300
	Section 2	5	89+500, 91+325, 96+675, 110+370 and 113+100
	Section 3	4*	116+500, 118+950 120+750 and 126+900
	Section 4	9	130+275, 137+140, 138+560, 142+990,147+200, 155+545, 168+430, 171+200 and 173+500
Highway A8 South	Section 5	0	
	Section 6	2	24+900, and 34+900

Source: 201_103_00_Synoptic PPP NNMS 2021.02.05.xlsx
* Note that an FOB already exists at CH 124+000 of Section 3 and will be maintained.

In addition to the two FOBs already planned for the A8 South Highway, 16 at-grade pedestrian crossing facilities will be installed. These crossing would comprise of a combination of zebra crossings, speed bumps and rumble strips in urban area while they would include only signage and zebra crossings at bus stops and at the level of schools in rural areas as illustrated in Figures 4-16 to 4-18. These pedestrian crossings will be located at CH 01+500, 15+900, 20+100, 20+500, 21+700, 31+000, 31+800, 33+500, 34+300, 35+400, 51+300, 53+000, 54+400, 55+050, 55+900 and 56+100.

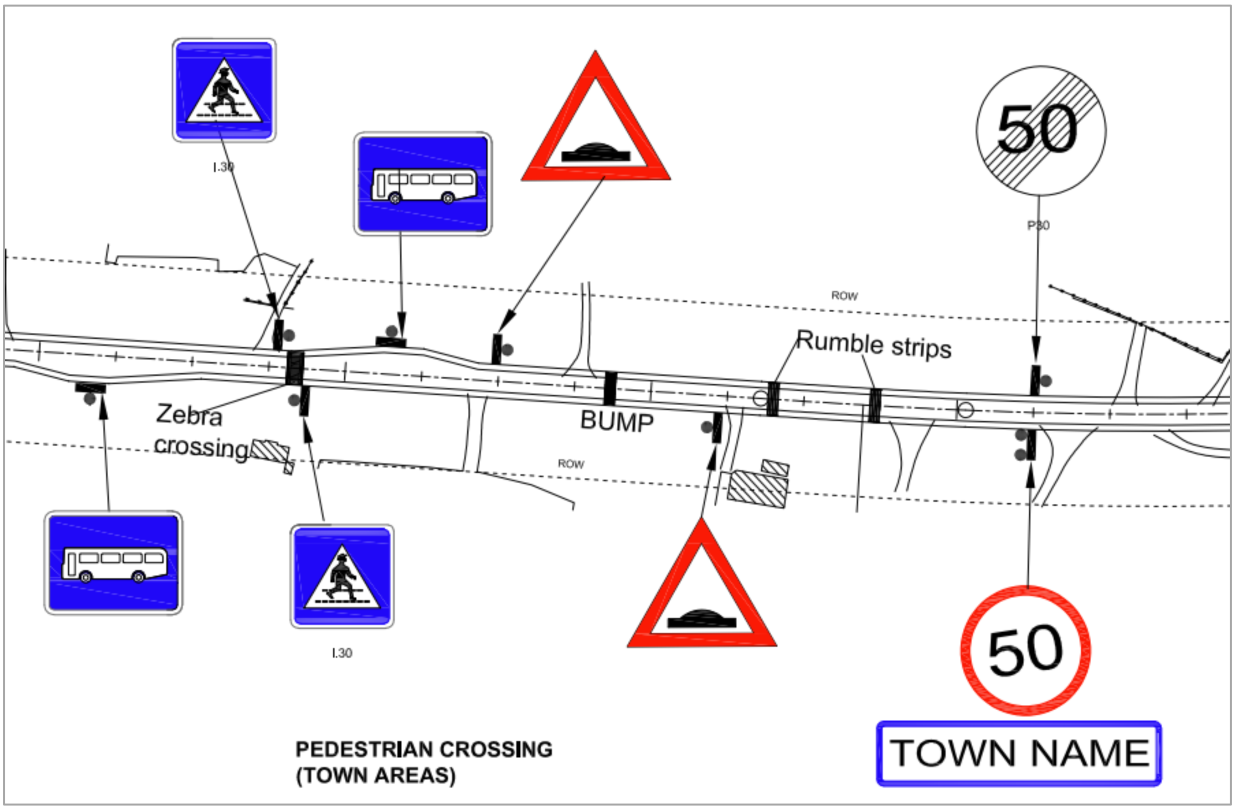


Figure 4-16 At-grade Pedestrian Crossing in Urban Area of the A8 South

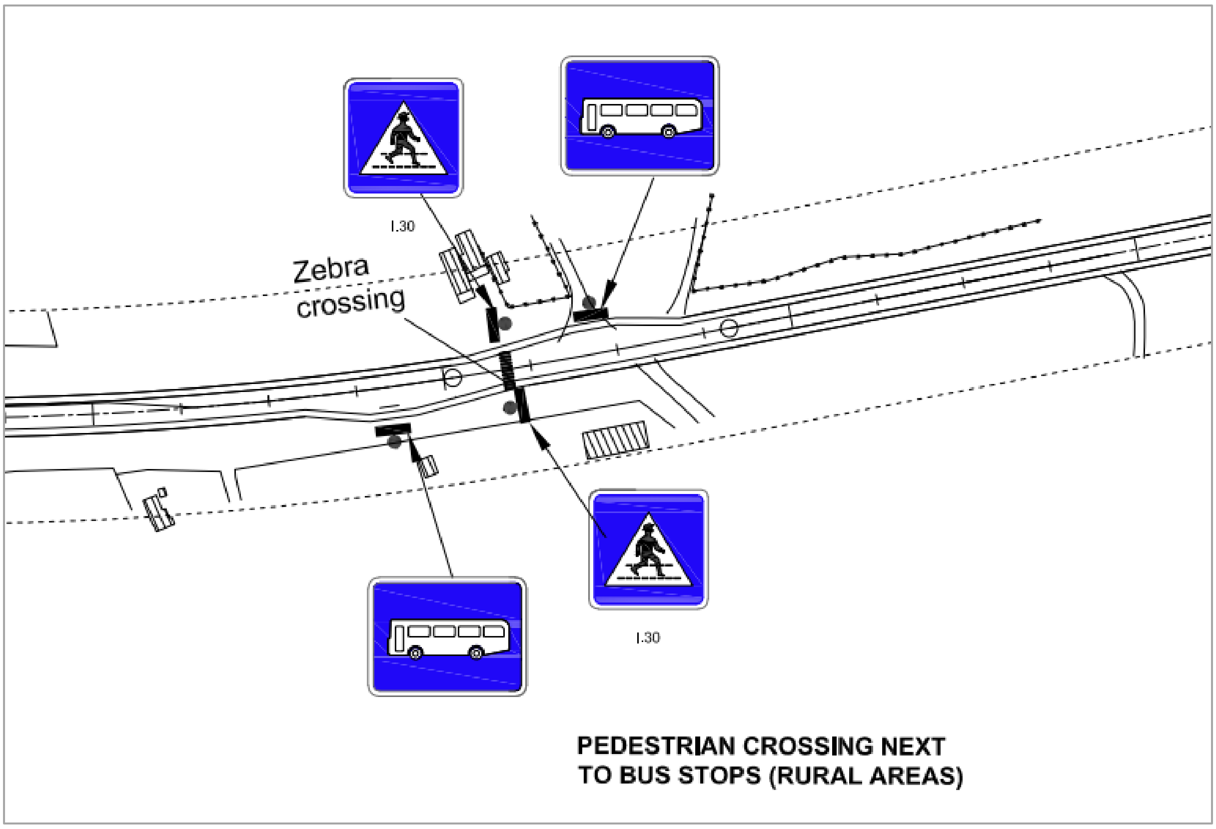


Figure 4-17 At-grade Pedestrian Crossing in Rural Areas at the Level of a Bus Stop

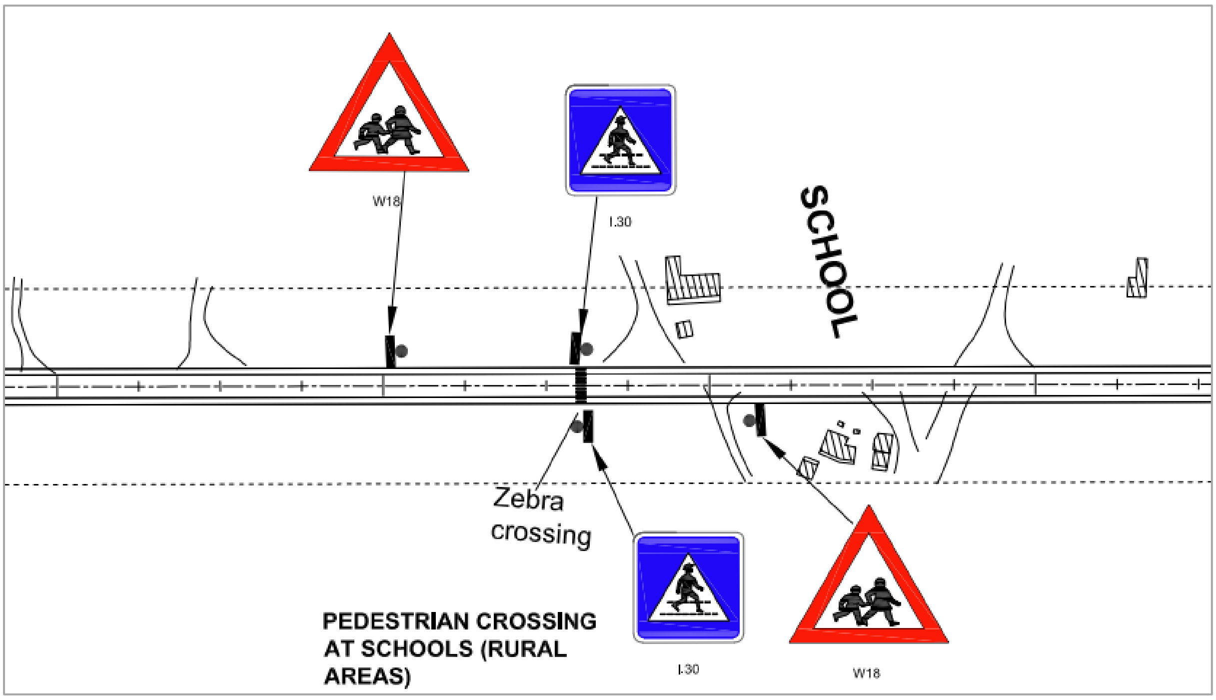


Figure 4-18 At-grade Pedestrian Crossing in Rural Areas at the Level of a School

In Nakuru, the existing road structure does not offer dedicated safe pedestrian crossings. The proposed design for the Nakuru crossing, presented in section 4.4.5, will offer various types of dedicated pedestrian crossings as illustrated in Figure 4-19. These crossing will include 4 at grade crossing the Mechanically Stabilized Earth (MSE) wall sections as illustrated in Figure 4-20 as well as six at-grade zebra crossings and two foot-over-bridges.

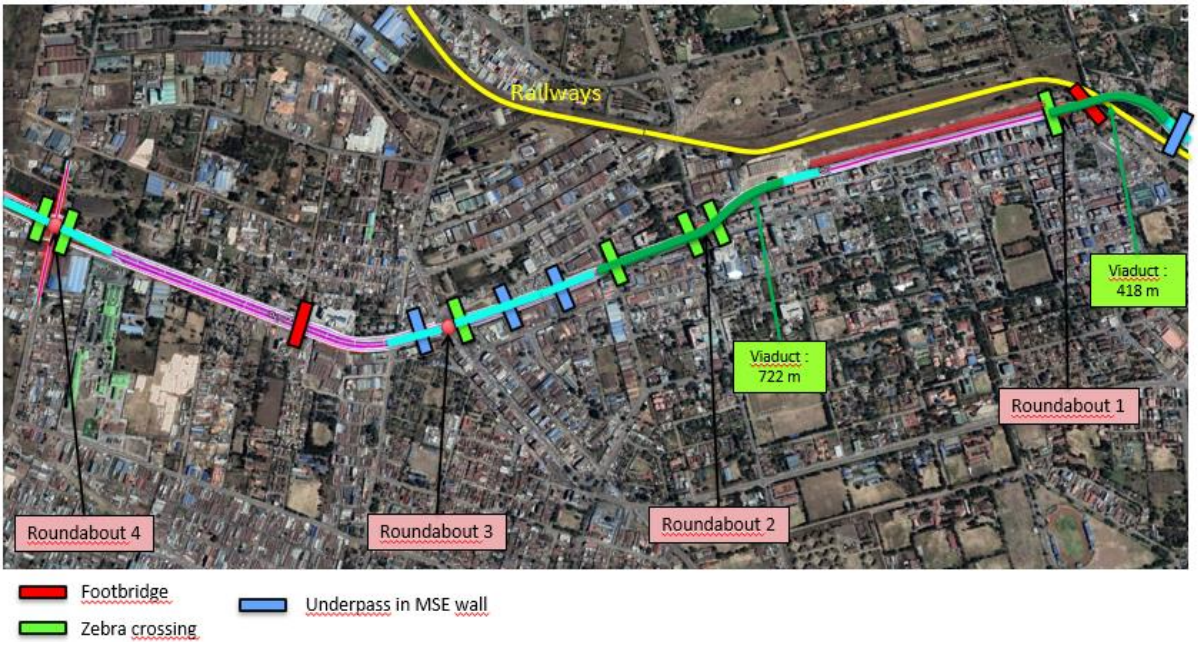


Figure 4-19 Proposed Pedestrian Crossings for the Nakuru Crossing Section

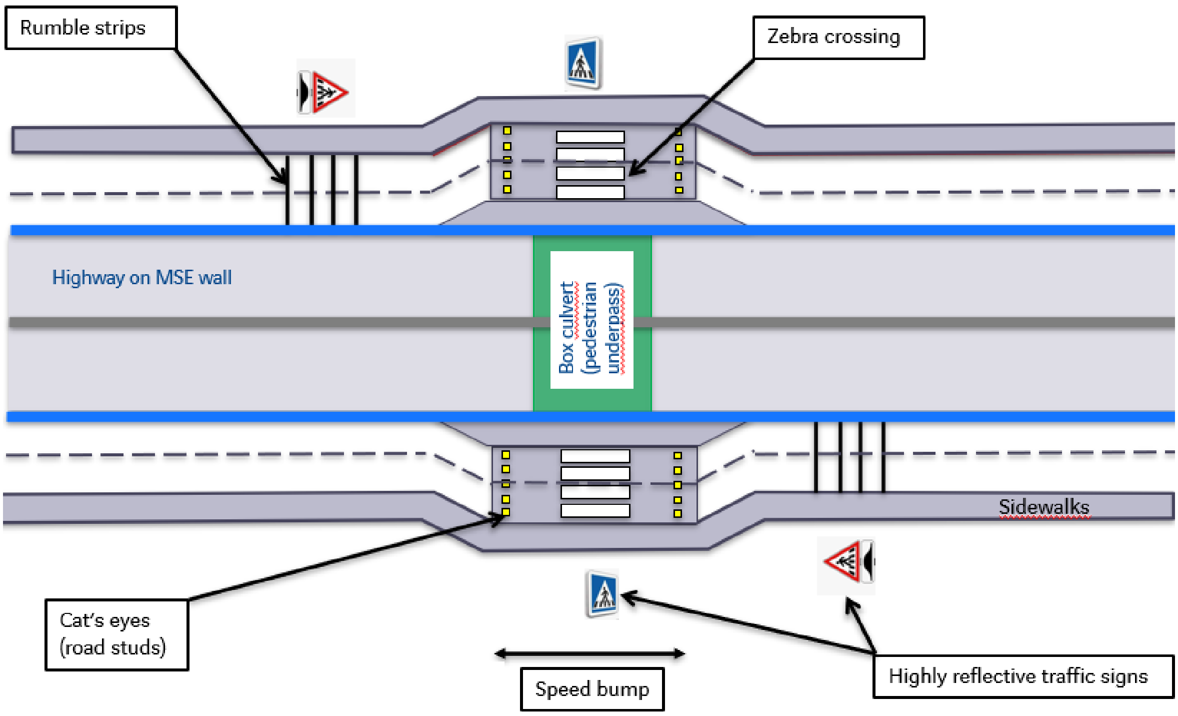


Figure 4-20 Typical At-grade Crossing through a MSE wall for the Nakuru City

4.4.12.2 CATTLE CROSSING

As for specific Cattle Underpasses (CUP) a total of 49 are planned along the A8 Highway and 2 on the A8 South Highway. Table 4-14 shows the distribution of these CUP structures and Figure 4-21 below shows a typical cross-section of a Cattle Underpass (CUP).

Table 4-14 Cattle Crossing Facilities in the Different Sections of Highway A8 and Highway A8 South

Road	Section	CUPs	Chainage (km)
Highway A8	Section 1	22*	1+325, 1+979, 4+160, 7+350, 8+100, 10+365, 14+110, 15+175, 17+905, 20+385, 22+825, 23+700, 25+325, 27+750, 29+200, 30+030, 33+140, 36+790, 45+230, 46+580, 53+375 and 55+700
	Section 2	20	61+300, 62+400, 64+715, 67+180, 69+235, 71+340, 73+705, 76+180, 76+660, 81+620, 84+680, 90+915, 92+040, 98+075, 101+370, 104+665, 106+215, 107+700 109+160 and 111+900
	Section 3	0	
	Section 4	7**	148+100, 153+525, 160+400, 161+900, 164+370, 165+765 and 172+000
Highway A8 South	Section 5	0	
	Section 6	0	

* Note that three VUP will also be accessible for Cattle crossing (CH 5+065, 18+820 and 50+090).
** Note that one VUP will also be accessible for Cattle crossing (CH 132+160).

With regards to Highway A8 South, the existing CUP will be maintained at CH 17+700 and 21+400 and, in addition, at-grade crossings will be provided at CH 13+450, 16+550, 30+200, 34+300 and 35+400.

In addition to the FOB and CUP structures and of the at-grade installations, pedestrian crossing will also be possible at all VOPs and VUPs (see section 4.4.7) and at planned wildlife crossings (see section 4.4.13), which are also considered as pedestrian passages. Considering all these structures, a total of 102 pedestrian passages are planned along Highway A8.

Pedestrian passages are planned at intervals of no more than 2 km within urban locations. Outside urban areas, fences will be implemented along 250 m on each side of pedestrian crossings. Priority will be given to keep existing pedestrian crossing facilities where possible.

Figure 4-21 3D picture of Cattle Underpass

4.4.12.3 LIGHTING

All the grade separated structures will be provided with street lighting and all pedestrian underpasses in urban areas will be provided with lighting. Also, lighting facilities will be implemented in the few sections where the project road passes through built-up sections/urban locations, thereby providing lighting to FOBs located in these areas. Refer to section 4.4.17 for further information on Project lighting.

4.4.13 WILDLIFE CROSSINGS AND FENCING

The Project traverses some recognized wildlife corridors for which wildlife crossings already exist along the current Highway. These crossing are essentially composed of underpasses and will be maintained and upgraded, as required, along with their associated fencing to guide the animals to cross at the designated crossings. Their current location is presented in Table 4-15 and their aspect will be similar in overall design as for the Cattle Underpasses (see Figure 4-21).

As required by the conclusion of the Project's impacts assessment on wildlife (see Chapter 8 and appendix 8-2), additional wildlife crossing may be added including some overpasses. The eventual overpasses would have a width of at least 30 m to favor free use by wildlife. The wildlife crossing surface will mimic natural habitats as much as possible instead of concrete flooring. Furthermore, a vegetative cover will be present near entrances to give animals security and a sense of naturalness and reduce negative effects of lighting and noise. Figure 4-22 and 4-23 show artistic renditions of the proposed wildlife overpasses

The Contracting Authority, with RVH, will regularly consult the state agencies concerned with wildlife crossing that is Kenya Wildlife Service (KWS), Kenya Forest Service (KFS) and National Environmental and Management Authority (NEMA).

Table 4-15 Existing Wildlife Crossings

Road Section	ID	Chainage (km)	Type of wildlife crossing	Size	Location	Description
1	WLC1	22+825	Underpass	1 x 5,00 x 3,50	Kijabe	Maintain Existing Underpass
1	WLC2	25+325	Underpass	1 x 5,00 x 3,50	Kijabe	Demolition & reconstruction
2	WLC4	69+235	Underpass	1 x 5,00 x 3,50	Marula	Demolition and reconstruction Underpass for Wildlife and livestock
2	WLC7	73+705	Underpass	3 x 5,00 x 3,50	Kigio	Demolition & reconstruction Underpass
2	WLC10	92+040	Underpass	1 x 5,00 x 3,50	Elmenteita-Kariandusi	Maintain Multi-use culvert for wildlife and livestock
2	WLC12	103+285	Underpass	1 x 5,00 x 3,50	Maendeleo-Soysambu	Demolition & reconstruction of a new underpass
2	WLC13	104+665	Underpass	1 x 5,00 x 3,50	Soysambu	Demolition and reconstruction of a new underpass
2	WLC14	106+215	Underpass	1 x 5,00 x 3,50	Soysambu	Maintain existing underpass

Figure 4-22 3D Rendition of a Proposed Wildlife Overpass

Figure 4-23 3D Sideview Rendition of a Proposed Wildlife Overpass

Electrified fencing will be implemented on each side of wildlife crossings to guide wildlife towards them. Figure 4-24 illustrates the design of the proposed electrified fencing. The fence design for the wildlife areas foresees an 8–strand electric fence with provision for tight lock to control burrowing animals from finding their way to the Project Road and control the larger mammals like elands from jumping over the fences.

4.4.14 SURFACE WATER MANAGEMENT

Surface water management is an important preoccupation for this project as there are known cases of localised flooding presumably associated with the presence of the existing highway (A104). Part of the problem seems to be related to inefficient drainage system including inexistent or blocked ditches and undersized culverts.

The design of the new highway surface water management will be using various components (ditches, culverts, retention basin, scrubbers & oil separators, flat ditches and diffusion pads) to ensure adequate capture and redirection of surface water within existing watercourses or in areas that will not create or worsen existing flooding areas. Known flooding areas will be studied in a case-by-case basis to see how flooding events can be minimized or eliminated.

DRAINAGE

Drainage will be installed in key areas to collect storm water generated by the highway and redirect it towards areas that have the capacity to receive these volumes without creating flooding risks. It may take many forms such as grassed, lined or waterproof ditches and grassed guttering to receive water from the highway and kerbs and various type of drains (cornice, slot drains and U shaped) to contain and collect water from the paved surfaces. Typical open ditches will have a width and depth of 50 cm and a slope of 3/2 while grassed guttering will have a depth of 30 cm and a slope of 3/1. Figure 4-25 illustrate typical cross sections of a grassed and impervious ditch.

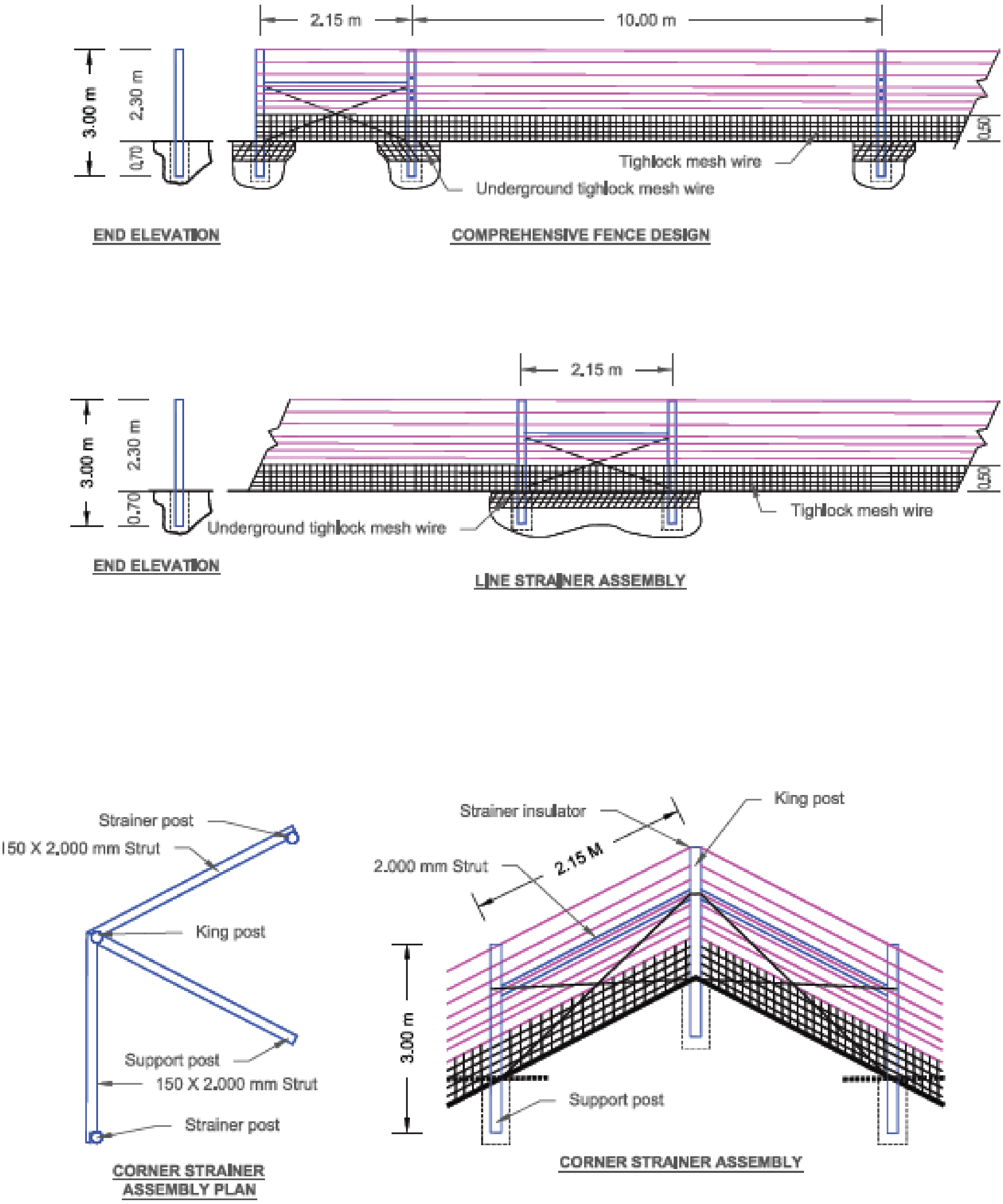


Figure 4-24 Design Drawings of Proposed Wildlife Related Fencing

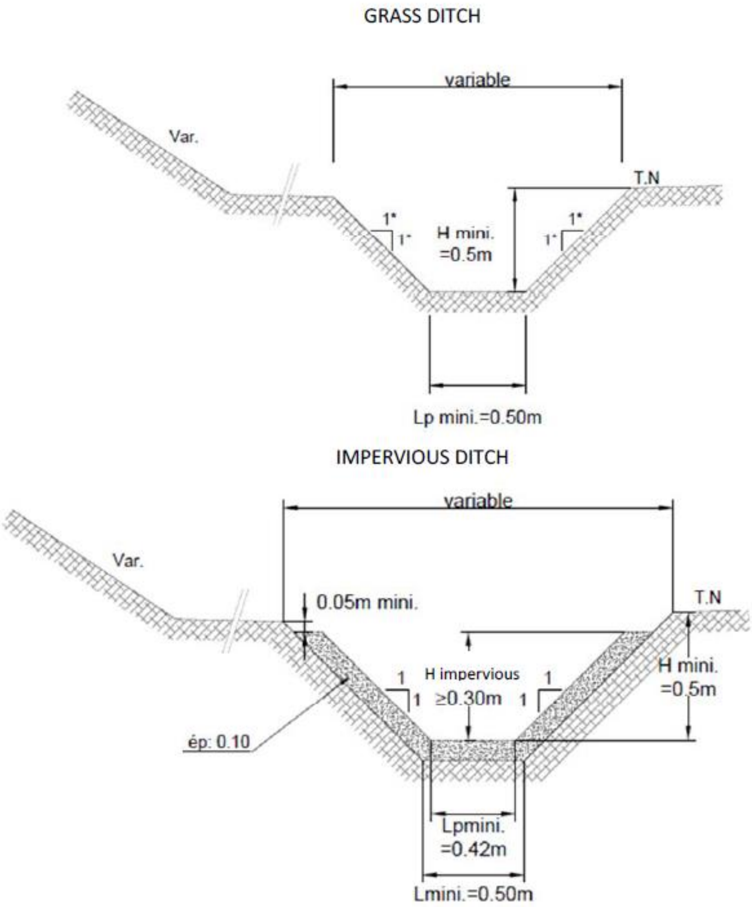


Figure 4-25 Typical Cross Sections of Grassed and Lined Ditches

CULVERTS

The existing culverts (over 600) will be preserved and extended. Insufficiently dimensioned culverts will be replaced by larger-sized structures (1x1 box culvert or D = 1000 pipes as much as possible preferred in these cases). All new culverts or existing culverts requiring replacement have been designed in relation with completion of hydraulic studies. Typical box culvert design is illustrated in Figure 4-26.

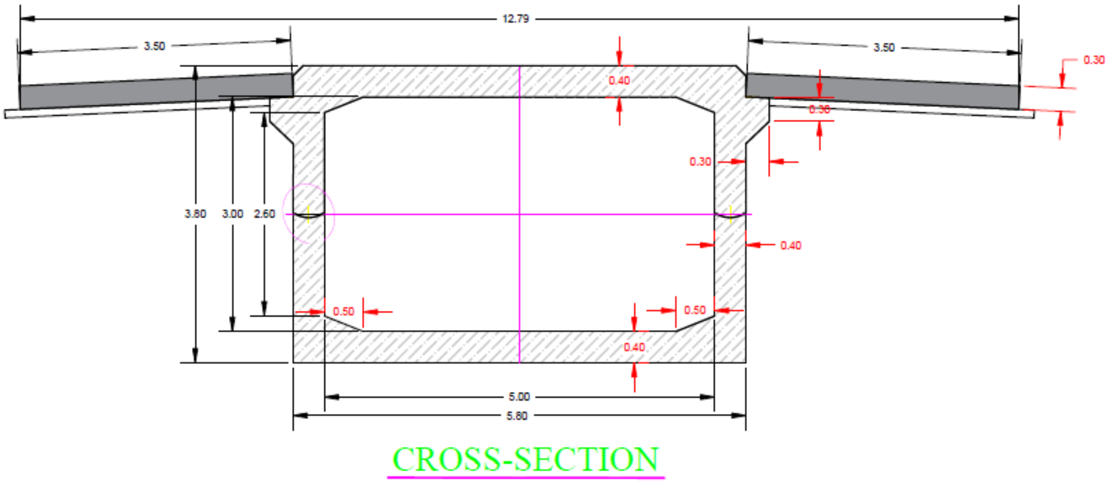


Figure 4-26 Typical Cross Section of a Box Culvert

TREATMENT INFRASTRUCTURES

Water treatment infrastructures will be used in critical areas where, for example, a permanent river or a wetland is crossed by the highway. The main objective is to capture potential contaminants originating from spill or leaks of vehicles using the highway and sediments transported by stormwater. The proposed infrastructures will include scrubbers & oil separators, flat ditches (30 m X 4 m) and retention basins. Typical cross section of a retention basin is presented in Figure 4-27.

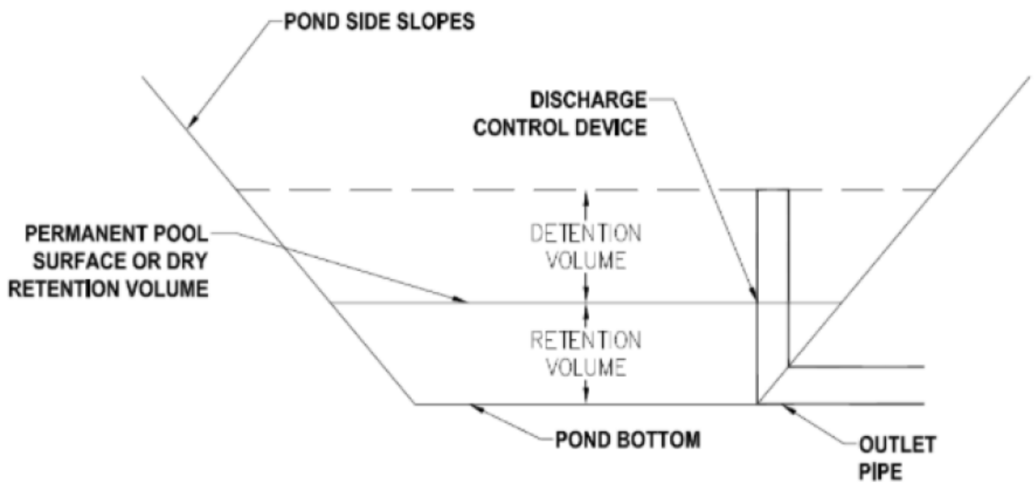


Figure 4-27 Typical Cross Section of a Retention Basin

The location of the main treatment infrastructures is presented in Table 4-16. Locations of treatment facilities are preliminary and final siting and design of the treatment ponds are upcoming, pending final hydrological study. Their design will ensure that no run-off water coming from the road will enter the targeted watercourses untreated. To that extent, more than one treatment pond are expected at some locations in order to catch run-off coming from all sides.

Table 4-16 List of Proposed Treatment Infrastructures and Location

Highway	Type of Equipment	Location
A8 South	Treatment Pond	21+070
A8	2 X Flat Ditches	3+500
	2 X Treatment Ponds	42+820
	Ditches / pipes to direct run-off to treatment pond at 42+820	43+900
	2 X Treatment Ponds	59+700
	Treatment Ponds	59+750
	2 X Flat Ditches	61+000
	2 X Flat Ditches	62+040
	2 X Flat Ditches	62+720
	Flat Ditch	63+140
	Flat Ditch	63+500
	Treatment Pond	64+720
	Treatment Pond	76+150
	Treatment Pond	76+220
	Treatment Pond	87+870
	Ditches / pipes to direct run-off to treatment pond at 90+900	90+400 – 90+900
	Treatment Pond	90+900
	Treatment Pond	92+300
	Treatment Pond	92+350
	2 X Treatment Ponds	104+500
	Treatment Pond	106+200
	Treatment Pond	106+320
	Treatment Pond	148+850
	Treatment Pond	149+730
	2 X Treatment Ponds	153+840
	Treatment Pond	159+000
	Treatment Pond	169+550
	Treatment Pond	171+900
	Treatment Pond	174+400

4.4.15 BUS BAYS AND BUS SHELTERS

Bus bays are designated areas with an additional lane apart from main traffic lanes for buses to stop and let passengers on and off. Bus shelters provide roof covering opportunities with at least one open side for passengers boarding or onboarding at the Bus Bay location.

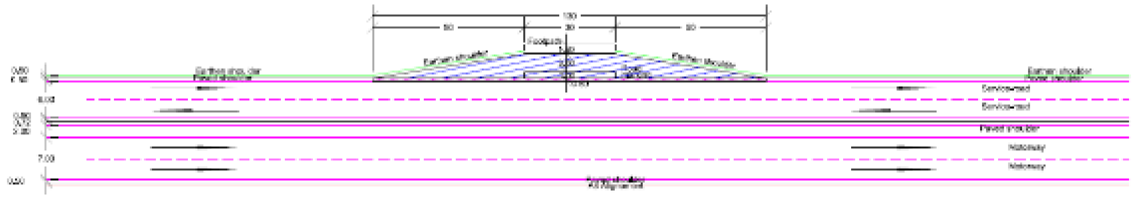
Bus Bays and shelters will be designed and constructed for all the existing Bus Bay locations along the Project Roads, and only a few will be slightly moved for security reasons. One hundred and fourteen (114) bus bays are planned along Highway A8 and thirty-seven (37) along Highway A8 South, including left-hand side and right-hand side bus bays. Their distribution in the different road sections is described in Table 4-17 and Figure 4-28, which illustrates their configuration.

On Highway A8, a vast majority of Bus Bays are provided on the Service Lanes and have no direct connection to the main Carriageway. In the rare case where there is no service lane nearby, the paved shoulder will be widened to act as deceleration and acceleration lanes before and after the Bus Bay. The Bus Bay will be separated from the carriageway by a concrete barrier. All Bus Bays are to be provided with a suitable bus shelter appropriate for all weather conditions.

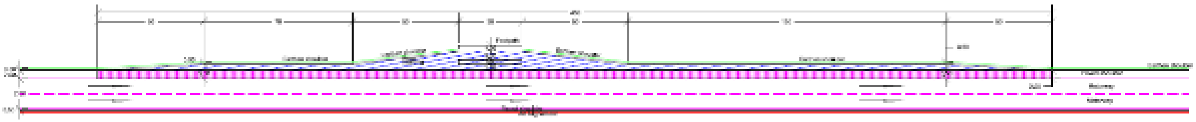
Table 4-17 Bus Bays in the Different Sections of Highway A8 and Highway A8 South

Road	Section	Bus Bays – On both sides	Chainage (approximate)	Bus Bays – On one Side	Chainage (approximate)
Highway A8	Section 1	18	7+225, 9+380, 10+150, 11+850, 14+200, 15+675, 19+450, 23+775, 25+60, 027+700, 29+475, 31+000, 32+375, 35+300, 41+975, 52+300, 55+600, 57+600	1	3+200 (left)
	Section 2	13	62+400, 63+550, 64_450, 68+800, 73+425, 81+900, 85+500, 89+400, 92+900, 96+650, 107+100, 108+900, 113+100	3	97+525 (left), 110+275 (right), 111+ 150 (left)
	Section 3	6	116+900, 118+900, 123+750, 126+800, 127+700, 129+300	2	120+400 (right), 122+300 (right),
	Section 4	17	131+375, 132+800, 135+100, 137+000, 140+450, 142+875, 145+450, 147+300, 148+250, 150+800, 153+050, 155+500, 158+400, 162+000, 166+200, 171+500, 174+200	0	
Highway A8 South	Section 5	1	1+400	0	
	Section 6	16	21+650, 24+850, 25+500, 26+250, 26+900, 31+625, 36+950, 37+750, 43+200, 46_800, 47+275, 47+925, 49+200, 50+060, 51+150, 52+800	3	20+650 (left),44+950 (right), 53+450 (right)

Source: 201_103_00_Synoptic PPP NNMS 2021.02.05.xlsx



BUS-BAY with Service road



BUS-BAY without Service road

Figure 4-28 Typical Bus-Bay Arrangements with and without Service Road

4.4.16 TRUCK LAY BYE

Truck lay bye refers to a paved area at the side of a highway designated for drivers to stop for emergency parking or where vehicles can wait.

Truck lay bays are to be designed and constructed to offer a minimum capacity for 3 trucks along either side of the Project Road, at an interval of no more than 7 km on plain/rolling terrain and 15 km on hilly/mountainous terrain of the Project Road.

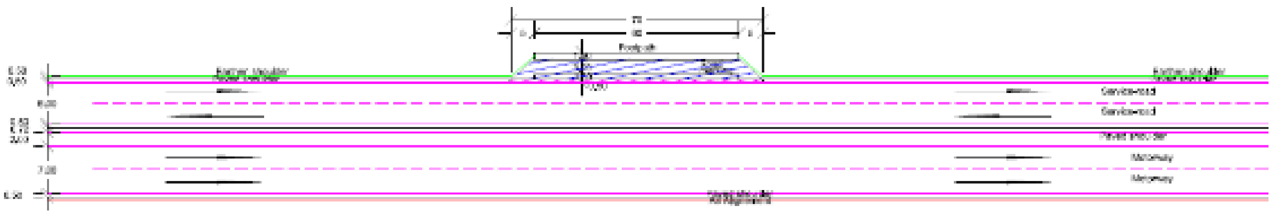
Forty-six (46) truck bays are planned along Highway A8 and eighteen (18) along Highway A8 South, including left-hand side and right-hand side truck bays. Their distribution in the different road sections is described in Table 4-18 and Figure 4-29, which illustrates their configuration.

It should also be noted that truck bays described below are totally distinct from Roadside Stations described in sections 6.4.13 and 8.5.1. While truck bays are funded as part of the Project, are project components integrated to the Project design and will be implemented within the RoW, Roadside Stations are part of a multinational project to equip the Northern Corridor with truck service facilities along the entire Northern Corridor i.e. in Kenya but also Uganda, Rwanda, RRC, Burundi and South Sudan. Those roadside stations are planned to be implemented outside the Project RoW.

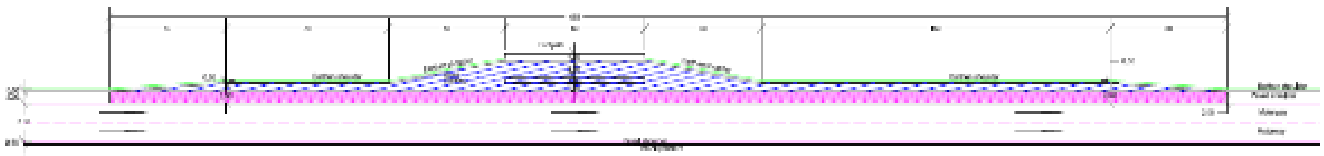
Table 4-18 Truck Bays in the Different Sections of Highway A8 and Highway A8 South

Road	Section	Truck Bays – Left-Hand Side	Truck Bays – Right-Hand Side	Chainage (Approximate)
Highway A8	Section 1	6	6	3+025, 10+000, 17+380, 29+650, 41+900, 53+400
	Section 2	8	8	61+800, 68+625, 75+250, 81+900, 89+500, 96+325, 101+750, 108+750
	Section 3	3	3	115+600, 122+300, 126+475
	Section 4	6	6	136+000, 140+800, 150+450, 157+650, 165+625, 171+400
Highway A8 South	Section 5	3	3	0+400, 7+400, 14+275
	Section 6	6	6	21+225, 27+825, 34+700, 41+900, 48+160, 55+600

Source: 201_103_00_Synoptic PPP NNMS 2021.02.05.xlsx



TRUCK-BAY with Service road



TRUCK-BAY without Service road

Figure 4-29 Typical Truck-Bay Cross-section with and without Service Road

4.4.17 LIGHTING FACILITIES

Most of the project road passes through rural areas and does not require any lighting facilities except for some of the major intersections. However, retroreflective road furniture is to be installed throughout the project road.

All the grade separated structures will be provided with street lighting and all pedestrian underpasses in urban areas will be provided with lighting. Also, in the few sections where the project road passes through built-up sections/urban locations, lighting facilities will be implemented. Section length, number of lighting lines and lighting length in each road section are presented in Table 4-19.

The precise location of the high mast lights will be determined based on the conclusions of the lighting studies. Priority will be given to the use of photovoltaic lighting as far as possible. Also, all existing lighting located in areas where no new sections of lighting are foreseen will be reinstalled after construction.

Table 4-19 Lighting in the Different Sections of Highway A8 and Highway A8 South

Road	Section	Section Length Left (m)	Section Length right (m)	Lighting length (m)
Highway A8	Section 1	14 900	14 200	29 100
	Section 2	6 100	4 500	10 600
	Section 3	7 700	18 500	26 200
	Section 4	2 800	2 800	5 600
Highway A8 South	Section 5	1 200	1 200	2 400
	Section 6	5 400	5 300	10 700

Source: 201_103_00_Synoptic PPP NNMS 2021.02.05.xlsx

4.4.18 GANTRIES, ROAD FURNITURE AND ROAD SIGNS

Road furniture forms an important consideration in the design of roads. Road furniture shall include:

- Directional information signs;
- Regulatory signs;
- Warning signs;
- Road markings;
- Road signs.

Gantries, which are bridged like overhead structures with a platform supporting road signals, will also be installed along the Highway. Detailed Road signage studies will be completed at a further stage of the project. All lights, cameras and signaling equipment installed will comply with Kenyan regulations.

4.4.19 GUARD RAIL/CRASH BARRIER PROVISIONS

Safety barriers will be installed on the side of the motorway in the presence of dangerous obstacles to ensure the safety of users. Their location will be defined in accordance with the road design manual Part I. Concrete barriers will be preferred.

4.4.20 OPERATION AND MAINTENANCE CENTERS

Operation and maintenance (O&M) facilities will be required during the life of the project to perform various functions required by highway management. The O&M Company will be located in 2 buildings during the project operation phase:

- The O&M Centre, planned to be located in the vicinity of Naivasha, will be equipped with the following equipment and facilities:
  - Offices including a control room to coordinate the emergency responses, monitor traffic cameras and display messages in the Variable Message System. All information collected by the highway monitoring system will be accessible from this operation centre (traffic counts, axle load measurements, weather monitoring and emergency call centre);
  - Garage for maintenance of the O&M company fleet as well as parking lots. The garage will be equipped with oil separators;
  - Storage facilities;
  - Petrol station dedicated for the refueling of the Operator's vehicles. This area will be covered by a roof, the pavement will be in concrete, there will be two pumps for the distribution of fuel, gasoil and gasoline, as well as 2 underground tanks of 20000 liters capacity;
  - Power Supply diesel generator (in case of electrical shutdown to supply the critical elements such as the control room);
  - Photovoltaic panels (and their necessary equipment) to cover a maximum of energy consumption.
- A support unit, to be located in Nakuru and to be equipped with offices, a maintenance garage and parking lots.

Minimum required land requirements for these installations are provided in Table 4-20 below. Plots will be acquired on willing seller / willing buyer basis.

Table 4-20 Expected Surfaces of the O&M Center and Nakuru Support Unit

Installation	Total Surface (m^2)
Support unit 1 (Nakuru)	1 300 m^2
Office	510 m^2
Garage	495 m^2
Parking	295 m^2
Operation center	2 367 m^2
CCO + SPV	811 m^2
Garage	825 m^2
Parking	650 m^2
Annex	81 m^2

4.4.21 PROJECT FEATURE CLASSIFICATION

IFC performance standards require that all physical elements, aspects, and facilities related to a project and that are likely to generate impacts in the context of the Project's Area of Influence (AoI) be identified and considered. These facilities can be classified in three categories:

1. Project components, which are funded as part of the project. Their impacts are studied systematically as part of the present ESIA;
2. Ancillary facilities, which are also funded as part of the project for the purpose of providing support to the primary activities or operation of the project. They include facilities such as borrow pits and quarries, and are also assessed as part of the ESIA;
3. Associated facilities, which are not funded as part of the project, but would not have been constructed or expanded if the project did not exist and without which the project would not be viable. The only identified associated facilities are upcoming tolling stations to be developed by KeNHA. They are studied as part of the cumulative impacts assessment.

All components and facilities described in sections above have been classified according to these definitions, in the table below.

Interconnecting roads are neither ancillary facilities nor associated facilities. Indeed, ancillary facilities are Project facilities providing necessary support to the primary activities or operation of the Project. Interconnecting roads do not qualify as they are not funded as part of the Project and do not provide specific support to the Project.

Similarly, associated facilities are those that are not funded as part of the Project and that would not have been constructed or expanded if the project did not exist and without which the project would not be viable. Interconnecting roads are not funded as part of the project but since they already exist it cannot be concluded that they would not have been constructed if the Project did not exist. They are therefore not associated facilities either.

Table 4-21 Listing of Project components, ancillary facilities and associated facilities

Facilities	Funded as part of the Project?	If not Project funded, name of Facility Operator/ Owner	Facility dependent on Project?	Project unviable without facility?	Classification	ESIA section Reference	Justification Comments
Dualled A8 Highway between Rironi and Mau Summit	Y	-	Y	Y	Project component	4.4.3	-
Strengthened A8-South Highway between Rironi and Naivasha	Y	-	Y	Y	Project component	4.4.4	-
Inherited interchanges	N	-	N	Y	Project component	4.4.4.1	Integrated to the project at the start of the operation phase
Combination of elevated structures, at grade section and viaducts in Nakuru City + service lanes	Y	-	Y	Y	Project component	4.4.5	-
Improvement of road junctions and u-turn facilities	Y	-	Y	Y	Project component	4.4.6	-
Vehicle overpasses (VOP) and Vehicle underpasses (VUP)	Y	-	Y	Y	Project component	4.4.7	-
Railway over and under bridges	Y	-	Y	Y	Project component	4.4.7 and 4.4.11	-
Service lanes	Y	-	Y	Y	Project component	4.4.8	-
Climbing lanes	Y	-	Y	Y	Project component	4.4.9	-
River Bridges	Y	-	Y	Y	Project component	4.4.10	-
Pedestrian and cattle crossing facilities (FOBs, at-grade crossings, PUPs, CUPs)	Y	-	Y	Y	Project component	4.4.12	-
Wildlife crossings and fencing	Y	-	Y	Y	Project component	4.4.13	-

Facilities	Funded as part of the Project?	If not Project funded, name of Facility Operator/ Owner	Facility dependent on Project?	Project unviable without facility?	Classification	ESIA section Reference	Justification Comments
Surface water management facilities (ditches, culverts, retention basin, scrubbers & oil separators, flat ditches and diffusion pads)	Y	-	Y	Y	Project component	4.4.14	-
Bus bays and bus shelters	Y	-	Y	Y	Project component	4.4.15	-
Truck lay-byes – distinct from Roadside Stations described in sections 6.4.13 /8.5.1	Y	-	Y	Y	Project component	4.4.16	-
Lighting facilities	Y	-	Y	Y	Project component	4.4.17	-
Gantries, road furniture and road signs	Y	-	Y	Y	Project component	4.4.18	-
Guard rail / crash barriers	Y	-	Y	Y	Project component	4.4.19	-
Operation and maintenance centers	Y	-	Y	Y	Project component	4.4.20	-
Tolling stations	N	KeNHA	Y	Y	Associated Facility	6.4.13	-
Quarries	Y	-	Y	Y	Ancillary Facility	4.4.2.1	-
Asphalt mixing plant, concrete works area, offices and workshops	Y	-	Y	Y	Ancillary Facility	4.4.2.2, 4.4.2.3 and 4.4.2.4	-
Establishment of construction sites	Y	-	Y	Y	Ancillary Facility	4.4.2	-
Establishment of material sites/laydowns	Y	-	Y	Y	Ancillary Facility	4.4.2	-

Facilities	Funded as part of the Project?	If not Project funded, name of Facility Operator/ Owner	Facility dependent on Project?	Project unviable without facility?	Classification	ESIA section Reference	Justification Comments
Borrow pits	Y	-	Y	Y	Ancillary Facility	4.7.1.1 and 4.7.1.2	-
Boreholes	Y	-	Y	Y	Ancillary Facility	4.7.1.5	-
Back-up generators during construction	Y	-	Y	Y	Ancillary Facility	4.7.1.6	-
Waste disposal facilities	N	tbd	N	Y	Suppliers	4.8	-
Cement factories	N	Simba cement, others tbd	N	Y	Suppliers	4.7.1.3	-
Bitumen providers	N	tbd	N	Y	Suppliers	4.7.1.4	-
Interconnecting Roads	N	KeNHA and/or KERRA	N	Y	Excluded from IA	n/a	Not funded as part of the project. Not dependent on the Project – such new roads could connect to the existing road Project entirely viable without new interconnecting roads
Roadside Stations – distinct from truck lay-byes described in section 4.4.16 and included as a Project component	N	Northern Corridor Transit and Transport Coordination Authority	N	Y	Excluded from IA	8.5.1	Considered in cumulative impact assessment.

4.5 DESIGN STANDARDS

The Design of the Project Road including Project Facilities shall conform to Kenyan design requirements, as set out in the List of Standards and Specifications provided in Table 4-22 below. Where Kenyan manuals do not include references about Standards and Specifications, International Standards and Specifications for Design and Construction Works described in Table 4-23 will be applied.

The Project Road shall follow the existing alignment of the Project Road and geometric deficiencies, if any, an adjustment of the speed limit will be preferred to stay in the right of way. Construction of Works including Project Facilities shall strictly conform to requirements set out in these Standards and Specifications.

Climate change resilience will be integrated in the Project's design. This aspect is discussed in Chapter 9 - Impact of climate changes.

Table 4-22 List of Standards and Specifications for Design and Construction Works

Standards and Specifications for the Design Works	
1	Part I – Geometric Design of Rural Roads, January 1979
2	Part II –Road Design Guidelines for Urban Roads, August 2001
3	Part III – Materials and Pavement Design for New Roads, August 1987
4	Part IV – Bridge Design (Including Major Structures)
5	Part V – Pavement Rehabilitation and Overlay Design, May 1988
6	Proposed Manual for Traffic Signs in Kenya – Part I, Road Markings published by Ministry of works Roads department, 1974
7	Proposed Manual for Traffic Signs in Kenya – Part II, Traffic signs published by Ministry of works Roads department, authorized by Kenya gazette supplement No 90, 1975.
8	Capacity analysis for Multi-lane Rural Road to be done through Road Capacity Manual of USA, Highway Capacity Manual (HCM), published by Transportation Research Board of the National Academics, Washington DC, USA
9	Relevant British Standards to be used for the design and installation of street lighting and high mast lighting
Standards and Specifications for Construction works	
10	Standard Specifications for Road and Bridge Construction, 1986 published by Ministry of Roads and Public Works
Guidelines to be followed for Environmental and Social Impact assessment and Mitigation measures during Design and Construction	
1	Provisions of Kenyan Constitution
2	Guidelines of National Environmental Management Authority of Kenya
3	Any relevant laws, acts, regulations and policies published or gazette by Government of Kenya
4	Word bank guidelines and IFC performance standards
5	Any other International Conventions and Treaties relating to the environment to be adhered for achieving sustainable development

Table 4-23 International Standards and Specifications for Design and Construction Works to Be Used for Missing References of Standards and Specifications in the Kenyan Manuals

Standard/Specification	International Standards/Specifications to be used
Rigid Pavement Design	Relevant manuals of American Association of State Highway and Transportation Officials (AASHTO)
Flexible Pavement Design (for above 60 msa traffic loading)	Relevant manuals of American Association of State Highway and Transportation Officials (AASHTO)
Overlay Design	Relevant manuals of American Association of State Highway and Transportation Officials (AASHTO)
Vehicle Damaging factor calculations	Relevant manuals of American Association of State Highway and Transportation Officials (AASHTO)
Intersection design analysis	Highway Capacity Manual (HCM), published by Transportation Research Board of the National Academies, Washington DC, USA.
Highway capacity analysis	Highway Capacity Manual (HCM), published by Transportation Research Board of the National Academics, Washington DC, USA
Hydrology and drainage design	TRRL East African Flood Model
Material design and specification (for the materials not defined in Part III Road Design Manual)	Relevant British Standards and American Society for Testing Materials standards
Traffic signs and road markings (for the traffic signs and road markings not defined in Proposed Manual for Traffic Signs in Kenya Part I)	Relevant sections of Design Manual for Roads and Bridges, UK.
Non-motorised facilities (including Pedestrian Facilities)	Relevant sections of Design Manual for Roads and Bridges, UK.
Street Lighting	Relevant British Standards (BS)

4.6 PROJECT ACTIVITIES

The construction and operation activities associated with the proposed highway expansion project are described hereafter.

4.6.1 PRE-CONSTRUCTION ACTIVITIES

4.6.1.1 SURVEY WORKS

Survey works shall begin immediately on the award of the contract and shall be carried out using the GPS system and total station as required. Specialized staff will carry out these works. Plotting of existing cross sections and profiles shall then be done using computer assisted methods. If the survey traverses to be used are close to the existing carriageway and interfere with construction works, then we shall relocate them to a location where they will not be disturbed. The coordinates and height of all crossing points located shall be listed and provided to the engineer for checking and/or approval.

4.6.1.2 RELOCATION OF SERVICES

The diversion of all existing services such as sewers, surface water drains, and cables for electricity and telephone, fiber-optic cables, telephone and lighting poles, water mains, etc., is under the responsibility of KeNHA. The work area is supposed to be cleared of all services prior to construction work initiation.

4.6.1.3 TRAFFIC MANAGEMENT

During construction activities, disruption of traffic shall be kept to a minimum by favouring temporary traffic diversion strategies. These strategies were presented in section 3.2.2 on traffic management alternatives.

Additionally, an adequate number of flagmen equipped with handheld radios shall be deployed at all affected intersections, and at work locations where necessary along the road to control traffic. Sufficient and well illuminated traffic warning signs, barricades and drums shall be strategically located to assist safe passage of vehicular traffic through the works.

To facilitate the smooth flow of traffic through the works, warning signs, temporary restriction signs, advance warning signs, barriers, temporary bumps and any other device will be provided. In addition, there will be personnel to ensure the safe passage of traffic through the works.

4.6.2 CONSTRUCTION ACTIVITIES

Key activities during the construction will include:

- Site clearance and topsoil stripping;
- Earthworks;
- Drainage and culvert work;
- Bridge works;
- Subgrade;
- Asphalt paving;
- Installation of road furniture (lighting, guard rails, road markings).

A description of the key activities during the construction of the road is presented to the extent known (based on typical construction of roads) and is subject to change on the final methodology adopted by RVH.

4.6.2.1 SITE CLEARANCE AND TOPSOIL STRIPPING

Before initiating work, the Project area shall be cleaned from all rubbish and unsuitable material. Site Clearance is defined as the clearing, grubbing, removal and disposal of all vegetation, grass, debris, bushes, scrub, dense bush, trees, hedges, undergrowth, stumps, roots, shrubs plants and the backfilling of holes left by the removal of stumps and roots.

All buildings, foundations, structures, fences and any other obstructions which have not been designated to remain will be demolished wholly or in part, removed and disposed of. The topsoil will be stripped and stockpiled for reuse at the locations.

4.6.2.2 EARTHWORKS

Excavation vehicles will also dig up and remove rocks and stones from the future road’s pathway. In order to limit soil erosion, none of the existing material that will remain on site should be loosened unnecessarily during excavation. Excavation works, along with all construction activities, must be undertaken in as safe a manner as possible to minimise the dangers to road users and the contractors’ personnel. Excavated materials will be assessed as suitable or unsuitable/spoil. Suitable materials should be used when possible in the works.

Poor excavated material will be taken to the disposal site, while good excavated materials considered as suitable could be directly put in fill or stocked and reloaded. In some cases, fill material from borrow pit and fill material from cutting will be required in addition to that provided by the excavation.

Filing areas shall be prepared before forming embankment. If existing ground is unsuitable in quality for receiving fill, it will be excavated to the depth instructed by the engineer and the material will be removed to a spoil area. Existing ground will be compacted over the full width of construction.

The embankment will be constructed using suitable materials obtained from cutting or imported material from borrow areas only if there is inadequate quantity of suitable materials on site.

Earthworks include mounting and grading. The road takes shape as diggers, excavation plant machinery and bulldozers mount dirt and soil over the area where the future pathway will run. The surface is then leveled and smoothed by graders. Fine grading requires construction workers to prepare the surface by leveling it according to plans provided by structural engineers. The contractors will be using a grader and/or bulldozer for placing materials in consecutive layers of uniform thickness.

Protection to embankment slopes, cut faces, side drains, shoulders, guiding dams and spoil or borrow areas will be provided in specific areas by grassing or/and top soiling and grassing.

4.6.2.3 DRAINAGE AND CULVERT WORKS

During construction, ditches are to be maintained to ensure proper drainage at all times. Any necessary ditches and channels should be constructed and maintained to ensure there is no damage to the roadway section.

Culverts will be composed of prefabricated or cast-in concrete product. Box culverts (see Figure 4-30) are prefabricated, they will be connected transversely to each other by connection joints. Excavation and compaction of the formation surface of the culverts will first be carried before the installation of precast elements.

Source: Annex TP4 Construction Plan – Main Works Construction Plan

Figure 4-30 Example of a major Prefabricated Box Culvert

4.6.2.4 BRIDGE WORKS

Bridge works include cattle and pedestrian underpasses, railway overpasses and underpasses, river bridges, vehicles underpasses, major junction overpasses as well a wildlife crossing. Part of the bridges will be prefabricated on the prefabrication plan and transported on site. Depending on the type of bridge, the foundation, the piers or wall and the deck could be casted in situ.

Activities for bridge works (overpass) will be phased as follows:

- Traffic management;
- Preliminary earthworks;
- Abutment C0 /Foundation /Wall /Head wall, if necessary;
- Pier P1 in median /Foundation /;
- Abutment C2 /Foundation /Wall /Head wall, if necessary;
- Deck /Installation of beams C0-P1 /Precast slab C0-P1 /Installation of beams P1-C2/Precast slab P1-C2;
- Reinforcement of deck /Concreting of the compression slab;
- Backfilling;
- Installation of paving slab;
- Installation of security equipment;
- Waterproofing;
- Surface dressing;
- Restoring traffic.

4.6.2.5 SUBGRADE

The subgrade will be realised, either with cement stabilized soil or with granular material. Cement stabilized subgrade will be made with soft material coming from cut excavation beforehand identified as suitable for treatment. Granular Subgrade will be purveyed by trucks, the granular materials will be placed by a grader and/or bulldozer equipped with GPS in consecutive layers of uniform thickness and compacted. After compaction, final levelling will be carried out by a grader and/or bulldozer equipped with GPS to ensure that subgrade levelling match with the altimetry specifications.

4.6.2.6 ASPHALT PAVING

Once the subgrade has been distributed evenly, the asphalt can be poured. Asphalt is a mixture of a petroleum by-product, an aggregate base material and a sticky, glue-like substance called bitumen. Depending on the expected traffic on the road, up to four layers of asphalt can be placed on top of each other. The asphalt usually is produced and mixed in large plants after the engineer's specifications. The asphalt shall be transported from the asphalt plant to the site by trucks and then laid by a paver. The asphalt shall be done in layers on a clean surface. A two-drum roller shall be used for an initial rolling process. A pneumatic tyred roller shall complete the compaction process to ensure that the surface is smoothened.

4.6.3 OPERATION

4.6.3.1 USE OF HIGHWAY

During the operation phase of the project, the completed highway will be open for motorized traffic. Figures 4-31 to 4-34 below, illustrate traffic projections for Light Vehicle (LV) and Heavy Goods Vehicles (HGV) from 2025 to 2040 in three locations of the A8 Highway that is in the southern (Mathore), central (Gilgil) and northern (Nakuru) part of the highway. Figure 4-33 illustrate traffic similar traffic projections for the A8 South Highway with data collected at Mai Mahu. For the A8 Highway, projected increases reach 180 % for total vehicle traffic in Mathore (22637 to 41750), 185% in Gilgil (20300 to 37625) and 207 % in Nakuru (64619 to 133686).

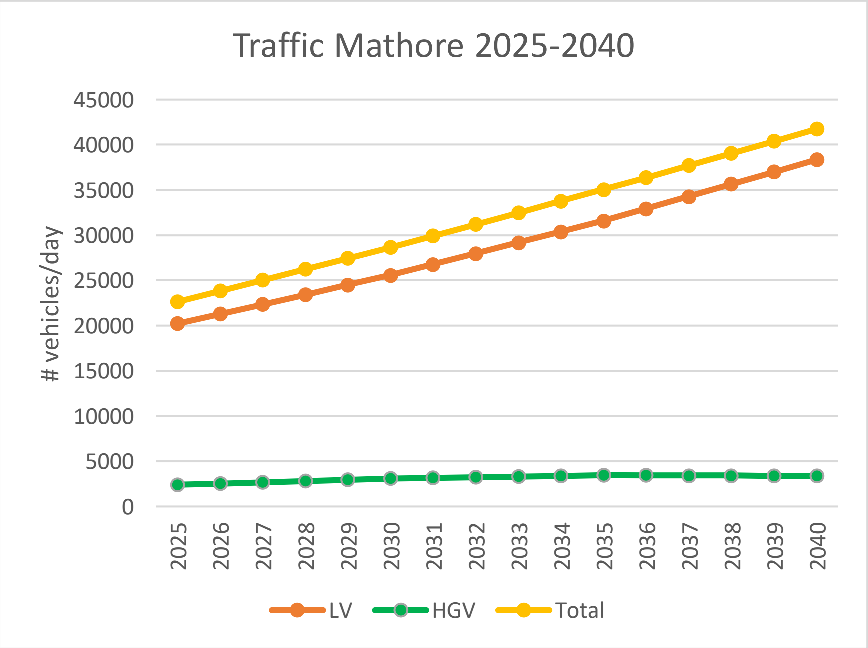


Figure 4-31 Traffic Projections From 2025 to 2040 in Mathore (A* Highway)

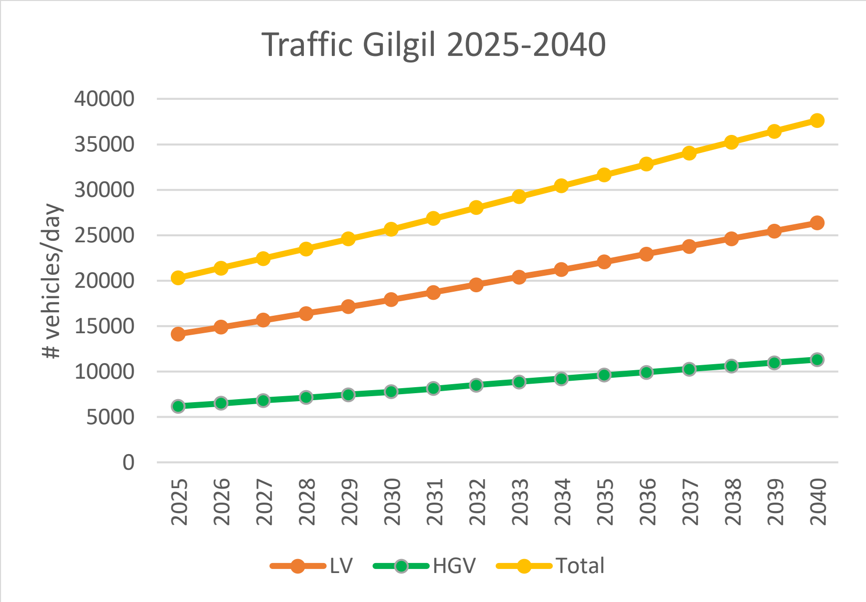


Figure 4-32 Traffic Projections From 2025 to 2040 in Gilgil (A8 Highway)

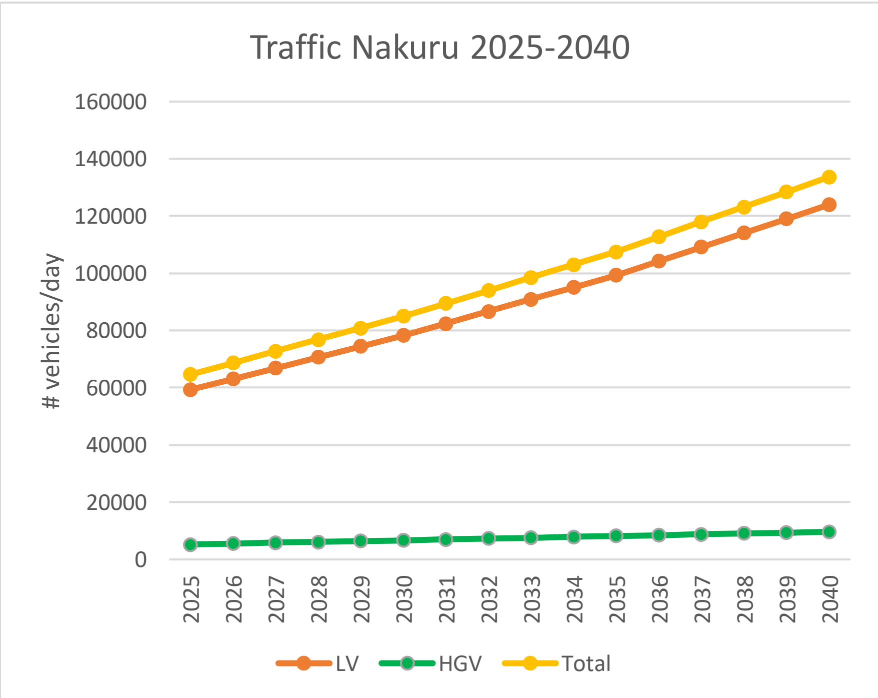


Figure 4-33 Traffic Projections from 2025 to 2040 in Nakuru (A8 Highway)

Projected total traffic increase on the A8 South is slightly lower with 175% Mai Mahu (10012 to 17600).

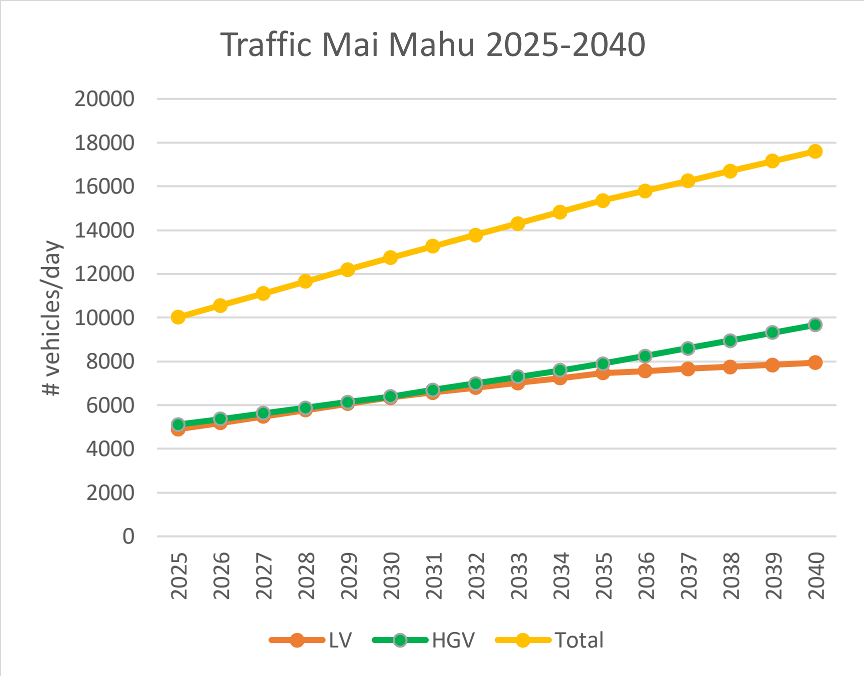


Figure 4-34 Traffic Projections from 2025 to 2040 in Mai Mahu (A8 South Highway)

4.6.3.2 MAINTENANCE

In order to preserve the project's infrastructures, RVH will prepare and submit for approval to KeNHA a Maintenance program that will include three main types of activities that is:

- Operation & Routine Maintenance;
- Emergency Works and Response;
- Heavy Maintenance.

OPERATION & ROUTINE MAINTENANCE

The Routine Maintenance Programme will detail the inspections frequency and maintenance activities for all maintenance to be carried out regarding the pavement, structures, appurtenances, equipment and all associated works in accordance with the technical requirements. The main day to day routine maintenance activities will include:

- Traffic signs and posts: including visual inspection, verification of reflectivity in night condition and cleaning. Defective equipment, outside permissible tolerance, will be repaired or replaced;
- Traffic signals: inspection to identify potential defective traffic signals. Upon detection the maintenance crew will:
  - Reset/update of the signal cycles from time to time;
  - Reset signals if the lights are in flash mode;
  - Replace dysfunctional LEDs (broken, end of life);
  - Set up portable "STOP" or "Yield Right of Way" signs from all directions until permanent repairs occur when the lights are completely out of service.

- Markings and studs: these will be visually inspected and repaired or replaced (for the studs) or repainted (for the markings);
- Vegetation: Periodical mowing of vegetation on highway sides. Frequency and nature of mowing will be adapted to plant types and season;
- Carriageway edges: Visual inspection of carriageway edges to detect need for corrective actions;
- Crash barriers: regular visual inspection of crash barriers and median barriers will be performed to ensure their effectiveness;
- Street lighting (at nighttime): Visual inspection of streetlights and replacement of burned or non-functional units. Damage poles will also be repaired or replaced as required;
- Structures: A regular visual verification of all structures or appurtenances will be performed by the Road Supervisors. During this verification, the condition of the structure components will be assessed, elements such as bridge rail, bearings, bridge deck, and bridge deck joints. For structures that are reasonably considered deficient, further investigation will be realised and corrective actions will be planned according to the needs. The corrective actions, which do not require to provide a temporary structure, include all heavy maintenance operations (see below). In case of closure of a structure, traffic management actions will be taken to ensure a continuity of traffic flow on the Project Road. In case of an extraordinary event which induces a complete closure of the structure, the implementation of a temporary structure will be evaluated based on the duration of the event and the time to implement the corrective actions.
- Fences of wildlife crossing: These structures will be inspected with the same method as regular structures thus a periodical visual verification of all structures or appurtenances will be performed by the Road Supervisors. During this verification, the condition of the structure components will be assessed, elements such as bridge rail, bridge deck, bridge deck joints. For structures that are reasonably considered deficient, further investigation will be conducted and corrective actions will be planned according to the needs.

With regards to Wildlife Crossing Structures, the verification of the fences will be undertaken during the inspection. If a fence appears to be damaged, the Maintenance Plan will be updated accordingly, and the Maintenance Team will then repair the impacted area. In the same way, RVH will ensure that Wildlife Structures do not have debris or silt blockages that may impede wildlife movements;

- Potholes and localised surface damage: Maintenance crew will ensure that all potholes and localised surface damaged are repaired;
- Drainage system: Detection and removal of major obstruction to ensure performance of drainage;
- Variable Message Signs: A cleaning and a technical check of all components related to Highway Information System will be performed. Inspection of all components of the Highway Information subsystems will be realised. These activities aim to extend their life expectancy. Upon detection of a damaged or non-functioning element of any Highway Information Systems or components, the Maintenance Plan will be updated accordingly, and the Maintenance crew will intervene to correct the situation. The Maintenance employees rotate for on-call duty and ensuring 24/7/365 availability in case of any major incident.; and
- Cleanliness of the Right of Way: to be realized through general visual inspection and collecting of any element which can become a hazard to drivers. More specifically, the following actions will be completed:
  - Remove any elements such as debris, roadkill, trees or rocks that could endangered Users;
  - Remove, collect and dispose of s large obstacles from the Carriageway and Off-carriageway;
  - In cases involving livestock, remove and dispose of the carcass at an approved site;
  - Remove and dispose of incidental refuse and litter from the on-carriageway that have any impact on the traffic flow; and
  - Remove any abandoned vehicle from the Right of Way.

EMERGENCY WORKS AND RESPONSE

Maintenance staff will be trained to respond to potential and immediate failure events to mitigate any adverse impacts on Users. Emergency procedures will be reviewed and rehearsed so that staff are proficient at responding and all safety and emergency measures are taken for all events that require it (e.g., emergency response, accidents, breakdowns, routine maintenance, and heavy maintenance).

Patrol & Rescue Services will be provided 24/7/365 to ensure an appropriate response to emergencies, accidents and breakdowns.

Patrols

Patrols services will actively monitor the road status through visual inspections, detect any incident on the road and ensure the safety surrounding the area of any emergency situation, they will then issue a report at the end of each shift, contributing to fill-in a computerized handrail. Each patrol will be provided with 1 vehicle and specific equipment.

In addition to the patrols, an information sign with an Emergency Phone Number will be displayed for Users so they can inform RVH of any incident that could arise on the Project Road. Moreover, close-circuit television (CCTV) cameras will be located on sensitive areas and will be monitored by the Traffic Monitoring team. All those measures will guarantee a maximum road availability and safety.

Ambulances

Ambulance Services will be provided at the Operation Centre and the Support Unit. These services will be subcontracted as it is an emergency response team with specific skills and training who need to respond to these situations. Each ambulance will have a crew formed of 1 driver, 1 certified paramedic and appropriate medical equipment.

Fire Brigades

Fire Brigade Services will be provided at the Operation Centre and the Support Unit. These services will be subcontracted as it is an emergency response team with specific skills and training who need to respond to these situations. Each fire brigade will have a crew formed of 2 certified firemen.

Towing Services

Towing Trucks will be provided at the Operations Centre and the Support Unit. Each towing team will be formed of 1 habilitated driver/operator and specific equipment.

Amongst the emergency works and response activities to be completed there are:

- Supplying and erecting of emergency signs;
- Informed road users through the variable message signs (VMS);
- Cleaning-up the collision or disaster sites;
- Removing from the highway surface, any material including damaged guardrail which represents a hazard to the travelling public;
- Applying absorbent material to minor spills at collision sites;
- Placing warning signs at the scene of collisions, spills or obstructions on the highway;
- Providing emergency traffic control and arrow-boards;
- Reopening of the highway within 1 hour upon notice from the police; and

- Communicating with, coordinating with, providing access for and/or dispatching emergency response services that may be required on the Infrastructure or be required to pass over the Infrastructure.

HEAVY MAINTENANCE

Heavy maintenance is concerned with actions associated with:

- Pavement: for which works are defined based on commonly observed scenarios of deterioration of the pavement condition, per type of pavement structure and material and depending on the traffic. The Heavy Maintenance works include but are not limited to:
  - Periodic renewal of the wearing course: overlay or inlay;
  - Light reinforcement: partial renewal of the binder course;
  - Full depth repairs: full depth repairs of part of every homogeneous section in order to achieve the remaining service life on every km of the project; percentage in accordance with the reliability taken into account and the terminal serviceability index;
- engineering structures: The maintenance plan is based on commonly observed scenarios of deterioration of the structures condition status, per type of structure and material. Typical works include, but is not limited to:
  - Waterproofing;
  - Bearings replacement (where applicable);
  - Concrete repairs;
  - Steel coating refection (where applicable);
  - Expansion joints treatment;
  - Safety barriers repairs; and
  - Scouring prevention for supports in riverbed.
- Facilities: Maintenance will be based on the facilities associated lifecycles. Table 4-24 summarizes the standard maintenance activities and associated typical lifecycle, and
- Information system: As for facilities, the maintenance of information system is based on their associated lifecycles and Table 4-25 summarizes the equipment to be replaced and their associated typical lifecycle.

Table 4-24 Maintenance Activities of Facilities and Typical Lifecycle

Item	Activities	Lifecycle
Road Markings	Painting renewal campaigns will be performed with an estimated schedule considering the volume of traffic, especially the heavy vehicles.	3 years
Fencing	Replacement	15-20 years
Signs	Replacement	20-25 years
Buildings	Rehabilitation of the Operation Center and other buildings belonging to the Project Road.	50 years
Guardrails	Replacement	40 years
Parking	Repairs	15-20 years
Bus Shelters	Repairs and painting renewals, if need be.	20-25 years

Item	Activities	Lifecycle
Drainage -Jetting	Repair when required	15-20 years
Drainage – Basins	Repair to waterproofing membrane	20 years
Lighting Equipment	Replacement of lighting fixture, solar panels (if required) or batteries (if applicable).	10-12 years
Lighting Mast	Replacement (if needed)	50 years

Table 4-25 Maintenance Activities of Information System Components and Typical Lifecycle

Item	Activity	Lifecycle
Vehicle Classification & Counting	Replacement of inductive loops	12 years
	Replacement of workstation	10 years
Variable Message Signs	Replacement of panels	12-15 years
Weather Monitoring System	Replacement of weather stations	15 years
Cameras	Replacement of cameras	8-10 years
Road User Emergency Cal & Customer Service System	Replacement of phone system	12-15 years
Overloading Measurement	Replacement of sensors	12 years
	Replacement of workstation	10 years
Core System	Replacement of servers	12 years
	Replacement of roadside cabinets (Switches, controllers, etc.)	12 years

The various activities listed above are planned for both the main A8 and A8 South roads as well as for service lanes.

4.7 INPUTS AND MATERIAL

4.7.1 CONSTRUCTION

Various materials will be required in large quantities for road construction. Table 4-26 below provides an estimate of their quantities, as well as the projected source of each material.

The project does not require sourcing of primary production as defined in IFC PS6 during the construction phase and thus PS6 requirements for supply chain are unlikely to apply.

Table 4-26 Materials Required for Road Construction

Material	Quantity	Source
Concrete	450,000 m^3	Local cement, crushed aggregates produced by the project
Steel Reinforcing	30,000 tons	Import
Crushed stone	5,500,000 tons	Local quarries
Sand (for concrete)	250,000 m^3	Purchase from a supplier
Bitumen	65,000 tons	Import
Diesel Fuel	65,000,000 litres	Local
Lubricant	2,000,000 litres	Local and Import

4.7.1.1 BORROW AREA

At this point of the project, an extensive survey is being conducted to locate potential sites to become borrow area for the soil required for the construction of the embankments and subgrades. Emphasis is placed on identifying such sites in the vicinity of the project road alignment within economical haulage project road sections.

The contractor is planning to have access to approximately one borrow pit every 10 kms along road corridor. Once identified and selected, the process followed to activate these sites will fulfill all applicable regulations requirements in terms of specific environmental assessments to obtain needed agreement and permits for their opening and operation. However, note that general impacts associated with the opening and operating of such sites have been taken into consideration within the current ESIA.

4.7.1.2 STONE MATERIALS

As presented in section 4.2.2.1, three existing and licensed stone quarries were identified as the potential source of granular material for road construction. The estimated granular material required for the project by requirements and by road section are as shown in Table 4-27.

During the material survey, it was found that natural sand is not available within the project road. The only available source of natural sand is from Machakos, which is 85 km from the project road. All along the project road, crusher dust can be used in place of natural sand.

As for the borrow areas, the opening and operating of new quarries will be covered by specific environmental assessments as required by the Kenyan legislation for the emission of operation permits. However, note that general impacts associated with the opening and operating of such sites have been taken into consideration within the current ESIA.

Table 4-27 Stone Material Requirements (in Metric Tons)

Use		A8			A8 South	
		Section 1	Section 2	Section 3	Section 4	Section 5 & 6
Foundation	0/60 mm	146 300	125 400	0	119 900	0
Foundation	0/31,5 mm	950 400	720 500	316 800	668 800	121 000
Foundation	0/20-0/14 mm	513 700	440 000	174 900	403 700	172 700
Surface dressing		55 000	30 800	15 400	29 700	8 800
Concrete		416 900	293 700	386 100	198 000	45 100
Total		2 082 300	1 610 400	893 200	1 420 100	347 600

4.7.1.3 CEMENT

Cement will be essentially obtained through existing manufacturers locally available and shall be conforming to established standards. At this time, the cement factories shown in Table 4-28 are sufficiently close to the project site to become potential suppliers.

Table 4-28 List of Cement Factories Available Near the Project road

County	Name	Location
Machakos	Bamburi cement	South of Nairobi, along A104
	Blue Triangle cement	South of Nairobi, along A104
	Ndovu cement	South of Nairobi, along A104
	Mombasa cement	South of Nairobi, along A104
	Savannah cement	South of Nairobi, along A104
	Simba cement	South of Nairobi, along A104
Nakuru	Simba cement	Northwest of Nakuru, along A104
Kericho	Rai cement	Northwest of Nakuru, along B1 Road

Most cement plants are located in the same area to the south of Nairobi to the southeast of the Nairobi National Park. Also, most cement factories are located near the A104 facilitating transport of the material to the various work sites.

4.7.1.4 BITUMEN

As bitumen manufactures are not existing in the country, it will be imported from various sources which will vary depending on market fluctuations. Potential sources include South Africa, Iran, Middle-East area and Europe.

4.7.1.5 WATER REQUIREMENTS

The construction of roads requires water for use during road compaction, keeping down dust, mixing of concrete, etc. The work sites and storage area which will include office spaces also requires a constant supply of clean water for its workers throughout the project construction life. The quantities of water necessary for the construction activities have been estimated at 1 400 000 m^3. The sources of water for the construction of this road will be determined during the detailed studies but will most likely come from various boreholes.

4.7.1.6 ENERGY SOURCES AND CONSUMPTION

The various installations associated with construction work will be connected to the main electrical network. Additional back-up generators will be installed in order to ensure continuity of the operations in case of shortage of power.

As for fuel consumption, Table 4-29 summarizes the expected volumes that will be required.

Table 4-29 Fuel Consumption for Construction Work

Type and Use of Fuel	Quantity (liters)
Kerosen for impregnation	3 437 500
Diesel for heavy machinery	27 687 760
Diesel for transport trucks	21 656 130
Diesel for light vehicles	3 654 010
Diesel for electric generators	5 646 810
Diesel to heat asphalt	10 887 720
Diesel for explosives	50 790

4.7.2 OPERATION

4.7.2.1 WATER REQUIREMENTS

Water will be needed in the operation and maintenance phase. According to the experience of the consortium in O&M activities, the order of magnitude of water consumption would be around 15,000 m^3 / year.

4.7.2.2 ENERGY CONSUMPTION

Most electricity need is identified for running the Operation and Maintenance center. The order of magnitude of the consumption is estimated at 900,000 kWh/year and mainly for road lighting, offices and ITS requirements.

Regarding road equipment, among which lighting, it is envisaged to feed it with renewable energy via on site photovoltaic panels.

Diesel consumption of O&M fleet is expected around 380,000 l/year.

4.7.2.3 PRIMARY PRODUCTION

The project does not require sourcing of primary production as defined in IFC PS6 during the operation phase and thus PS6 requirements for supply chain are unlikely to apply.

4.8 OUTPUTS AND WASTES

Wastes will be generated by the project's vehicle and machinery fleet and its maintenance, such as lubricants, filters, wear parts and tires. Other construction wastes, such as concrete and spinning plants waste, scrap metal and asphalt waste will be removed / treated / stored in accordance with local regulations via specialized companies approved by the authorities (NEMA).

At this stage the quantity of waste generated has been estimated but it must be noted that the supplied values may change as details on the development of the Project are finalized. Available estimates show the following potential outputs and wastes:

- 2 million liters of lubricants;
- 1,000,000 m^3 of unused soils;
- 243 tons of hazardous wastes (excluding oil);

- 2000 tons of used oils;
- 268 tons of non-hazardous wastes (construction related wastes);
- 136 tons of domestic waste;
- 97 tons of inert waste (excluding soil).

It must be noted that non-contaminated waste soils will be reused to fill the borrow pits.

4.9 EQUIPMENT AND MACHINERY

4.9.1 PRE-CONSTRUCTION AND CONSTRUCTION

Road construction requires the use of various equipment and machinery. The typical types of equipment to be used in the construction of the proposed road are presented in the Table 4-30. It is important to note that quantities presented are only an estimate as requirements may vary during construction.

Table 4-30 Equipment to be Used During Construction

Equipment	Quantity
Asphalt Plant - 150 - 200 T/H	3
Hydraulic Rock Breaker For 25-35 T Power Shovel	8
Bull Ripper	14
12t 4x4 Truck- Hiab 15 T.M.	12
6 tipper Truck	160
4x4 Fuel Tanker	6
Water Truck	30
4x4 Maintenance Truck	6
Concrete Mixer Truck – 6 M3	12
Lorry Mounted Crane Truck. 4x4	3
Cement Transport Truck	3
Truck for Employee Transport (50 Seats)	25
Concrete Plant 60 M3/H CLASS III Fixed + SILOS	2
Concrete Plant Beton 80 M3/H Oru - 2 Silo +Vis	2
Cement storage silo for cold mix plant	3
Hydraulique Drill Rig	4
Pneumatic Drill Rig	2
Forklift 3t - 7 m	14
Cheap Spreader + Truck	9
Vibrating Bi-Drum -Compactor V2	6
Vibrating Mono-Drum Compactor- V5	20
Compressor XAS 407 kW - ROC CM 341	2
Compressor XAS 97 / 36 kW	10
Finisher Track	4

Equipment	Quantity
Generator	30
Grader	20
Crushing Plant 200 T3h	3
Electric Welding Equipment LINCOLN 400 A	10
Mobile Crushing Unit- Cone and Jaw crusher type	4
Tower Crane	4
Hydraulic Excavator Track	25
Mobile Crane – 40 T – 120 T	25
Cement Pump 54 M3/H on Truck + Spire	4
Planer W1000re	1
Recycler Cat Rm 500	3
Railtainer Unit	3
Hydraulic Ciment Distributor	6
Bitumen Distributor 9000l	10
Conveyer and screening unit Finlay 311	3
Track Crane – 80 T – 150 T	5
Tractor 6x4 – Equipement Carrier 50-70 T	6
Farm Tractor	9
Tractor – Truck	3
Emulsion Plant	2
Vl – Break 4x4 – Station	7
Vl – Pick-Up 4x4 – D. Cab	150
VL – PICK-UP 4x4 S. CAB	150
Vl -Ambulance	2
Waterpump	3
Weigth Bridge – 60t – 16 m	6
Welding Generator	3
Wheel Compactor	12
Wheel Loader	24

4.9.2 OPERATION AND MAINTENANCE

The O&M Team will have vehicles and equipment readily available on site to guarantee smooth operations on the Project Road such as:

- Light trucks;
- Mowers;
- Tractors;
- Bucket truck;
- Variable message boards;
- Fire Engines;
- Ambulances;
- Towing Trucks.

Exact numbers of each equipment type remain to be determined at this point. Nonetheless, ambulances, Fire Engines and Towing Trucks will be based at several locations to ensure short response times to events on the road.

Also, some equipment on lease hire on a "as-and-when-needed- basis" could be rented on these terms for specific tasks (e.g., electrician truck with bucket).

4.10 WORKFORCE

4.10.1 PRE-CONSTRUCTION AND CONSTRUCTION

The average workforce requirements during the construction phase will be

- Supervisory staff: 300 (half of which should come from local available work force);
- Construction workers:
  - Unskilled :1200;
  - Skilled: 800;
  - Highly skilled: 300.

Supervisory staff will be employed for the duration of all construction works, whereas skilled and unskilled workers will be employed for the duration of works for each homogeneous section in order to promote the employment of local labour. It is estimated that about 90 % of the construction workers will be composed of locals.

Type of jobs include:

- Maneuver;
- Pointer, qualified laboratory worker, surveyor, mechanic,
- Iron worker, form worker, mason;

– Light Vehicle (LV) / Heavy Goods Vehicle (HGV) driver, public works machinery operator;
– Team leader, site manager;
– Security guard, secretary, cook, gardener, maintenance agent, nurse;
– Works engineers, Quality Assurance Manager Health, Safety and Environment (HSE) Manager, AutoCAD engineers.

4.10.2 OPERATION AND MAINTENANCE

The operation and routine maintenance activities will generate 200 direct jobs yearly, all local, except for the Chief Operation Officer.

Figure 4-35 shows the typical organisational chart of the operation and routine maintenance team.

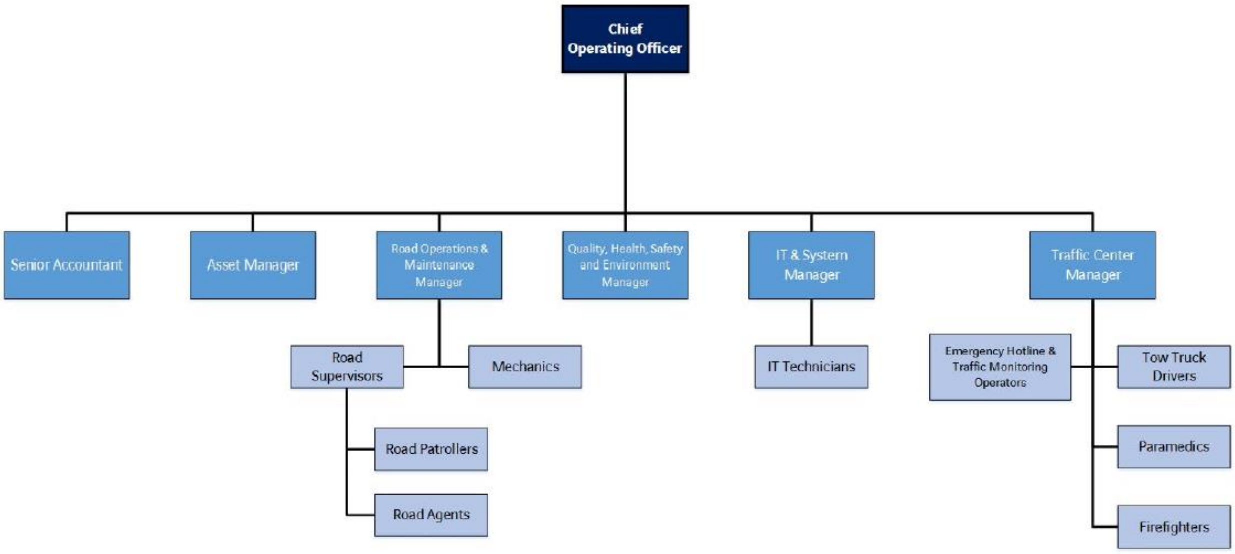


Figure 4-35 Organisational Chart of the Operating and Routine Maintenance Team

It is intended to cover all the positions with Kenyan Nationals except for the Chief Operating Officer.

The goal is to hire the most appropriate candidates and ensure the required technical capacity. The process of the Operations & Maintenance Team (O&M Team) for recruiting new personnel will be based on proven recruitment programs. It will be developed to hire qualified employees who are the most suitable for Operation & Maintenance (O&M) activities.

Equal opportunity will be ensured through fair judgement to avoid any discrimination of an applicant based on her/his race, gender or disabilities. All applicants will be evaluated by the same manner in terms of their education, general skills and work experience.

4.11 SCHEDULE

It is expected that the Final Design Studies integrating ESIA benefits will be completed in 2021 and the project construction should take place from 2022 to 2025. Works on the different sections of the A8 and A8 South Road will be conducted parallelly, although works in sections 5 and 6 will be the first to begin and be completed (within 13 months). The works in section 3 of A8 in Nakuru City will be the last to be completed (Figure 4-36). The detailed pre-construction and construction work program is provided in Table 4-31.

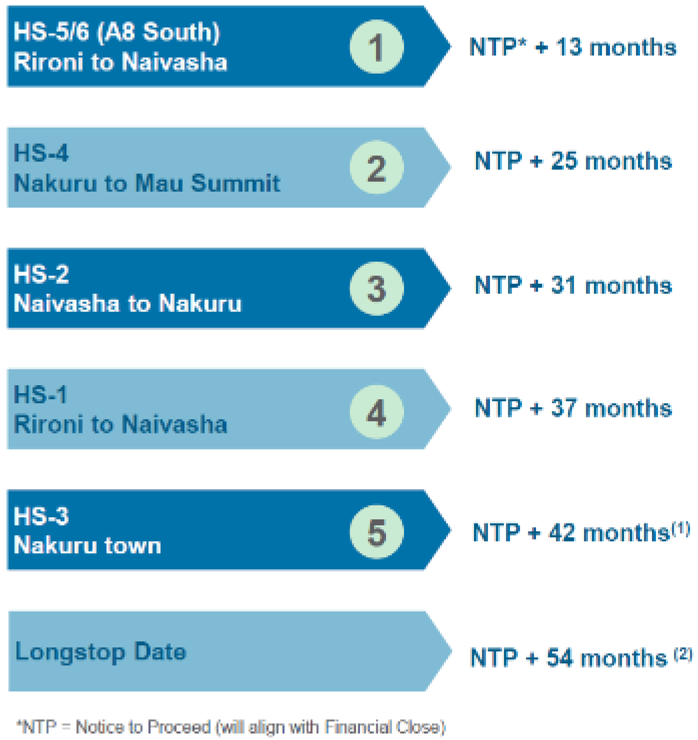
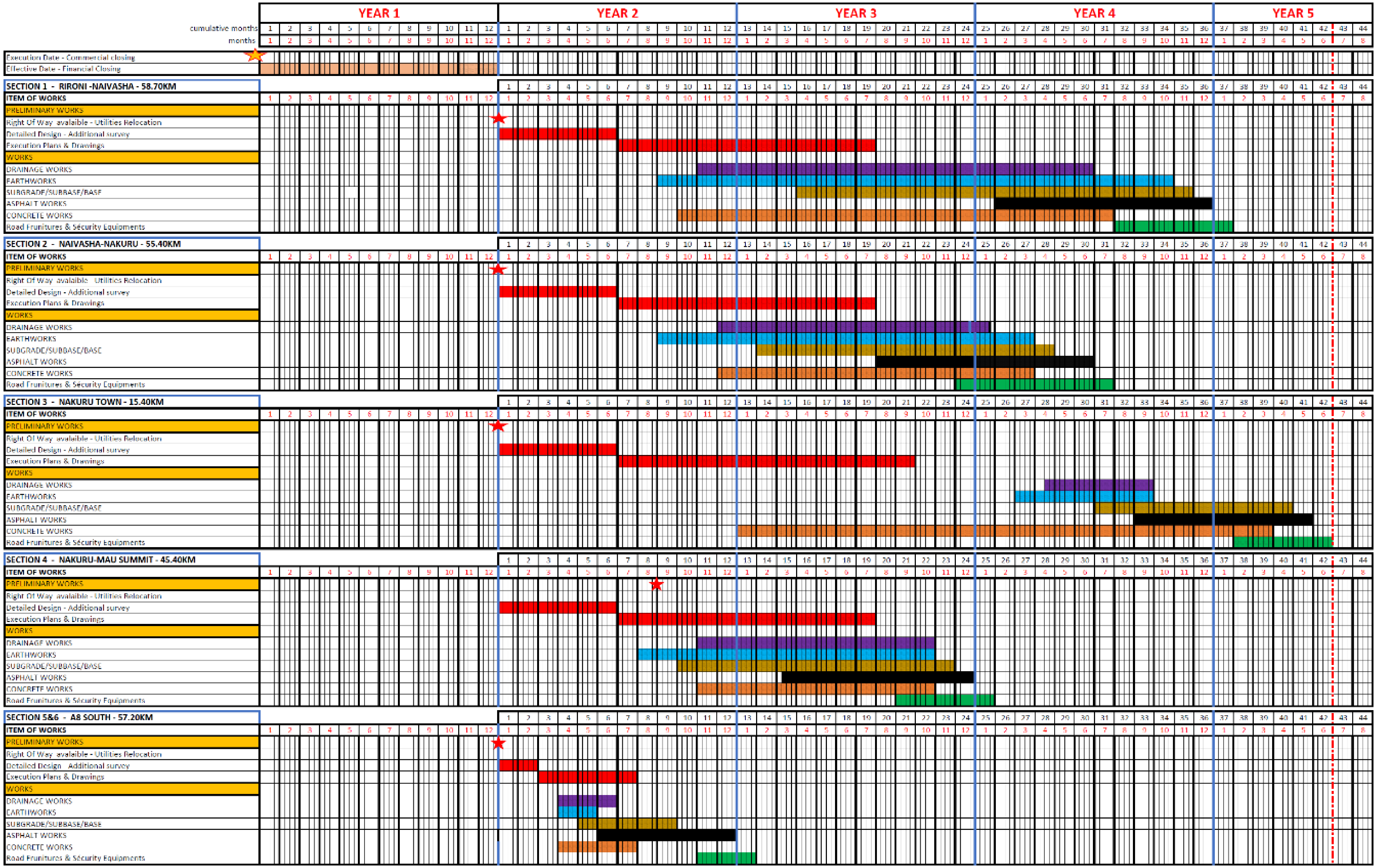


Figure 4-36 Planned Completion Timeline of the Different Road Sections

Table 4-31 Pre-construction and Construction Works Program



4.12 LIFESPAN OF THE UPGRADED ROAD

The lifespan for all engineering structures (bridges, underpasses, viaducts) is approximately 100 years. For other road equipment (lighting, gantries, etc.) the lifespan varies from 3 to 30 years prior to requiring significant maintenance or replacement.

In order to preserve the project's infrastructures, RVH is responsible for maintaining them over the concession period through routine and heavy maintenance activities as described in section 4.6.3.2. RVH is contractually committed to performance criteria that define the level of service.

RVH is also contractually committed to a set of requirements that define the physical condition of the Project Road and Project Facilities at the end of the concession period (time of handback). If needed, remedial works are contractually required for the road and the associated facilities in order to meet the level of service and the remaining service life at the time of handback. The criteria for handback of the project road and the project facilities cover:

- Carriageway including amongst others pavement, shoulders and slopes;
- Drainage (pipes, culverts, ditches, etc);
- Structures (bridges and other structures);
- Other Project facilities (crash barriers, guard rails, lighting, Bus lay bye, Truck lay bays, etc).

5 APPROACH AND METHODOLOGY

This chapter outlines the approach and methodology used to complete this ESIA, including the following aspects:

- Specific COVID-19 considerations;
- Selection of valued environmental components (VECs) described in the Description of Baseline Condition chapter (Chapter 6) and further evaluated in the Impact Assessment and Mitigation chapter (Chapter 8);
- Delineation of spatial boundaries considered;
- Methodological approaches used for the collection of desktop data and field surveys;
- Assessment methodology used to characterize the Project-related construction and operation impact on physical, biological, and socioeconomic VECs;
- Assessment methodology used to characterize the Project-related cumulative impact.

5.1 COVID-19 CONSIDERATIONS

It is important to mention that this ESIA was developed during the COVID-19 worldwide pandemic which has substantially impacted almost every country in the world including Kenya.

Thus, the epidemic had a number of effects on the ESIA planning and development. The ESIA team needed to monitor and adjust to the evolving situation throughout the ESIA development. The scheduling and undertaking of in-country ESIA activities were more specifically impacted namely: field reconnaissance visits, technical meetings with relevant authorities and organizations, public consultation meetings, multidisciplinary biophysical baseline inventories and detailed socioeconomic surveys which have required some traveling from international experts and the respect of numerous specific COVID measures. It should be noted that due to the COVID-19 restrictions and curfews, it was not possible/permit to conduct detailed surveys of nocturnal bird species in the context of the ESIA.

In response to the rise of coronavirus cases in Kenya, the government has adopted throughout the various phases of the pandemic, several measures aiming at limiting/mitigating the negative effects of the pandemic including:

- Travel restrictions – limitation of interregional travel and suspension of international flights;
- Nationwide temporary curfew;
- Public and private workers were at time forced to work from home;
- Restrictions and limitations for all in-person public/social gatherings were imposed;
- A number of temporary closures (school, bar / restaurant) were applied;
- Self quarantine measures;
- General social distancing including passenger-distancing in all public service vehicles;
- Face mask wearing to reduce the chances of transmission of the virus;
- Etc.

The COVID-19 pandemic has impacted many dimensions of the day-to-day life including daily patterns and habits, mental health, stress levels, economic activities, tourism, etc. It also had a number of direct and indirect negative and positive effects on the environment. According to BDO[1] , Edinburg Sensors[2], and European Environment Agency (EEA)[3] some of most tangible environmental effects encountered during the COVID 19 pandemic have been reduced GHG (greenhouse gas) emissions in some locations, improved air quality in some areas, reduced noise pollution, improved water quality, wildlife distribution and restoration as well as traffic reduction/congestion in large cities worldwide.

As for the worldwide observations, the COVID pandemic has undoubtfully impacted the day-to-day activities in Kenya and the regional assessment area considered for the ESIA.

While it is difficult to formally confirm and quantify the potential effects, it must be acknowledged that some data acquired during the ESIA baseline surveys may have been somehow influenced by the COVID 19 situation including: results from ambient air quality baseline measures for particulate matter and air contaminants, 1 hour traffic count and measured ambient noise levels. When comparing ESIA baseline results with modelized data using 2017 traffic counts adjusted to 2025(time zero of Project), ESIA baseline results are considered relevant and representative to describe existing baseline conditions.

Technical meetings and public consultation meetings were held at appropriate/authorized moment, in favorable environment considering social distancing requirements and in compliance with all applicable Government of Kenya's recommendations and measures. Similarly, appropriate COVID-19 restriction measures were considered and respected during the socioeconomic surveys with chiefs, key informants and community members.

5.2 SPATIAL BOUNDARIES

Three distinct levels of spatial boundaries have been established and considered in this ESAI:

- The **Project Development Area (PDA)** corresponds to the existing Road Reserve and Project footprint or direct influence area associated with the implementation of the Project;
- The **Local Assessment Area (LAA)** includes the PDA and its nearby and adjacent surroundings where Project impact can be induced, anticipated, and reasonably expected. The LAA is specific to each VEC;
- The **Regional Assessment Area (RAA)** includes a broader geographical zone used to capture the regional context and where some potential Project impact can be induced, anticipated, and reasonably expected for a reduced number of valued components. The RAA is specific to each VEC.

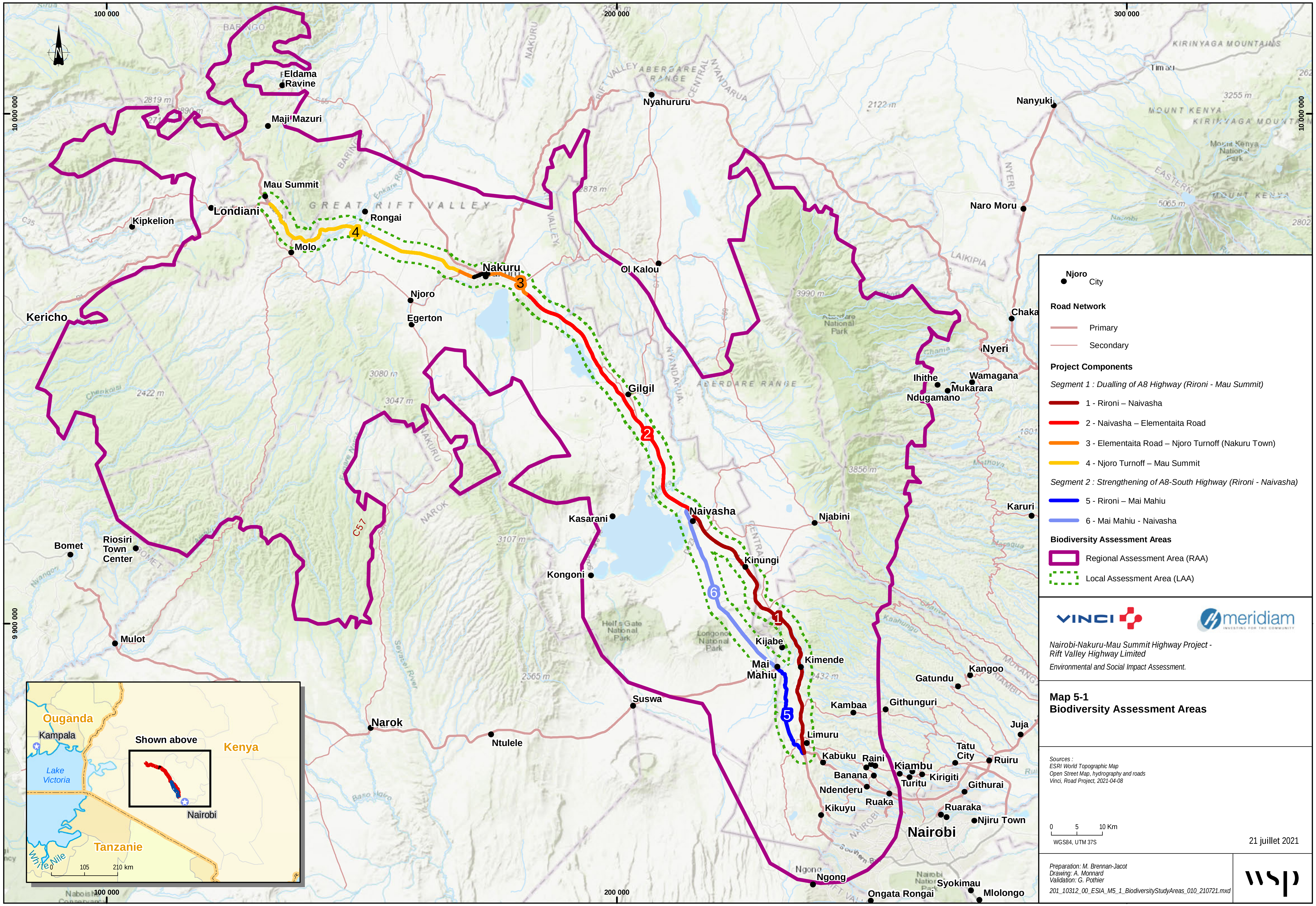
For the Physical Environment, a distance of 500 m on either side of the PDA is considered sufficient to incorporate environmental changes that can be felt directly and indirectly on the selected physical VECs. As for the RAA, it will be limited to a distance of 2 km on each side of the PDA.

For the Biological Environment, the LAA is a 2 km buffer around the PDA, which corresponds to the zone where direct impact as a result of the project is likely to affect the local level biodiversity. An extended LAA encompassing a 10 km buffer was identified for the biodiversity sensitivity analysis, because it is deemed to provide a better overview of the context that may be affected by direct impacts in relation with the project development (increased traffic to the project area and increased use of immediate neighboring zones). The Biodiversity RAA was determined considering ecological connectivity, public and private conservation areas and land-cover type. It covers a 15 km buffer around the project's alignment and includes all protected areas and Internationally Recognized Areas (e.g., Natural World Heritage Sites, KBAs or Ramsar sites) that intersect with this 15 km buffer. It was first delineated by The Biodiversity Consultancy as Discrete Management Unit (DMU) for critical habitat screening (Bennun et *al.*, 2018).

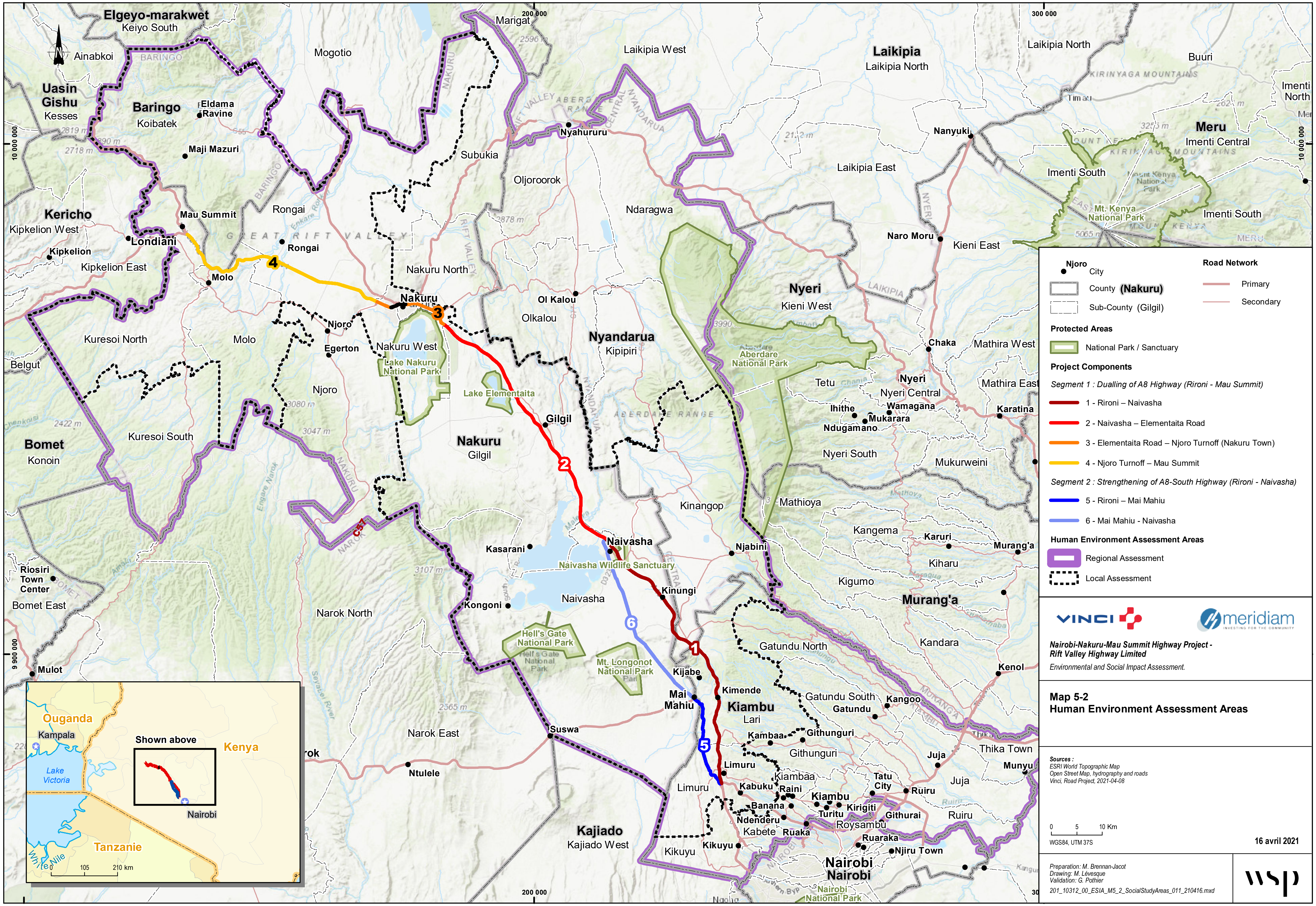
1 https://www.bdo.global/en-gb/insights/global-industries/natural-resources/how-does-covid-19-impact-the-environment
2 https://edinburghsensors.com/news-and-events/the-effect-of-the-covid-19-pandemic-on-the-environment-following-one-year-in-lockdown/
3 https://www.eea.europa.eu/publications/covid-19-and-europe-s

For the Human Environment, the LAA will correspond to the limits of the sub counties directly in contact with the PDA while the RAA will correspond to the limits of the three main counties crossed by the Project: Nakuru, Nayandarua and Kiambu.

Maps 5-1 and 5-2 illustrate the proposed spatial boundaries considered for biological and human environment.



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

5.3 VALUED ENVIRONMENTAL COMPONENTS

This ESIA specifically targets VECs that have an important environmental and social interest to local communities and regulatory authorities and that are likely to be directly or indirectly affected by the construction activities of the proposed Project.

VECs were selected based on the IFC Performance Standards and Guidelines, the scope of the Project, the stakeholder engagement program, experience on similar projects, and professional judgment of the Environmental and Social Evaluation practitioners. Relevant baseline information relating to each VEC and subcomponent carried forward are provided in Chapter 6.

Table 5-1 outlines the justification for the selection of the VECs considered in the ESIA. The table includes the following three distinct columns:

- **Valued Components and Sub-Components:** Lists the environmental components and sub-components;
- **Rationale for VEC Selection:** Provides justification for screening out, or carrying forward an environmental component or subcomponent as a VEC;
- **VEC Carried Forward:** Confirms whether an environmental component or subcomponent is selected as a VEC to be described in the Description of Baseline Condition chapter (Chapter 6) and assessed in the Impact Assessment and Mitigation chapter (Chapter 8).

Table 5-1 Selected Valued Environmental Components for the Nairobi-Nakuru-Mau Summit Highway Project

Environmental Component and Sub-Component		Rationale for VEC Selection	VEC Carried Forward (Y/N) Baseline	VEC Carried Forward (Y/N) Assessment
Physical Environment				
Atmospheric environment	**Meteorological conditions**	Understanding meteorological conditions is important as they may affect construction and exploitation activities related to the Project. Meteorological conditions are also linked with several other dimensions of the biophysical environment. Baseline meteorological conditions are documented in the Description of Baseline Condition chapter (Chapter 6) to fully describe the Project's environmental setting. However, this subcomponent is not further considered in the impact assessment as the construction and operation activities will not have any impact on the meteorological conditions.	Y	N
	Ambient air quality	Ambient air quality is fundamental to human well-being and health. The proposed construction activities could release dust and atmospheric contaminants that may affect air quality (i.e., from cut and fill, vehicles, machinery traffic, crushing/screening and asphalt plants). Once the highway is in operation, anticipated increase of road traffic and road maintenance activities can also generate dust and atmospheric contaminants. Therefore, existing ambient air quality is described in the Description of Baseline Condition chapter (Chapter 6) and the Project's impacts on this VEC are further evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	GHG emissions	Greenhouse gases (GHGs) are known to contribute to global warming and climate change. Kenya has signed the 1992 United Nations Framework Convention on Climate Change (UNFCC) and has enacted the Climate Change Act, 2016, which provides for the development of National Climate Change Action Plans to prescribe measures and mechanisms to mainstream adaptation and mitigation actions into sector functions of National and County Governments. Construction activities associated with the road upgrade may generate greenhouse gas (GHG) emissions. During road operation, anticipated increase of road traffic and road maintenance activities will also generate GHG emissions. Therefore, current GHG emissions are described within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Ambient Noise		Ambient noise is important as it may affect human well-being and health. Construction activities as well as traffic during road operation may result in increased noise levels s. Consequently, baseline noise conditions are documented within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Geology, Volcanism and Seismicity		Geology, volcanism as well as seismicity are features that must be considered as part as the project design. Thus, these aspects are documented in the Description of Baseline Condition chapter (Chapter 6) but will not be further considered in the impact assessment as the construction and operation activities will not have any impact on these components of the physical environment.	Y	N
Topography		Topography is an important component as it informs project design and allows for anticipation of geological risks along the existing road. Consequently, topography is documented in the Description of Baseline Condition chapter (Chapter 6) to provide an overview of topographic constraints and geological risks. However, this subcomponent is not further considered in the impact assessment as the construction and operation activities will not have any impact on topography.	Y	N
Water resources	**Hydrology**	Areas along the A8 and A8 South are prone to flooding during rain season. Efficient drainage and careful evacuation of collected storm waters are important to minimize the impact on surrounding communities. Therefore, this component is described within the Description of Baseline Condition chapter (Chapter 6) and carried forward to be evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Surface water quality	The Nairobi-Nakuru-Mau Summit Highway crosses several streams and rivers, amongst which are tributaries of lakes Naivasha, Elmenteita and Nakuru, upstream and downstream of the Project. Surface water quality is linked with good aquatic habitat. Construction activities may impact surface water quality, especially through erosion and sediment transport by runoff water. Operation of the road can also affect water quality through the generation of contaminated stormwater. Consequently, baseline surface water quality was described and is documented within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Groundwater quality and quantity	The construction and operation of the Project are set within the Nakuru, Elmenteita and Naivasha basin where important aquifers are present and intricately linked with the lakes and surface through fault lines and cracks. They are known to be supplied mainly by rainfall confirming that contamination derived from construction or operation activities of the Highway could have incidence on groundwater. Furthermore, the Kenyan Water Resource Authority data confirms that groundwater is extensively used for domestic, agricultural and industrial uses and that boreholes are present along both road sections. Thus, additional use of groundwater for the Project requirement could have an effect on groundwater availability. Consequently, this component is described in the Description of Baseline Condition chapter (Chapter 6) and considered in the impact assessment (Chapter 8).	Y	Y

Environmental Component and Sub-Component		Rationale for VEC Selection	VEC Carried Forward (Y/N)	
			Baseline	**Assessment**
Soils and sediments	**Soil stability/erosion**	Project construction activities are likely to modify the physical characteristics of soils in various ways, either by changing its structure, compaction, exposure, erosion, sedimentation, displacement or landslides. Therefore, this subcomponent is described within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the impact assessment (Chapter 8).	Y	Y
	Soil quality	Construction activities will require the manipulation and transport of soil which will need to be managed according to their contamination level. Otherwise, the construction and operation activities will not result in impact on soil quality other than those relating to possible accidental leaks or spills. Accidental leaks or spills would be managed through standard work site best management practices presented in the ESMS action plans. Baseline soil quality is documented in the Description of Baseline Condition chapter (Chapter 6) to fully describe the Project's environmental setting and the Project's impact on this VEC are evaluated in the impact assessment (Chapter 8).	Y	Y
	Sediment quality	The construction activities will not result in impact on sediment quality other than those relating to possible accidental leaks or spills, especially during works in water. Accidental leaks or spills would be managed through standard work site best management practices. However, construction of crossing watercourse crossing infrastructure may require excavation and management of sediments. These sediments will need to be managed according to their contamination level. Baseline sediment quality is documented in the Description of Baseline Condition chapter (Chapter 6) to fully describe the Project's environmental setting and the Project's impact on this VEC are evaluated in the impact assessment (Chapter 8).	Y	Y
Biological Environment				
Habitats and Flora		The Project will be implemented within the existing road reserve which hosts limited vegetation cover. Existing vegetation cover in the RoW is primarily dominated by a mix of short herbaceous and shrubby vegetation characteristic of recently disturbed land. However, a number of valuable terrestrial habitats are present at the local and regional level alongside of the road. Terrestrial habitats provide many services, including providing habitat for fauna and flora, providing food, fiber and shelter resources, storing, transforming and releasing carbon, water and other nutrients, protecting soil resources from salinity and erosion, producing atmospheric oxygen and regulating climate. Habitats and flora are essential to ecological function and connectivity. Therefore, terrestrial habitats and flora are considered a VEC, and is described within the Description of Baseline Condition chapter (Chapter 6) and project impact on this VEC are assessed in Chapter 8.	Y	Y
Birds		According to BirdLife International, several Important Bird Areas (areas identified as being globally important for the conservation of bird populations) (IBA) are present near the road alignment, including adjacent, Nakuru, Elmenteita and Naivasha Lakes, as well as Kikuyu Escarpment forest. Therefore, this VEC was characterized, and the results documented in the Description of Baseline Condition chapter (Chapter 6), and Project impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Reptiles and Amphibians		Several threatened or endemic reptiles and amphibian species are known from the project area. Barrier effects and increased mortality from road crossings, while human relocation associated with road construction and operation can affect these species through habitat loss. Therefore, this VEC was characterized, and the results documented in the Description of Baseline Condition chapter (Chapter 6), and Project impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Mammals	**Small Mammals**	The project area is the home to some endemic, restricted-range small mammal species. Small mammals are likely to suffer from barrier effect of the road and the project footprint or relocation may have impacted their habitat. Therefore, this VEC was characterized, and the results documented in the Description of Baseline Condition chapter (Chapter 6), and Project impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Large mammals	The road passes next to important sites for a suit of large mammals, known to cross the current highway during seasonal movements, dispersal or foraging, that will potentially be affected by barrier and fragmentation effect, and collision mortality related to the road construction and operation. Therefore, this VEC was characterized, and the results documented in the Description of Baseline Condition chapter (Chapter 6), and Project impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Freshwater Ecology	**Aquatic Habitat**	The road alignment crosses several wetlands and rivers as well as perennial and non-perennial streams, that may be affected by habitat degradation through pollution and sedimentation or hydrological changes during construction and operation. These habitats are important to numerous flora and fauna species. Consequently, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Macroinvertebrates	Invertebrates are also likely to be affected by pollution or hydrological changes in rivers and streams that may occur during road construction and operation. The project area intersects the range of an endemic mollusk species. Consequently, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Fish	Fish are likely to be affected by pollution or hydrological changes in rivers and streams that may occur during road construction and operation. Because of the interconnected nature of aquatic ecosystems, these effects can be expected to be felt downstream, whereas Critically Endangered species are potentially present. Consequently, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y

Environmental Component and Sub-Component		Rationale for VEC Selection	VEC Carried Forward (Y/N)	
			Baseline	Assessment
Ecosystem Services		Ecosystem services are the benefits that people, including businesses, derive from ecosystems. They are organized into four types: (i) provisioning services, which are the products people obtain from ecosystems; (ii) regulating services, which are the benefits people obtain from the regulation of ecosystem processes; (iii) cultural services, which are the nonmaterial benefits people obtain from ecosystems; and (iv) supporting services. As the project may have an impact on ecosystem services, these are described in the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Human environment				
Population		This component relates to the characteristic of the population living or undertaking activities in the vicinity of the highway or in the Road Reserve. Baseline information relevant to the population is presented in Chapter 6 to characterize the socio-demographic conditions of those living by the Project.	Y	N
Land Development, Use and Occupation		The Project will be mostly located within the existing Road Reserve (Right of Way, ROW) delimited by KeNHA for the enlargement of the existing highway (A8) and within the existing Road Reserve of the A8 South. KeNHA is responsible for the resettlement and compensation activities required in the right-of-way. A Resettlement Action Plan (RAP) has been developed, approved by the Worldbank and is currently being implemented by KeNHA. However, some additional land may be temporarily required for construction requirements (storage of material and machinery, maintenance activities, production of granular material and asphalt, etc.) and the installation of viaducts, interchanges, bridges, underpasses, overpasses for pedestrians, wildlife, vehicles and the railway. Land development, use and occupation is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Community Well-Being and Safety		This component relates to the quality of life, well-being, mobility, social cohesion, and health and safety of surrounding community members. Construction and operation activities and influx of workers and job seekers may impact communities through nuisances, increased traffic, and social problems among others. This component also relates to the use people make of the highway to access goods and services, to commute to their income-generating activities, and for other sociocultural reasons. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Living Conditions, social amenities and community assets	**Living conditions**	This component relates to the physical capital that people in the PDA have in terms of housing and equipment and access to services. Except for those that may be resettled, the Project will not directly impact living conditions but may influence the housing market (those that will live very close to the widen highway may see their house value depreciated while some others, thanks to improve transport services may see their house value increase). Resettlement and Compensation of displacement of houses and economic activities affected by the Project are addressed in the Resettlement Action Plan, managed by KeNHA and excluded from the scope of the ESIA. This VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Social amenities and community assets	Side dirt roads and paths run parallel to the highway. These are of great significance for non-motorized transport of community members and are sometimes located within the Road Reserve. These roads and paths are often informal. They are at risk of disappearing due to the widening of the highway. Other social amenities may be present in the Road Reserve and may be impacted by the Project. This VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y

Environmental Component and Sub-Component		Rationale for VEC Selection	VEC Carried Forward (Y/N)	
			Baseline	Assessment
Livelihood strategies and economic activities	Land-based livelihood activities	This VEC includes cattle herding, small-scale agriculture activities and community-based forestry. Cattle herding and grazing of domestic livestock can take place in the Road Reserve and will be affected by construction work and the creation of a barrier effect with the enlarged highway. This activity is the main land-based livelihood in the PDA. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8). Some community-based forestry activities and small-scale agriculture are present along the project alignment. However, these do not encroach on the Road Reserve and will therefore not be impacted. Therefore, these VEC are considered within the Description of Baseline Condition chapter (Chapter 6) but only those related to cattle herding will be evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Self-employed and business-based livelihood	This VEC includes trade businesses such as shops, markets and street vendors located along the highway. Construction activities might affect access to markets, shops and street vendors along the road. On the other hand, construction work will require the acquisition of goods and services and generate contract opportunities for businesses at the local and regional levels resulting in the creation of jobs. Once operational, the new highway will allow for the development of new businesses and improve mobility of goods and services. On the other hand, some vendors that encroach in the Road Reserve will be negatively impacted. Street vendors are particularly vulnerable due to their informal status and their dependency on the Road Reserve to sustain their livelihood activity. This Project-induced vulnerability will be assessed as well. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Fisheries (water-based livelihood)	Fisheries are important formal and informal water-based livelihood activities occurring mainly, in the RAA, within the Rift Valley lake system and more specifically in lakes Naivasha and Nakuru. At a much smaller scale, some informal fishing occurs in the various water courses crossing the A8 and A8 South. These activities offer some income and additional subsistence to the regional population. Considering the relative importance of fishing in the region, this component is described in the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Industry (large-scale economic activities)	Proposed construction activities will require the acquisition of material (quarries, sand pit, etc.) and generate contract opportunities for industries at the local and regional levels resulting in the preservation and/or creation of jobs. Once operational, the new highway will also improve mobility of goods and services which will benefit local manufacturing industries and enterprise-based livelihood. In addition, many people living in the RAA are employed in this sector as daily workers or permanent employees and are commuting on the road network to access their place of work. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Transport sector	Many people living in the PDA are employed or self-employed in the transport sector as a truck driver or bus driver. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Tourism and recreational activities	Tourism is an important direct and indirect source of income within the project area with the presence of numerous parks and reserves (i.e., Nakuru National Park, Soysambu) and private installations receiving tourists. The proposed Project may have effects on touristic activities during construction through the creation of temporary traveling problems and the generation of nuisances. On the other hand, during exploitation, the improve highway should be beneficial for touristic activities as it would facilitate travel and improve security of the travelers. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Labor Conditions		This important VEC is a key concern not only for community members and workers themselves but also for the population in general due to the legacy of poor labor conditions on road construction in the region. Social impact associated with poor labor conditions can lead to significant reputational risk for the Project. Therefore, this VEC is considered within the Description of Baseline Condition chapter with a description of local and regional return of experience of construction works (Chapter 6). This VEC is also addressed in the Impact Assessment and Mitigation chapter (Chapter 8) through the angle of: – Impact on workers' conditions caused by poor health and safety conditions and high level of casualization (informality); – Impact on workers and surrounding communities caused by the lack of oversight of subcontractors and suppliers of goods and services in the supply chain who may abuse worker rights; – Impact on the Project's social acceptability caused by job seekers influx.	Y	Y

Environmental Component and Sub-Component		Rationale for VEC Selection	VEC Carried Forward (Y/N)	
			Baseline	**Assessment**
Vulnerable and Marginalized Groups (VMGs)		Some groups of people are considered historically underserved and deserve some attention due to their collective vulnerability. Two such communities are present in the vicinity of the highway: the Maasai and the Ogiek. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Gender aspects		Gender aspects will be mainstreamed in the analysis of VECs and the baseline description of VEC and impact assessment is as much as possible gender disaggregated. However, good international practices recommend dedicating a section to describe women challenges and risks associated with labor influx such as gender-based violence. Therefore, this VEC is considered within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC are evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Public infrastructure and Services	**Roads**	Construction activities will generate additional transportation and vehicle movements that may affect the existing road network and traffic. This section deals with official roads maintained by the government (KURA, KeRRA) The new highway will attract more trucks that might put pressure on secondary roads. The presence of the new toll highway may also induce additional pressure on surrounding secondary road network as drivers will try to by-pass the new highway to avoid toll payment. Therefore, this VEC is described within the Description of Baseline Condition chapter (Chapter 6) and carried forward to be evaluated in the Impact Assessment and Mitigations (Chapter 8).	Y	Y
	Railways	Railways are present in the project area and crossed by the project. Construction activities, at crossing points, could have some repercussions on the railway and its exploitation. Therefore, this VEC is described within the Description of Baseline Condition chapter (Chapter 6) and carried forward to be evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Electricity and telecommunication	Electricity and telecommunication lines might be affected during construction. Therefore, this VEC is described within the Description of Baseline Condition chapter (Chapter 6) and carried forward to be evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
	Underground utilities	Culverts, pipes and other underground utilities such as sewage and water distribution potentially present along the Road Reserve and may be temporarily impacted during construction. Therefore, this VEC is described within the Description of Baseline Condition chapter (Chapter 6) and carried forward to be evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).		
Archaeology and Cultural Heritage		Archaeology and cultural heritage are sensitive aspects for the Kenyan population in general and has been taken seriously by the Kenyan Government who established the National Museums and Heritage Act for the protection of cultural heritage and chance findings (Section 30 of the Act). In addition, there are monuments and other heritage structures close to the Road Reserve, which will need to be protected from construction activities. Therefore, this component is described within the Description of Baseline Condition chapter (Chapter 6) and carried forward to be evaluated in the Impact Assessment and Mitigation chapter (Chapter 8).	Y	Y
Visual environment		A good visual environment contributes to general quality of life and well-being and supports touristic activities. However, the project implies essentially low-lying infrastructure which will not change the current visual environment except for the crossing of the city of Nakuru (duplex type road infrastructure). Consequently, baseline conditions will be qualitatively documented within the Description of Baseline Condition chapter (Chapter 6) and the Project's impact on this VEC will be evaluated in the Impact Assessment and Mitigation chapter (Chapter 8) focusing on the Nakuru Viaduct.	Y	Y

5.4 DATA COLLECTION METHODOLOGIES

This section presents the methodological approaches followed to conduct the various field surveys, to complete the impact assessments for the identified VEC and to complete the cumulative impact assessment.

5.4.1 *DESKTOP ANALYSES*

5.4.1.1 REVIEW OF 2018 ENVIRONMENTAL IMPACT ASSESSMENT

In 2018, Charles & Barker Ltd, on behalf of KeNHA, completed a preliminary Environmental and Social Impact Assessment (ESIA) based on the initial design for the Proposed Development, Maintenance and Management of Rironi Mau Summit PPP Project. The ESIA was prepared and completed with the objective of meeting Kenya's national Environmental legal requirements in order to obtain a Licence from the National Environment Management Authority (NEMA) for the project. The license was finally issued in May of 2020. The project was finally awarded as a PPP project to the Rift Valley Connect Consortium in 2020. Amongst the obligation of the consortium is the requirement to generate an Environmental and Social Impact Assessment based on a more advanced design of the project that will meet both National and International requirements.

A thorough review of the 2018 preliminary ESIA was completed to identify the information and sources that can be used for the preparation of the ESIA and to identify the gaps between the ESIA and the requirements to meet international standards. The main resulting observations are that:

- the ESIA was based on a very preliminary design of the highway project;
- most of the data presented in the 2018 ESIA requires updates;
- the physical baseline is mainly based on existing data with validation type field surveys;
- the biological environment was described through the use of existing available data and the completion of a Critical Habitat Screening during the site visits;
- socioeconomic and gender aspects were covered;
- only one round of consultation was conducted with key stakeholders;
- the project being at the feasibility stage, the project effects on the environment were considered through the risk assessment angle which already gives a good appreciation of impacts to be expected;
- a good Environmental and Social Management Plan was proposed;
- a Resettlement Action Plan (RAP) was prepared to allow for the project's right-of-way clearance which KeNHA implemented. The RAP was approved by the World Bank in 2018.

All useful information and information sources will be considered for the preparation of the current ESIA.

5.4.1.2 DESKTOP DATA ACQUISITION

Existing desktop data and information were acquired through requests to various government agencies and a vast literature search, which included the following information:

- Available meteorological data from the Kenya Meteorological Department, including data related to climate types, temperature, precipitation and wind;
- Available air quality data from the National Environment Management Authority (NEMA);
- Available desktop information regarding current GHG emissions and documented climate change impacts in Kenya;
- Information related to hydrology and groundwater available from the Water Resources Authority (WRA) of Kenya;
- Cartography, geodesy, topography, photogrammetry and gravimetry information from various existing scientific literature, the Incorporated Research Institutions for Seismology (IRIS), the ThinkHazard web interface (World Bank and GFDRR) and the analysis of available maps and satellite imagery;
- Information regarding the biodiversity context, such as the presence of Ramsar sites and Important Bird Areas;
- Information regarding the flora and fauna in the RAA, with special attention given to birds, wetlands, fauna in general and fauna movement through existing literature and through national agencies such as the Kenyan Wildlife Services and the Kenyan Forest Services. Literature reviewed for each biological component is detailed in the sectorial reports in Appendices 6-13 to 6-24;
- Information regarding fisheries and aquaculture-specific programs for the protection and recovery of fishery resources from Kenya Marine and Fisheries Research Institute (KMFRI);
- Known occurrences in the Global Biodiversity Information Facility (GBIF) database and in the Kenya Bird Map project;
- Review of Counties Development Plans for the counties of Kiambu, Nakuru and Nyandarua;
- Review of other existing socioeconomic baseline information relating to the administrative framework, land tenure, demographic data, housing and living conditions, education, healthcare facilities and health issues (e.g., epidemics, etc.), labor and workforce, livelihood, employment and income, life expectancy, economic activities (e.g., tourism, industry, commerce, farming/grazing/fishing, etc.), access to water, security and human rights, etc.

5.4.1.3 APPROACH TO GHG CALCULATIONS

Kenya has signed the Paris Agreement on climate change which was finally adopted in December 2015.This Agreement aims at limiting global warming to well below 2 degrees Celsius compared to pre-industrial levels. In parallel to signing this Agreement, Kenya had committed itself, through its 2013 Climate Change Action Plan to reduce GHG emissions by 30% in 2030. The country is seeking to reach this objective through increasing rail transport of goods and implementing better agricultural practices. One effective effort which will directly affect the project area is the development of a new railway connecting Mombasa to Nairobi and continuing toward Naivasha, Nakuru and the Uganda border. GHG calculations are based on GHG protocol[4] included in Equator Principles[5] and IPCC rules, in accordance with IFC Performance Standard 3 which refers to IPCC methodologies. IFC EHS Guidelines do not refer to any GHG quantification methodology.

---

4 The Greenhouse Gas Protocol : A Corporate Accounting and Reporting Standard, 2004. https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf

5 Equator Principles (EP4), 2020. https://equator-principles.com/app/uploads/The-Equator-Principles_EP4_July2020.pdf

DEFINITION OF SCOPES

To help delineate direct and indirect emission sources, improve transparency, and provide utility for different types of organizations and different types of climate policies and business goals, three "scopes" are defined for GHG accounting and reporting purposes:

- Scope 1 is for direct GHG emissions that occur from sources that are owned or controlled by the company, for example from combustion of owned or controlled boilers, furnaces, vehicles, etc. Direct CO_2 emissions from the combustion of biomass shall not be included in scope 1 but reported separately;
- Scope 2 accounts for GHG emissions from the generation of purchased electricity consumed by the company;
- Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions.

Change in land use was not considered since the large majority of the project will be realized within an existing right-of-way already cleared from any significant vegetation cover and which is dedicated for transport use. Furthermore, all other potential land use change associated with the project will concern small areas which will only contribute to a negligible amount of GHG emissions.

Table 5-2 shows the GHG emissions for each scope.

Table 5-2 GHG emissions for each scope

Phases	Type of GHG Emissions	Scope	Included (Y/N)
Construction	Combustion of fuel by equipment and machinery	1	Y
	Cement production	3	Y
	Asphalt production	3	N
	Tree cutting	1	N
	Electric consumption for activities	2	Y
Operations	Use of the new highways (Traffic)	3	Y
	Combustion of fuel by maintenance vehicles	1	Y
	Electric consumption by operation & maintenance building and traffic lights	2	Y

GLOBAL WARMING POTENTIAL

In order to evaluate the release of different greenhouse gases against a common basis, the global warming potential (GWP) is used. GWP is a factor describing the radiative forcing impact (degree of harm to the atmosphere) of one unit of a given greenhouse gas relative to one unit of CO_2.

In this report, GWP of the 5th report of the GIEC is used:

- GWP (CO_2) = 1;
- GWP (CH_4) = 28;
- GWP (N_2O) = 265.

By example, 1 tonne of N_2O is equal to 265 tonnes of CO_2 equivalent noted eCO_2.

GHG CALCULATION FOR TRAFFIC

The GHG calculation for traffic is estimated by the traffic intensity in 2025 and 2040 and calculated by EPA's Motor Vehicle Emission Simulator (MOVES). MOVES is a state-of-the-science emission modeling system that estimates emissions for mobile sources at the national, county, and project level for criteria air pollutants, greenhouse gases, and air toxics. The parameters characterizing the vehicle fleet in MOVES are adapted to the fleet present in Kenya.

GHG CALCULATION FOR CONSTRUCTION

GHG emissions during the construction phase are essentially related to the combustion of various types of fuel by equipment and machinery. These emissions are related to scope 1. For the emissions associated with vehicle movements, the calculation is based the quantity of fuel used and an emission factor as per the following equation:

$$\textbf{GHG emissions} = \sum (\text{activity data}_j * \text{emission factor}_j)$$

(The Greenhouse Gas Protocol, 2004, Figure 10)

Applied to fuel consumption:

$$\textbf{GHG emissions} = \sum (\text{Fuel}_j * \text{EF}_j)$$

With:

- Fuel_j = quantity of fuel j used (L, kg or m³);
- EF_j = emission factor (g GHG/L, kg, GJ or m³ of fuel);
- j = fuel type.

As for the production of cement, the estimation of associated emissions was based on emission factors from the Intergovernmental Panel on Climate Change (IPCC) and the quantities to be produced.

EMISSION FACTORS

As requested by the GHG Protocol, the emission factors come from Guidelines for National Greenhouse Gas Inventories of Intergovernmental Panel on Climate Change (IPCC) and are summarized in Table 5-3.

Table 5-3 Emission Factors for Vehicles – Road Transportation

Type	CO_2 (g/GJ)	CH_4 (g/GJ)	N_2O (g/GJ)	eCO2 (g/GJ)	Source
Natural gas	56 100	92	3.0	59 471	IPCC, 2006. Tables 3.2.1 and 3.2.2
Propane	63 100	62	0.2	64 889	IPCC, 2006. Tables 3.21 and 3.2.2
Gasoline vehicles	69 300	25	8.0	72 120	IPCC, 2006. Tables 3.2.1 and 3.2.2
Diesel vehicles	74 100	3.9	3.9	75 243	IPCC, 2006. Tables 3.2.1 and 3.2.2
Stationary equipment	74 100	3	0.6	74 343	IPCC, 2006. Table 2.2

To calculate the emissions associated with the production of cement (Scope 3 calculation), the emission factor given by the IPCC (2007), with 0.507 tonnes of CO_2 by tonne of clinker, will be used. Cement is composed at 85% of clinker.

The GHG emission for asphalt and bitumen are negligible (IPCC, 2006) and thus not included.

FUEL CONSUMPTION

Effective fuel consumption during construction is estimated based on Vinci Construction's experience on various similar highway projects and considers type and numbers of machinery/equipment to be used on the project, estimated material quantities, estimated transportation distances and estimated operating hours.

The emission factors in Table 5-3 are in g of GHG by gigajoules (GJ). A conversion factor will be used to convert this value into g/kL to allow for the calculation of the GHG emission. This factor corresponds to the higher heating value (HHV) which indicates the upper limit of the available thermal energy produced by a complete combustion of fuel in GJ/kL. Table 5-4 gives the HHV for different types of fuel and table 5-5 gives the emission factors in g/L.

Table 5-4 HHV for Different Types of Fuel

Type	HHV (GJ/kL)	Source
Natural gas	0.03522	Stafell, University of Birmingham, UK
Propane	25.36	USEPA
Gasoline vehicles	32.70	Stafell, University of Birmingham, UK
Diesel vehicles	38.29	Stafell, University of Birmingham, UK
Stationary equipment	38.29	Stafell, University of Birmingham, UK

Table 5-5 Emission Factors for Vehicles in g/L

Type	CO_2 (g/L)	CH_4 (g/L)	N_2O (g/L)	eCO2 (g/L)	Source
Natural gas	2	0,003	0,000	2	IPCC, 2006. Tables 3.2.1 and 3.2.2
Propane	1 600	1,572	0,005	1 646	IPCC, 2006. Tables 3.2.1 and 3.2.2
Diesel vehicles	2 837	0,149	0,149	2 881	IPCC, 2006. Tables 3.2.1 and 3.2.2
Stationary	2 837	0,115	0,023	2 846	IPCC, 2006, Table 2.2
Gasoline vehicles	2 266	0,818	0,262	2 358	IPCC, 2006. Tables 3.2.1 and 3.2.2

The impact of land use on GHG emission is considered negligible because the right-of-way required for the Project has already been cleared and thus no significant tree cutting is necessary.

For the emissions associated with electricity consumption related to scope 2, the calculation is based on the quantity of electricity used and an emission factor as per the following equation from GHG protocol:

GHG emissions = Electricity * EF

With:

- Electricity = quantity of electricity used (kWh);
- EF = emission factor (g GHG/kWh of electricity used).

The emission factor used for electricity consumption is specific to Kenya and is 294 g CO_2/kWh (The Climate Registry, 2020).

GHG CALCULATION FOR OPERATION

Other than the GHG emissions associated with traffic, the emissions associated with the Operation phase are essentially related to the combustion of fuel by the O&M fleet and electricity consumption needed to run the O&M center. As per the construction phase, effective fuel consumption during construction is estimated based on Vinci Construction's experience on various similar highway projects and considers length of the road to operate, float of vehicles and associated consumption characteristics as well as estimated numbers of km travelled.

The approach to quantifying the emissions associated with the combustion of fuel by the O&M is the same as the one used for the Construction phase.

As for the emissions associated with electricity consumption (Scope 2 calculation), the calculation is based on the quantity of electricity used and an emission factor as per the following equation:

GHG emissions = Electricity * EF

With:

- Electricity = quantity of electricity used (kWh).
- EF = emission factor (g GHG/kWh of electricity used).

The emission factor used for electricity consumption is specific to Kenya and is 294 g CO_2/kWh (The Climate Registry, 2020).

5.4.2 SURVEYS

Various field surveys and model-based surveys were conducted to complete the desk top review of biophysical and human environment baseline. The following sections present the methodologies used to complete the required surveys.

5.4.2.1 AIR QUALITY

PREAMBLE

As presented in Chapter 2, ambient air quality is covered by the Environmental Management and Coordination (Air Quality) Regulations which was enacted in 2014. This legislation specifies national ambient air quality standards for residential and industrial areas. According to deSouza (2020), it is the Kenya Meteorological Department (KMD) who owns and operates a mobile monitoring van equipped with high-quality instruments capable of measuring a wide variety of pollutants. However, none of the readings completed to date have been made public and the rare information coming from the KMD all relates to the Nairobi area.

However, Pope et al. (2018) and Odhiambo et al. (2010), in their respective air quality study on Nairobi, also positioned a sampling point in a more rural area as background reference. These sites correspond more to the type of environment crossed by the Project as one of the sites is in the periphery of the city of Nakuru. Both studies considered essentially the parameters of the PM_{10} and $PM_{2.5}$ and readings for the background locations surveyed are far below the IFC or Kenyan Standard which are the standards considered for the Project.

In the absence of existing data for the project area, baseline air quality was established by conducting a specific survey by deploying three sampling stations within the highway's proximity. The sampling effort to determine the baseline air quality was performed over a period of 2 months (February-March) corresponding to the short dry season. This period was selected as dry seasons correspond to the worst-case situation for air quality when the dry weather typically allows for greater emission of dust movement and occurrence of bush fires.

The precise sampling period and frequencies for monitoring are instrument specific:

- For total suspended particles, breathable particles (PM_{10}) and fine particles ($PM_{2.5}$) have been sampled five times, each sample covering a period of 24 hours, as per prescribed by the good practice and the American Environmental Protection Agency (EPA). These samples were collected between February 25 and March 4, 2021;
- For passive gas sampling, this was conducted once per sampling point, using an exposition duration of 18 days which is adequate to guarantee a detection limit lower than the applicable standard, per type of gas (NO_2, SO_2, O_3, VOCs)[6].

FIELD SURVEYS

Air quality surveys are required to establish baseline air quality levels along the proposed highway sections affected by the project. The overall proposed approach was presented in the protocol included in Appendix 5-1 and consists in the deployment of three sampling stations within the road's right-of-way. The parameters considered included the measurement of the concentration of breathable particles PM_{10}, fine particles $PM_{2.5}$, NO_2, SO_2, VOCs and O_3. Although CO was initially planned on being sampled, the gathering of data from a scientific study completed in Nairobi (Nthusi, 2017), in a dense traffic environment, showed no exceeding of existing standards. This prompted the use of the data presented in this article as basis for the modeling and determination of Vaseline CO air concentrations since levels of CO within the highway environment are expected to be lower than those collected within Nairobi.

[6] Although CO was initially planned on being sampled, the data from a scientific study completed in Nairobi (Nthusi, 2017) in a dense traffic environment, showed no exceeding of existing standards for this parameter. This prompted the use of the data presented in this article as basis for the modeling and determination of baseline CO air concentrations since levels of CO within the highway environment are expected to be lower than those collected within Nairobi.

Two main sampling methods were proposed, and each requires the sending of samples to laboratories:

1 The use of micro-volume air samplers (Minivol TAS sampler) for the sampling of particulate matters (PM_{10} and $PM_{2.5}$). This method uses pre-weighted 47 mm sampling filter through which a determined volume of air is pumped during a 24-hour period. The filters are then sent to a laboratory for gravimetric analysis of the dust collected.

2 The use of passive adsorption sampling cartridge for NO_2, SO_2, O_3 and VOC (Gradko adsorption tube). These resin-based cartridges are deployed at specific sampling points on protective supporting casing and collected after a period of 4 weeks. Once collected, the cartridges are sent back to an accredited laboratory for analysis.

The highway was separated in three main areas for which a sampling point was positioned. These areas are:

- A1 : Nakuru-Nairobi Road (A104) at Ngarariga between the Kiambu and C66 road;
- A2 : Old Nairobi Road (A104) at Nakuru East between C83 and Nyeri Nyahururu Road;
- A3 : Nairobi Road (A104) at Sobea.

The criteria used for locating the specific sampling point included:

- Open area, away from any vertical obstacle by a horizontal distance of at least the height of this obstacle;
- Away from industrial or commercial emission sources or from a combustion system;
- Place considered typical of the region to characterize;
- Technical, safety and security considerations;
- Fenced locations with available electrical energy will be preferred.

The locations of the selected sampling points are listed in Table 5-6 and presented on Map 5-3.

Table 5-6 Air Quality Sampling Point Location

Sampling Point	GPS Coordinates	Site Description
A1	$1^0$05'10.0''S; $36^0$37'56.2'' E	Residential home & a church
A2	0°17'31.31"S; 36° 07'04.69"E	Church
A3	0°14'45.88"S; 35°57'37.64"E	Residential home

MODEL-BASED SURVEY

A modeling of the dispersion of atmospheric emissions was completed to evaluate the project's impact on traffic related emissions on the areas surrounding the new highway during the operation phase. No air dispersion modeling for air quality was done for the construction phase because the activities performed in road construction are not adequately covered by dispersion modelling due to limitations of air dispersion models and is therefore against best practices. This is due to the fact that construction phase sources are moving and varying constantly, their emission types and intensity are not in steady state. In the end, the emissions for construction are best managed with an air emissions management plan since the main issue during construction is dust emissions which is not covered by dispersion modelling.

The following sections present the basic parameters to be considered, the selected model used and its associated required preparation.

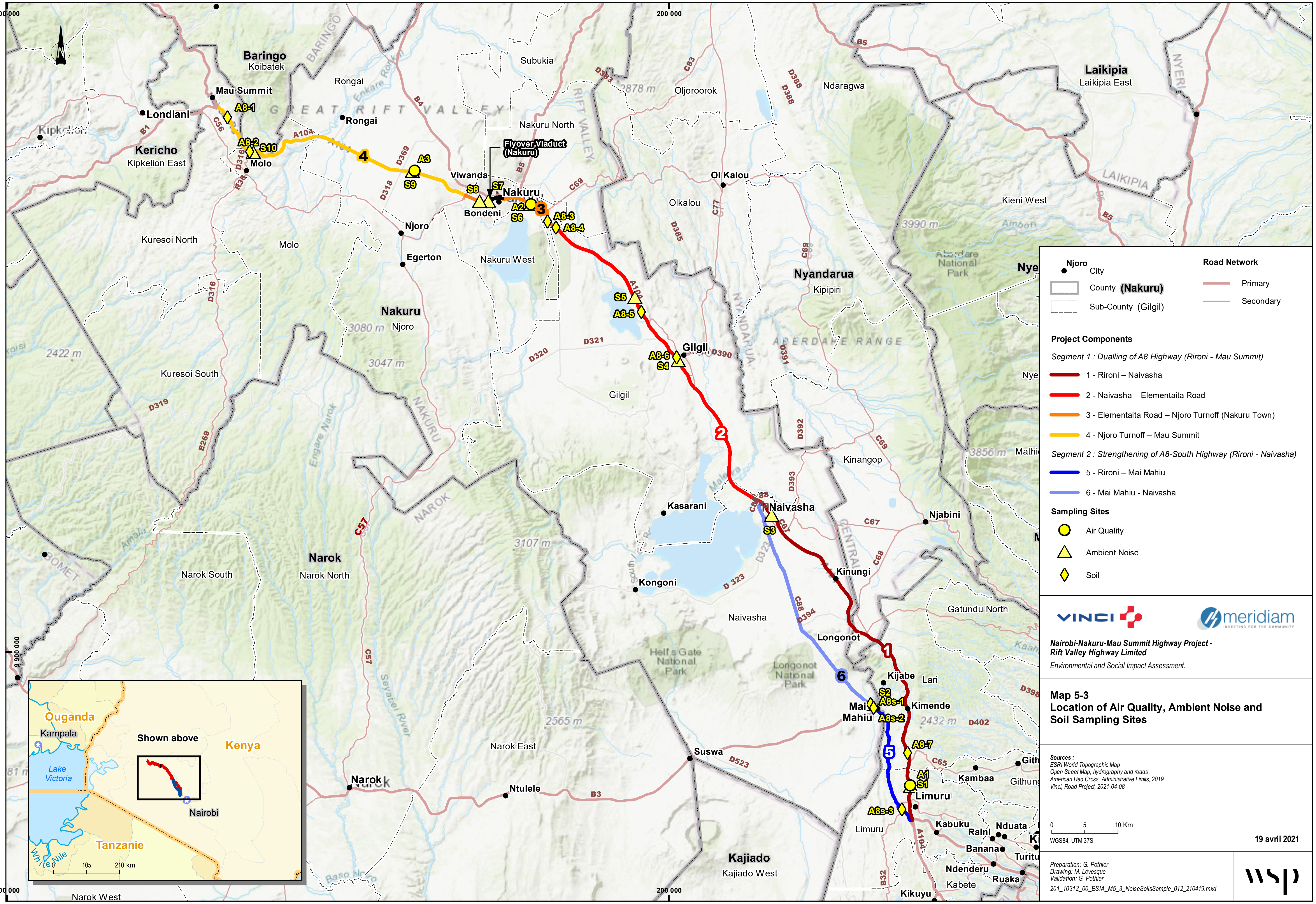
BASIC PARAMETERS

Four basic parameters were established that is:

- Types of scenarios considered: Four scenarios were considered that is modeling at time zero which was set to 2025 and fifteen years in the future, that is 2040 with and without the project;
- Project segmentation: The project is subdivided into six sections (S1 to S4 for the A8 and S5-S6 for the A8 South, see project location on Map 1-1). A segment of 1 km was modelized for each section;
- Parameters retained for analysis: Total Suspended Particles (TSP), Particulate Matter 10 and 2.5 microns (PM_{10} and $PM_{2.5}$), NO_2 and SO_2;
- Reference Standards: The most stringent between those from IFC and NEMA as presented in green in Table 5-7.

Table 5-7 Reference Standards Selected

Contaminants	Period	IFC (µg/m³)	NEMA (µg/m³)
TSP	24 h	-	200
PM_{10}	24 h	50	100
$PM_{2.5}$	24 h	25	75
NO_2	24 h	-	80
SO_2	24 h	20	125



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

SELECTED DISPERSION MODEL

The dispersion model selected is the AERMOD dispersion model (version 19191). This model is a Gaussian dispersion model used to calculate the concentrations of gaseous compounds or particulate matter resulting from emissions from point, area or volume sources in urban or rural areas. The program has the following features:

- Use of hourly meteorological data;
- Creation of temperature, wind and turbulence profiles in order to determine a mechanical and convective mixing height;
- Probability distribution function adapting to the conditions of stability of the atmosphere (Gaussian or not);
- Integration of terrain surface characteristics such as roughness, albedo and Bowen ratio;
- Flexible receiver grid;
- Incorporation of adjustment terms making it possible to take account of the physicochemical properties that may affect the behavior of certain compounds.

The program uses hourly weather data to estimate the concentrations of particles or gaseous substances in ambient air at different calculation points for different time periods (e.g. hourly, 8-hour, 24 hours, annual, etc.). It also integrates the BPIP-PRIME (Building Profile Input Program) module to consider the wake effect (turbulence) induced by the presence of buildings. This option is particularly important in cases where buildings that could alter the air flow are found near point sources.

MODEL PARAMETRY

The model was prepared to be ran by adjusting it with the following inputs:

- Determining geographic limits of the road segment to be modelized. A 4 km by 4 km area was considered around each segment which includes sufficient area to include all of the first land use zones likely to be exposed to atmospheric emissions;
- Establishing the receptor grid which is a fence line grid distributed in the modeling area and the resolution of which varies according to the distance from the center of the considered segment. A good density of the receiver grid makes it possible to generate enough modeled values to obtain a good representativeness of the estimated concentrations in ambient air (see Figure 5-1 for an example related to segment 3);
- Using the ERA5 hourly weather data from the Copernicus (2021) site;
- Generating typical emission rates from road vehicles estimated using the United States Environmental Protection Agency's Motor Vehicle Emission Simulator (MOVES) model version 3 and traffic data supplied by traffic counts (adjusted to take into consideration the COVID-19 effects) completed by RVH;
- Selecting the useful options of the AERMOD model (in this case the default options were used, which included the RURAL mode).

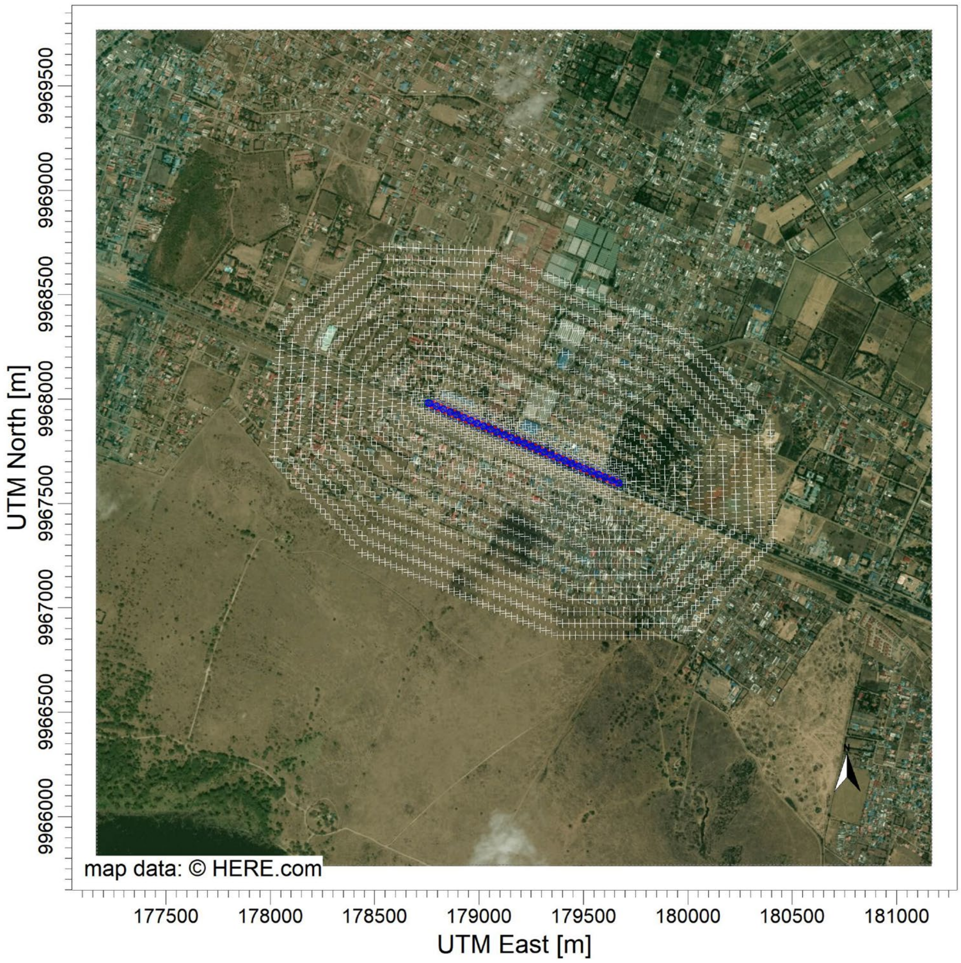


Figure 5-1 Typical Receptor Grid Density for Segment 3

5.4.2.2 AMBIENT NOISE

FIELD SURVEY

Ambient noise surveys are required to illustrate existing baseline ambient noise levels along the proposed highway sections affected by the project. The overall proposed approach was presented in the protocol included in Appendix 5-1, and consists in carrying out a continuous sound survey, in ten areas, for at least 24 hours, with audio recording and a 1-hour traffic count.

The instruments used for the noise surveys were a sonometer (Model LxT NS 0004841) and a Calibrator (Model SV34 NS 36457) corresponding to the protocol's specifications and were calibrated by an independent laboratory within the year. Furthermore, hourly data from an official online source was used to collect basic weather data including temperature, wind speed and direction as well as humidity.

Technicians were present throughout the duration of the ambient noise survey recording.

The noise survey stations were positioned within the following ten zones covering both the A8 and A8 South highways:

- S1: Nakuru-Nairobi Road (A104) to Ngarariga between Kiambu Road and C66 Road;
- S2: Old Naivasha Road and Kamandura-Mai Mahiu – Narok Road;
- S3: Nakuru-Nairobi Road (A104) to Naivasha between Kenyatta Avenue and Moi South Lake Road;
- S4: Nakuru-Nairobi Road (A104) to Gilgil;
- S5: Nakuru-Nairobi Road (A104), rural area between Gilgil and Nakuru East;
- S6: Old Nairobi Road (A104) to Nakuru East between C83 Road and Nyeri Nyahururu Road (Route B5);
- S7: Geoffrey Kamau Avenue (A104) to Nakuru between the Mburu Gichua Road roundabout and the W Road roundabout;
- S8: Nakuru Kisumu Road (A104) to Nakuru between both roundabouts;
- S9: Nairobi Road (A104) to Sobea;
- S10: Nairobi Road (A104) near Kibunja Road.

The parameters considered establishing the specific location of the survey stations included:

- Areas where no other noise sources than road traffic is present;
- At least 7 meters from the nearest road;
- No closer than 30 m from residences;
- Absence of any noise reflecting surfaces closer than 3.5 m from the equipment's microphone.

The locations of the selected sampling points are listed in Table 5-8 and presented on Map 5-3.

It is important to understand that because of 2020-2021 COVID-19 pandemic situation, measures collected does not reflect effective normal ambient noise situation. However, it still gives an overview of areas along the existing highways that shows greater ambient noise problems, which would need to be considered more specifically during impacts assessment and mitigation. Additionally, the collected results are important as they are used to calibrate the model selected to evaluate ambient noise levels at time zero of project (2025) and at plus fifteen years during operation phase (2040).

Table 5-8 Ambient Noise Sampling Point Location

Sampling Point	GPS Coordinates	Site Description
S1	1^{0}05’14.51’’S; 36^{0}37’56.75’’ E	Residential home & a church
S2	0°58'32.46"S; 36°34'46.17"E	Residential home
S3	0°43'01.25"S; 36°26'40.42"E	Church
S4	0^{0}30’20.42’’S; 36^{0}19’04.29’’ E	Church
S5	0^{0}25’08.74’’S; 36^{0}15’31.64’’ E	Residential home
S6	0°17'31.31"S; 36° 07'04.69"E	Church and college
S7	0^{0}17’14.2’’S; 36^{0}03’36.2’’ E	Commercial building
S8	0^{0}17’16.56’’S; 36^{0}02’54.10’’ E	Church
S9	0^{0}14’50.12’’S; 35^{0}57’24.93’’ E	Residential home
S10	0^{0}13’15.36’’S; 35^{0}44’28.72’’ E	Residential home

TRAFFIC COUNT

As indicated in the acoustic protocol, a vehicle count, by direction and with classification, was carried out over a period of one hour concomitantly with each sound survey. The classification includes the following four types of vehicles:

- **Motorcycle –** 2 or 3 wheels (motorcycle, tuk, motorized boda, motorized piki, scooter, etc.);
- **Cars –** 2 driving axles and 4 wheels (car, minivan, pick-up truck, SUV, etc.);
- **Mid-size Truck –** 2 driving axles and 6 wheels (bus, matatu, tractor, cube truck, etc.);
- **Heavy truck –** 3 driving axles or more (platform truck, van, articulated truck, dump truck, etc.).

MODEL-BASED SURVEYS

The model-based surveys were conducted using the TNM calculation module, version 2.5 (Traffic Noise Model) from the Federal Highway Administration of the United States.

The main factors influencing noise propagation that are considered by the software include:

- Reference average energy levels for each class of vehicles (cars, mid-size trucks, heavy trucks, buses and motorcycles) assessed from sound measurements on approximately 6,000 vehicles;
- Two noise heights per vehicle, i.e., 0 meter contact tire with pavement, 1.5 meters above the pavement for vehicles and 3.66 meters for trucks;
- Free and controlled flow of traffic (stop, traffic lights, etc.);
- Noise propagation as a function of the source-to-receiver distance and the type of soil;
- Length of road segments;
- Slope of roads above 1.5%;
- Type of road (concrete, asphalt, etc.);

- Mitigation by obstacles (buildings, rows of houses, dense woodland, etc.).

The basic data used to feed the model included:

- Traffic count made during 2021 field surveys, required for model calibration;
- Road averages daily traffic in 2025 and 2040, used for calculated noise levels;
- Vehicle speeds from the SETEC report *Traffic Study Nairobi-Nakuru-Mau* in 2018 have been used for calibration and assessment of models for the current configuration projected in 2025 and 2040;
- Project vehicle speeds have been used for assessment models for the future configuration.

For the realization of the modeling, virtual receptor points were added, along the A8 Highway in addition to the 9 completed during the field survey. These receptor points are presented on Map 5-4.

5.4.2.3 SURFACE WATER

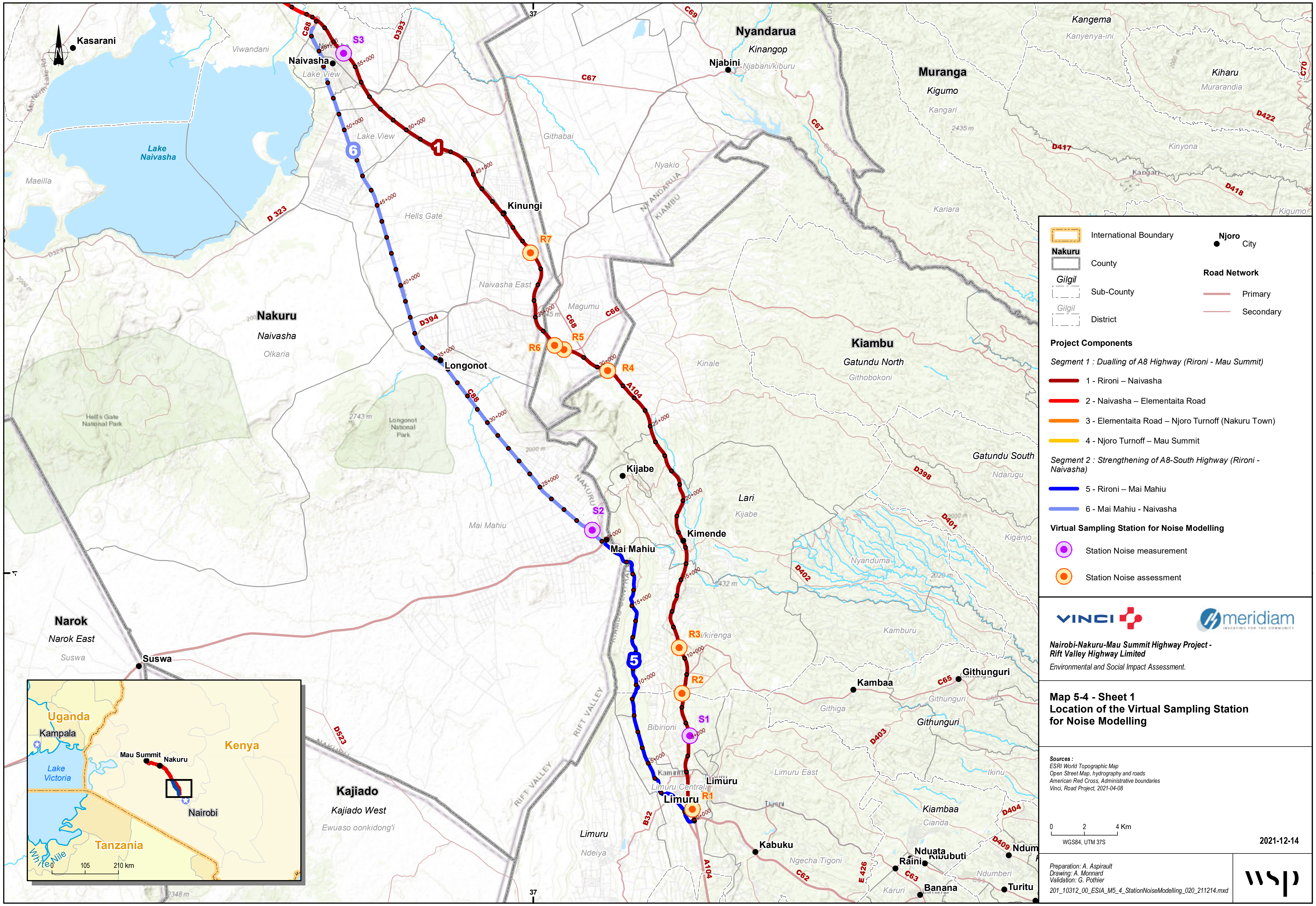
Surface water surveys were conducted for two main purposes. One, to establish a water quality baseline within the water courses presenting water and crossed by the A8 and A8 South, and the other, to collect descriptive data on each of these water courses.

A total of 63 water courses were visited and for each a data sheet was filled. The model of data sheet used is presented in Appendix 5-1 with the sampling protocol. It allows for the collection of the following information:

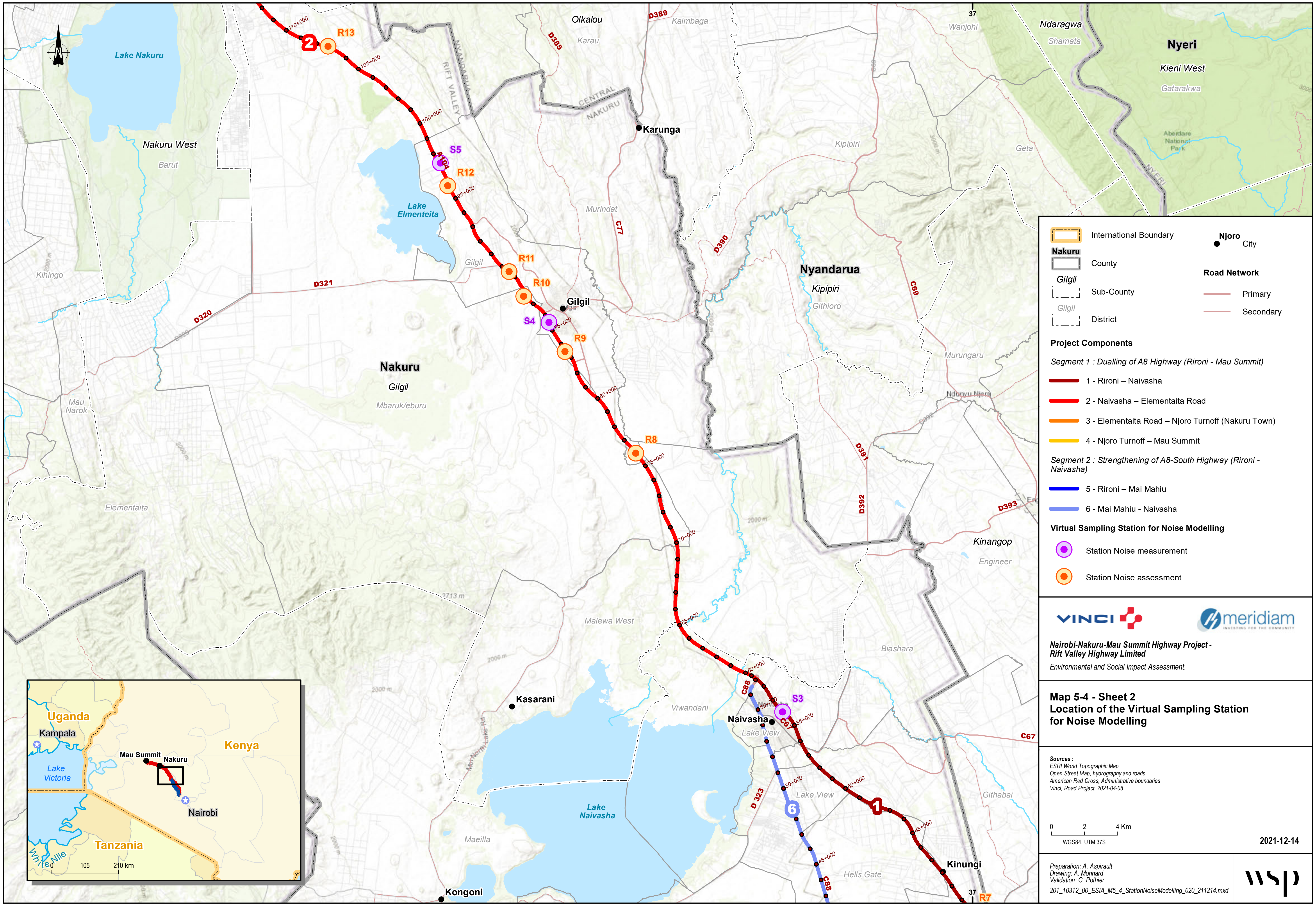
- The presence or not of water at the time of the visit;
- Weather conditions in the last 24 hours and at present;
- Various information on the water course upstream and downstream from the highway including, time of the visit, approximate water course depth, sampling depth, coordinates, photograph number, collection of a duplicate sample or not, general site description, possible existing visible contamination sources, extent of floodplain (estimation), and type of substrate;
- Results of use of multiparameter probe including: Temperature (°C), conductivity (µS/cm), dissolved oxygen (mg/l), pH, Salinity (ppt) and TDS (mg/l).

Of the visited water courses, 12 were sampled during dry season and 13 during rain season (see Map 5-5). Sampling followed the protocol presented in Appendix 5-1 which, globally requires that:

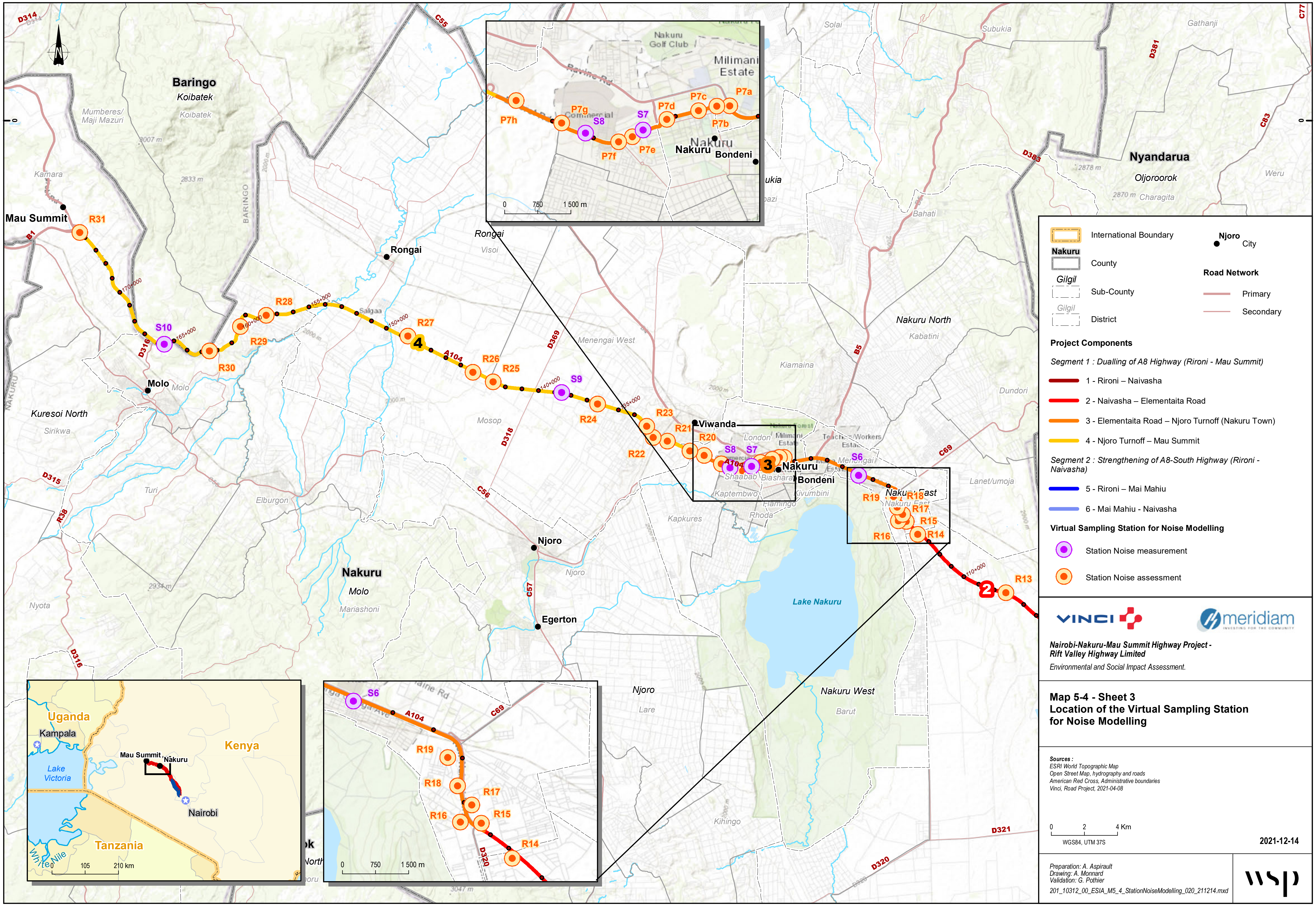
- GPS coordinates be taken of each sampling point;
- Those samples are collected in a safe and efficient way depending on the water courses' characteristics that is either by standing in the middle of the water course facing current or, if too deep, using a stick or pole to which the sampling bottle is fixed;
- Use clean plastic bottles on which the cap is kept until ready to sample and try and collect samples at least 30 cm below surface (when possible). The bottle should be filled and unfilled at least once before collecting the effective sample;
- Once the sample is collected put on nitrile gloves and fill the various bottles supplied by the laboratory.



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

All samples were thoroughly identified and placed in cooler container with ice to maintain them at approximately 4ºC until they reach the laboratory. In addition, to the water sample, a multiparameter probe was used at each station to collect data on temperature, conductivity, dissolved oxygen, pH, salinity and TDS.

Samples were sent to the SGS Laboratory located in Mombasa, Kenya where they were analyzed for the following parameters: pH, hardness, electrical conductivity, TSS, TDS, color, turbidity, BOD, COD, metals (copper, lead, zinc, iron, aluminum, cobalt, cadmium, nickel, chromium), organics (phenols, BETX, TPH, PAH), oil and grease, nitrates, phosphate, calcium, chloride, fluoride, sodium and E. coli.

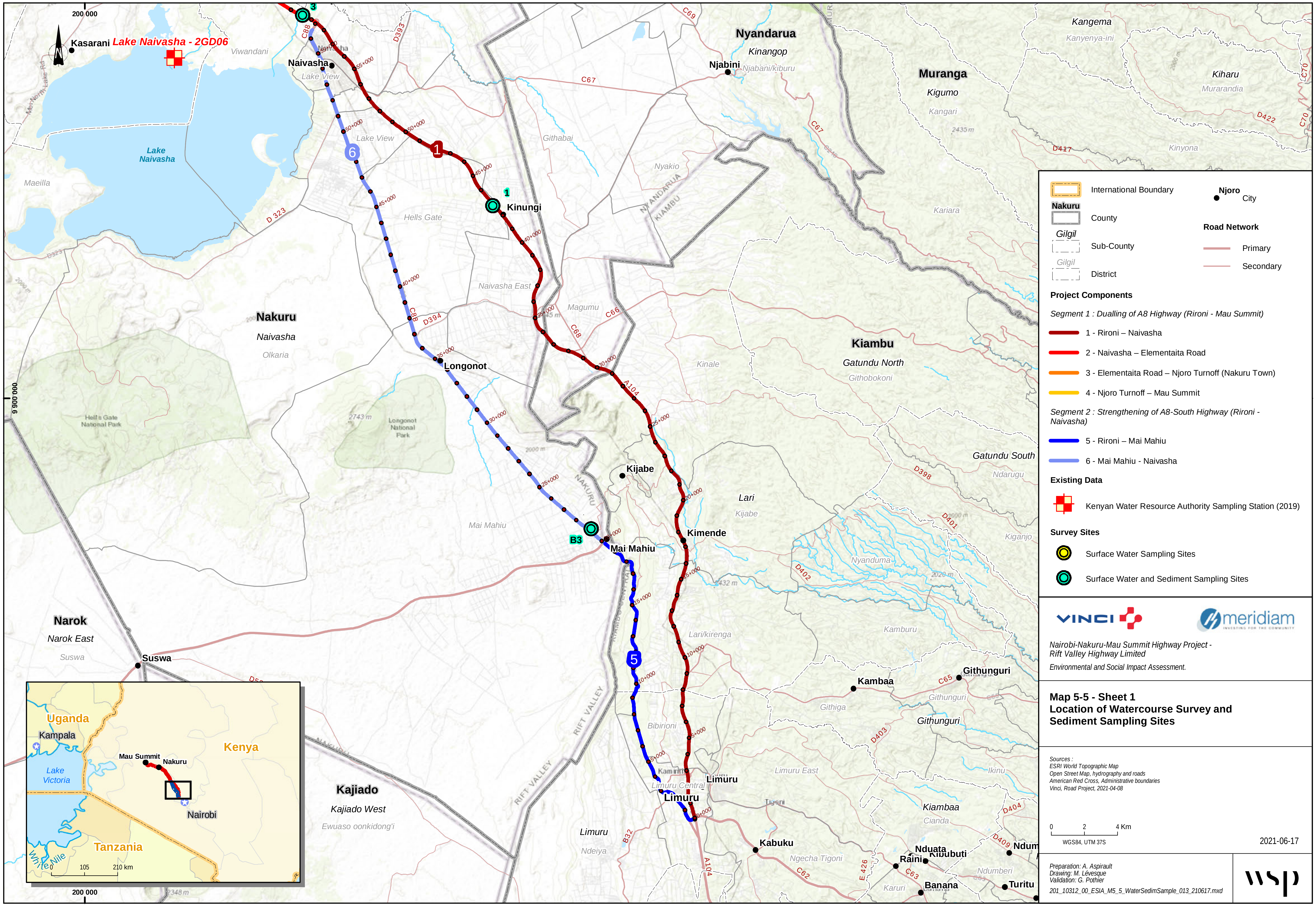
5.4.2.4 SOIL QUALITY

Soil sampling was conducted on a limited number of sites selected as being typical for presenting greater contamination potential. A total of ten sites were selected aiming essentially at truck stops, fueling stations, depots and a pipeline. The objective was not to characterize thoroughly the entire length of the highway sections but to validate the potential risk of finding contaminated soils within the right-of-way. Additional soil characterization may be required during the initial stages of the site preparation for the effective construction activities in areas where soil movements will be required.

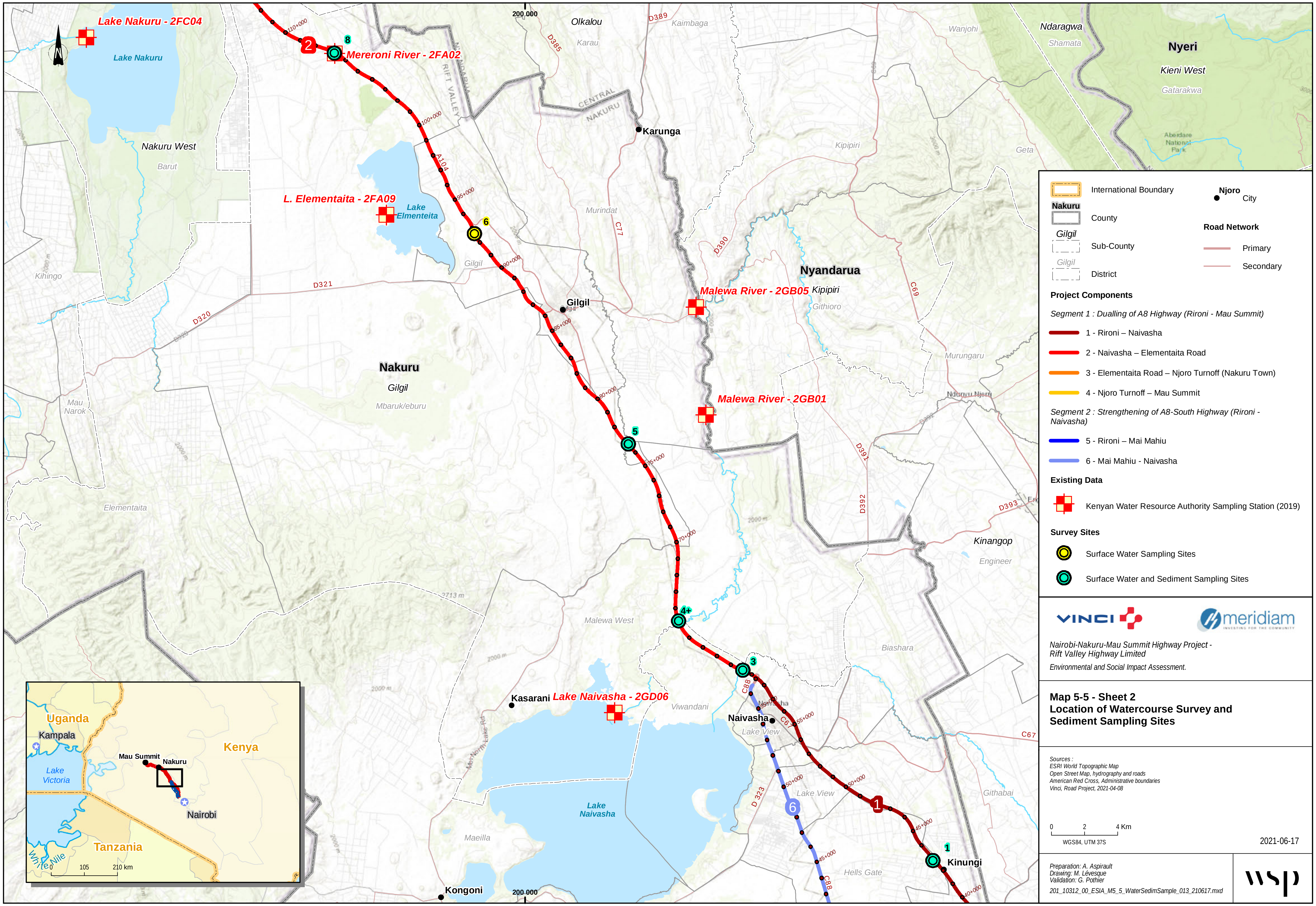
The selected ten sites are listed in Table 5-9 and presented on Map 5-3.

Table 5-9 Soil Sampling Points Location

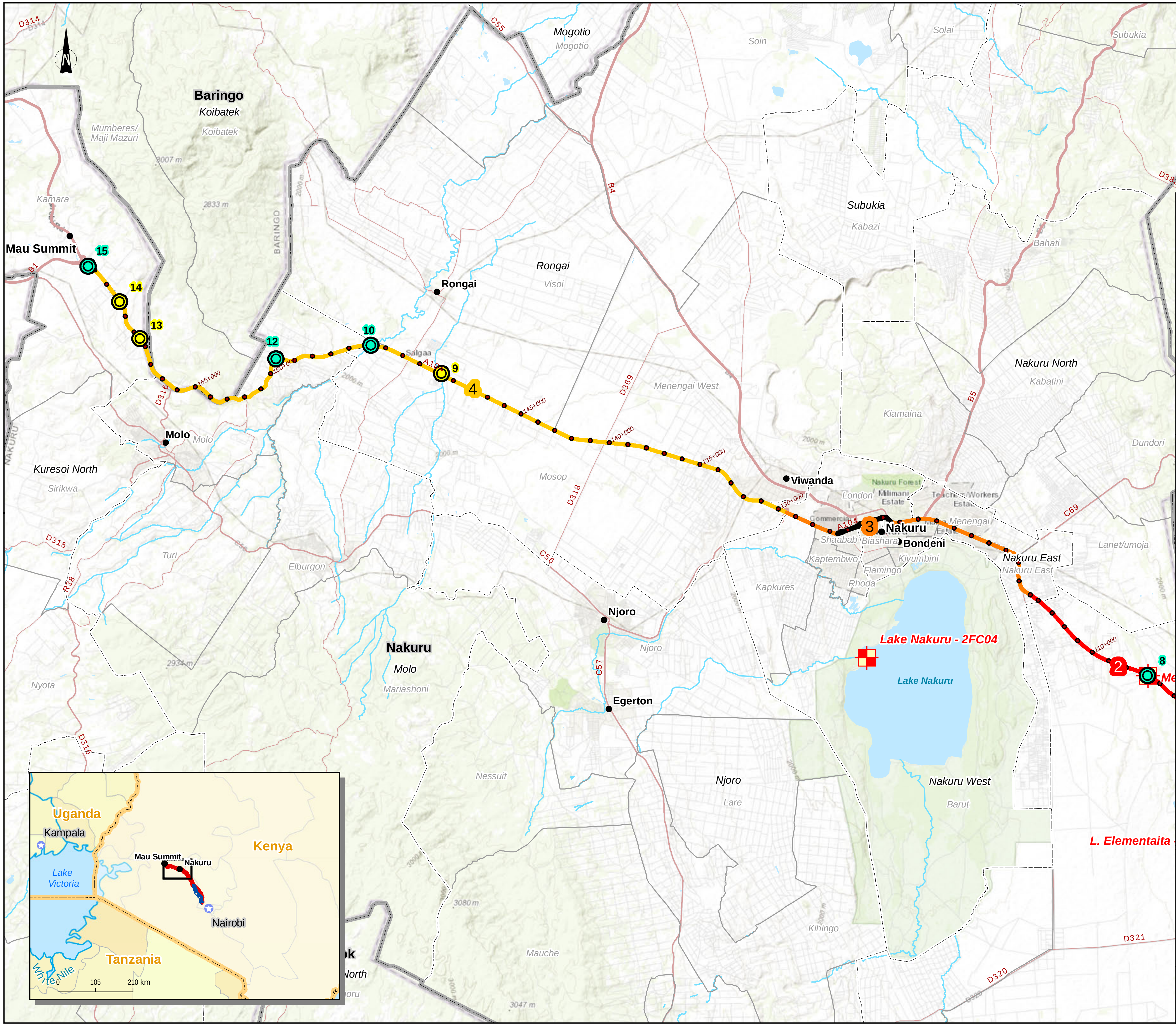
Point	GPS	Description
A8-1	0^{0}10’22.98’’S; 35^{0}42’23.26’’ E	Fuel station
A8-2	0°13'11.89"S; 35°44'10.79"S	Truck yard/ parking
A8-3	0°18'55.81"S; 36°08'25.0"E	Fuel station
A8-4	0^{0}19’24.9’’S; 36^{0}09’06.47’’ E	Fuel station
A8-5	0^{0}26’20.0’’S; 36^{0}16’02.75’’ E	Fuel station
A8-6	0°30'03.91"S; 36°18'55.43"E	Truck yard
A8-7	1^{0}02’29.82’’S; 36^{0}37’41.93’’ E	Fuel station
A8s-1	0^{0}58’30.42’’S; 36^{0}34’41.27’’ E	Truck yard/ truck wash yard
A8s-2	0^{0}58’49.23’’S; 36^{0}34’56.18’’ E	Truck yard
A8s-3	1^{0}07’08.34’’S; 36^{0}37’15.09’’ E	Fuel station



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.



International Boundary

Nakuru — County

Gilgil — Sub-County

Gilgil — District

Njoro — City

Road Network

Primary

Secondary

Project Components

Segment 1 : Dualling of A8 Highway (Rironi - Mau Summit)

1 - Rironi – Naivasha

2 - Naivasha – Elementaita Road

3 - Elementaita Road – Njoro Turnoff (Nakuru Town)

4 - Njoro Turnoff – Mau Summit

Segment 2 : Strengthening of A8-South Highway (Rironi - Naivasha)

5 - Rironi – Mai Mahiu

6 - Mai Mahiu - Naivasha

Existing Data

Kenyan Water Resource Authority Sampling Station (2019)

Survey Sites

Surface Water Sampling Sites

Surface Water and Sediment Sampling Sites

Nairobi-Nakuru-Mau Summit Highway Project - Rift Valley Highway Limited

Environmental and Social Impact Assessment.

Map 5-5 - Sheet 3
Location of Watercourse Survey and Sediment Sampling Sites

Sources :
ESRI World Topographic Map
Open Street Map, hydrography and roads
American Red Cross, Administrative boundaries
Vinci, Road Project, 2021-04-08

0 2 4 Km
WGS84, UTM 37S

2021-06-17

Preparation: A. Aspirault
Drawing: M. Lévesque
Validation: G. Pothier
201_10312_00_ESIA_M5_5_WaterSedimSample_013_210617.mxd

Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

The detailed protocol for collecting the soil samples is presented in Appendix 5-1. However, the main steps include:

- Completing a photographic coverage of the site and its surroundings;
- Collecting general information on the sampling site: coordinates, surrounding land use, nature of soils, visual evidence of soil impact, suspected indication of subsurface impact, any other pertinent descriptive aspect;
- Prepare site for sampling while ensuring it clears any existing surface or underground infrastructure/equipment;
- Proceed with the excavation down to a depth of approximately 50 cm;
- Dispose the material per horizons on an impervious sheeting;
- While wearing nitrile gloves, collect, from the material, a representative sample and fill the bags (for physical analysis) and containers (for chemical analysis) supplied by the laboratory;
- Store the samples in a manner that will prevent conditions which would alter the properties of the sample. Samples for chemical analysis were stored in cooler containers maintained at 4ºC until they reached the laboratory;
- Cleaning of all equipment before moving on to the next sampling location.

Soil samples were sent to SGS Laboratory in Mombasa, Kenya for chemical analysis and those for physical analysis to the Kenya Marine and Fisheries Research Institute (KMFRI). The parameters analyzed included:

- For physical aspects:
  - Particle size distribution (PSD);
  - Permeability;
  - Erodibility;
  - Porosity;
  - Soil-water Retention.
- For chemical aspects:
  - Metals;
  - Benzene, toluene, ethylbenzene and xylene (BTEX);
  - Total Petroleum Hydrocarbons (TPH);
- Polycyclic Aromatic Hydrocarbons (PAH).

5.4.2.5 SEDIMENTS

Sediments were sampled for ten of the main watercourses crossed by the highway to establish typical sediment quality baseline. The location of the water courses sampled is presented on Map 5-5.

The collection of samples followed the methodology presented in the protocol included in Appendix 5-1 and the main steps include:

- Collect the information on each sampling site as per the associated Sediment Sampling Data Sheet including water course depth (approximate), site description, geographical coordinates, general weather conditions, collection efforts and success, sample description (granulometry, odor, color, presence of debris, organic material and living organisms).
- Depending on water depth, use a shovel or a small Ponar Grab to collect 3 subsamples;
- Homogenize the subsamples and while wearing nitrile gloves, take a picture of the sample and then fill the jars supplied by the laboratory;
- Clean the equipment before leaving for the next collection site.

The samples were kept in a cooler container with ice to maintain their temperature at 4°C until they reached the laboratory. The parameters analyzed by the laboratory included granulometry, total organic content, PAH and metals.

5.4.2.6 BIODIVERSITY

GENERAL SAMPLING STRATEGY

To help guide the sampling strategy, a preliminary vegetation and land use mapping exercise were undertaken. First, the vegetation potential of eastern Africa map developed in the context of the Vegetation and Climate Change in East Africa Project (VECEA) by Kindt et al. (2011) and simplified by van Breugel et al. (2015) was considered as adequate to determine the nature of the "precursor" natural vegetation zones that define the study area. A land cover / land use mapping was then completed obtaining an up-to-date overview of the situation and the possible evolution of habitat conditions over the precursor broad vegetation / habitat types previously described.

Based on this mapping, a preliminary Standardised Biodiversity Sensitivity Analysis (SBSA) was done to further help with the definition of important areas for sampling. The detailed methodological process followed to undertake this analysis is presented in Appendix 5-1. The output generated represents a classification of the landscape of concern on a scale ranging from 1 (very low sensitivity) to 5 (very high sensitivity). The analysis was undertaken at a scale of 1 ha precision, which allows the targeted selection of sites of higher sensitivity at a high resolution.

The sampling strategy is based on a "landscape approach" which relies on a grid-based system, where each grid cell is considered a sampling grid cell. Typically, for study areas spanning up to 2,000 km^2 using a 1 km^2 grid cell size is considered appropriate. To ensure representativeness, it is targeted that from the total number of grid cells within the study area, 10% of the grid cells need to be visited. Considering that the Biodiversity LAA is 908 km^2, using the 10% target highlights that 98-sampling grid-cells will need to be visited. For freshwater ecology, as the sampling area represents 361 km^2, the 10% requirements highlight that 36 sampling grid cells should be visited as an optimal target, while 18 sampling grid cells should be the minimum target.

The sampling strategy further left room for adaptive (selective) sampling in order to cater for:

- New information obtained during the baseline studies and warranting further research;
- Complement current study patterns if judged insufficient;
- Selective sampling of specific attributes considered necessary.

Hence, 15 additional sampling grid cells of 1 km² (1,500 ha or 2% of direct impact study area) were located either randomly or subjectively. The combination of defined and undefined sampling areas represents >10% of the total direct impact study area where baseline studies have been conducted.

On the basis of this strategy, a preliminary selection of sampling locations fitting the specified stratification and selection stages has been developed. This has culminated in a preliminary list of 442 potential sampling locations and a total of 284 potential sampling grid cells within the study area.

The field survey team leaders for each field of investigation/ discipline/ taxonomic group evaluated the suggested list of locations for sampling and identified, with respect to their field of investigation, which sampling locations have the best chances of providing the level of evidence required. Sampling locations were selected in pairs, either on the same grid cell or in grid cells that are adjacent or closely related in space. This requirement was established to ensure a wet and dry season investigation pattern of the locations in addition to the spatial representativeness.

Two rounds of field surveys, one 10-day field survey during the dry season, from February 17th to 26th, and one 12-day field survey during the wet season, April 13th to 25th 2021.

The methodologies applied for biological components are described below.

VEGETATION AND HABITAT TYPE SURVEYS

A total of 219 sample plots were assessed over three sampling periods; 38 of which were assessed over six days during the biodiversity reconnaissance survey (14 - 21 November 2020), 90 sample plots assessed over 10 days of fieldwork during the dry season survey (17 - 26 February 2021) and 91 sample plots assessed over 12 days of fieldwork during the wet season survey (13 - 25 April 2021). A total of 36% of the 980 grid cells encompassing the study area were investigated through the body of work conducted during the dry and wet season surveys. Table 5-10 presents the general parameters of survey site locations during the dry and wet season, while Figure 5-2 illustrates the location of survey sites throughout the LAA.

Table 5-10 General parameters of vegetation survey site locations within the biodiversity LAA

Habitat types (VECEA)	Number of sites sampled in 2021*	Area sampled (in (m²)	Area sampled in ha	Mean of Altitude (m) for the sites sampled	Mean of Radius of validity for status noted
Afromontane bamboo	5	3,000.0	0.3	2,609.8	50.0
Afromontane rain forest	2	1,200.0	0.1	2,409.0	25.0
Afromontane undifferentiated forest	52	31,200.0	3.1	2,286.1	55.8
Edaphic wooded grassland on drainage-impeded or seasonally flooded soils	3	1,800.0	0.2	2,540.3	75.0
Evergreen and semi-evergreen bushland and thicket	87	52,200.0	5.2	1,951.9	66.4
Halophytic vegetation	5	3,000.0	0.3	1,790.2	85.0
Riverine wooded vegetation	21	12,600.0	1.3	1,875.9	63.1
Upland Acacia wooded grassland	5	3,000.0	0.3	1,942.6	50.0
Water bodies	1	600.0	0.1	1,781.0	25.0
Grand Total	181	108,600.0	10.9	2,066.4	62.0

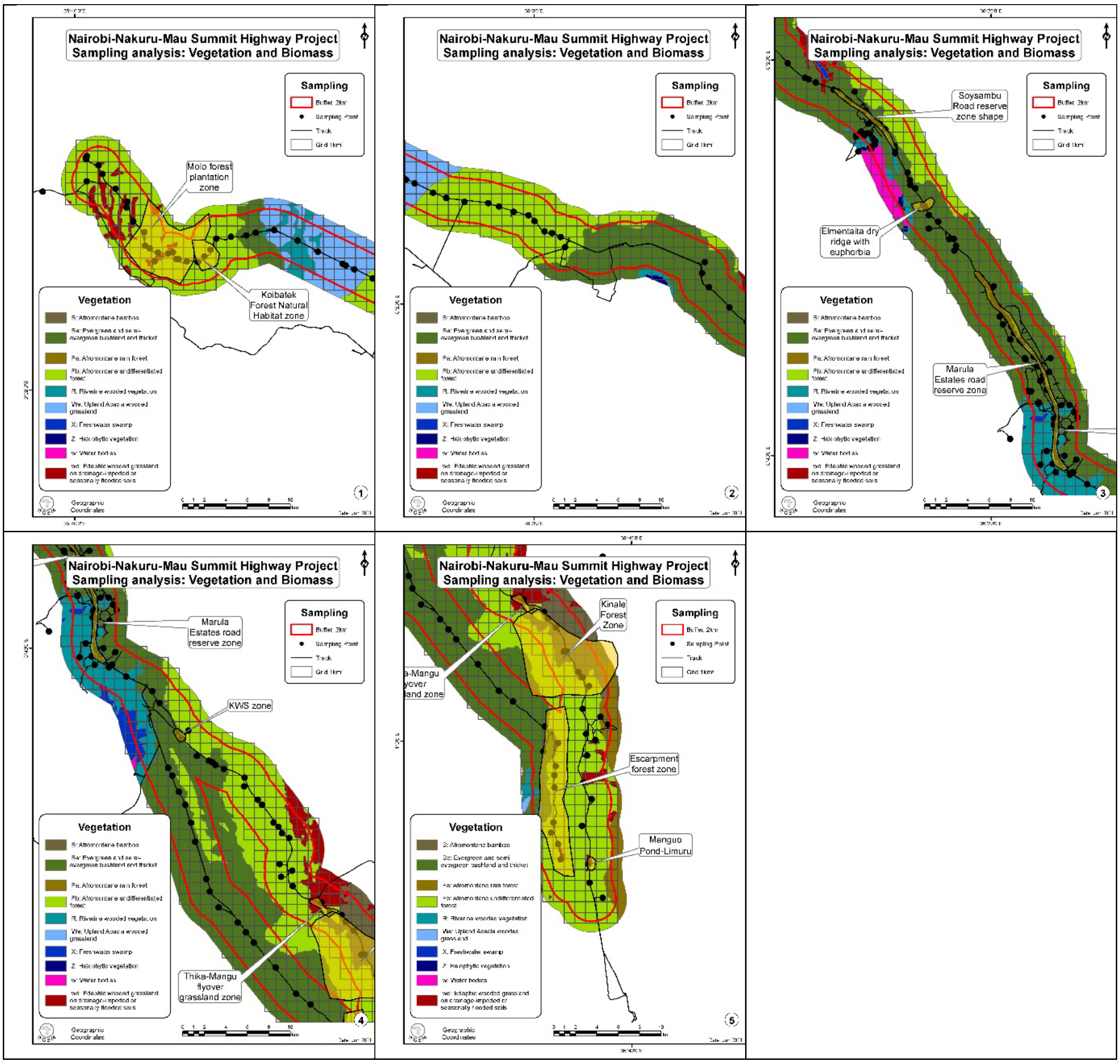


Figure 5-2 Location of habitat and flora survey points

Sample plots were generally 25 m x 25 m square but adjusted to terrain features along streams or river courses where plot size was 60 m x 10 m. A GPS reading was taken at the starting point of the plot cutline. Vegetation surveys were conducted following the Zürich-Montpellier (Braun-Blanquet) School of total floristic composition (Werger, 1974).

At each sample plot the following assessments were made:

- Floristic assessment: all plant species were recorded (trees, shrubs, grasses, sedges, ferns, forbs, geophytes, succulents and aliens/exotics) and a cover value, following the Braun-Blanquet cover/abundance scale (Mueller-Dombois & Ellenberg 1974), allocated to each species.
- Structural assessment: estimates were made for the total woody cover as well as the cover and mean plant height of the following layers: > 20 m woody layer (high trees), 11 - 20 m woody layer (tall trees), 6 - 10 m woody layer (short trees), 2 - 5 m woody layer (low trees), grass layer, non-grassy herbaceous plants (forb layer), bamboos, orchids, lichen, moss, fungi and litter/detritus.
- Carbon assessment: stem diameter (at breast height) and tree height were recorded for all woody individuals, with a stem diameter of > 10 cm, within the sample plot (see carbon report).
- Habitat assessment: habitat features such as topography; aspect (cardinal direction that a terrain surface faces); slope; degree of erosion; clay content of the soil; pebble, stone, rock and boulder cover; litter depth, presence of streams or water courses, were recorded.
- Site quality assessment: transformation, fragmentation as well as regeneration status/mode were evaluated.
- Environmental assessment: light (lux), temperature (°C), noise (decibel), humidity (%) and cloud cover were measured at the time of the surveys. Since these parameters vary depending on the time of day and also seasonally, mean values are not easily compared among associations.
- Animal assessment: any signs of birds, mammals, reptiles, amphibians, insects or fish were noted.
- Additionally, any signs of human influence or natural resource use were noted.

Species accumulation curves (SAC) were generated for all data points to determine sampling sufficiency, for the wet season and dry season surveys separately.

An assessment of habitat degradation, fragmentation and quality was completed based on environmental modeling guidelines promulgated by Pianosi et *al*. (2016) and an adaptation of the model by Elliott et *al*. (2013). The degradation assessment considers a range of variables that contribute to habitat restoration and their actual condition in relation to a theoretical high integrity state. A guided subjective ranking, using a scale of 1 to 5, was used to rank the habitat quality deemed adequate to describe the site visited.

AVIFAUNA SURVEYS

During the survey, bird species and their respective habitat types were identified, and where necessary, verified using relevant literature. The occurrence of bird species was also recorded by means of their calls and other signs such as nests, discarded eggshells, feathers and even road kills. In addition, the expected occurrence of cryptic or elusive species was verified by the targeted playback of their respective calls (e.g., nocturnal/ crepuscular taxa such as owls and nightjars).

POINT COUNTS

Bird data was collected by means of 161 point counts, where all birds seen and heard from a specific point over a set period of time are recorded. Birds were counted by means of 73 point counts during the dry season and 88 point counts during the wet season. Data from the point counts was analyzed to determine dominant and diagnostic bird species (so-called discriminant or indicator species) and to delineate the different associations present.

The spatial position of each point count is illustrated in Figure 5-3. Their placement was determined through a stratified random design which ensures adequate coverage of each habitat type (Table 5-11).

Table 5-11 Point count stations per habitat types within the Biodiversity LAA

Broad-scale Habitat	Dry Season (Feb 2021)	Wet Season (Apr 2021)	Total counts (both seasons)
1. Afromontane Undifferentiated Forest (AUF)	30	17	47
2. Afromontane Rainforest (AfR)	2	8	10
3. Afromontane Bamboo (AfmB)	5	3	8
4. Upper Acacia Wooded Grassland (UAWG)	1	8	9
5. Evergreen and Semi evergreen Bushland and Thicket (ESEBT)	19	35	54
6. Edaphic wooded grassland (EWG)	7	4	11
7. Riverine wooded vegetation (RWV)	4	8	12
8. Halophytic vegetation (HalV)	5	5	10
Total	**73**	**88**	**161**

At each point, all the bird species seen within approximately 50 m from the center of the point were recorded along with their respective abundance values. Each point count lasted approximately 20 -30 minutes, while the area within the immediate vicinity was slowly traversed to ensure that all bird species were detected. To ensure the independence of observations, points were positioned at least 200 m apart.

RANDOM (AD HOC) SURVEYS

To obtain an inventory of bird species present (apart from those observed during the point counts), all bird species observed/detected while moving between point counts were identified and noted. Particular attention was devoted to suitable roosting, foraging and nesting habitat for species of conservation concern (e.g. threatened or near threatened species).

NOCTURNAL OBSERVATIONS

It was not possible to conduct detailed surveys of nocturnal bird species due to the COVID-19 restrictions and curfews. It was only possible to survey two sites representing Afromontane undifferentiated forest (site 145) and evergreen and semi evergreen bushland and thicket (site 262) during the February 2021 campaign. At each of these sites, attention was paid to the calls of specific bird species such as owls and nightjars using audio equipment by broadcasting playback of bird calls/songs. Nocturnal bird species (mainly owls and nightjars) were noted while driving to these points at night.

PLAYBACK/BROADCASTING AND RECORDING OF BIRD VOCALIZATIONS

The probability of detecting skulking/ elusive species (e.g. forest-interior species) or species for which the distribution ranges are insufficiently known in Kenya was verified by playback of bird calls/songs wherever suitable habitat was detected (e.g. ground-thrush species of the genus *Geokichla* and Bar-tailed Trogon *Apaloderma vittatum*). Special care was taken to keep disturbance to a minimum and not to affect the bird's natural behavior (e.g. to prevent unnecessary habituation). In certain instances, the calls/vocalizations of species which are confusing and problematic were recorded for later identification.

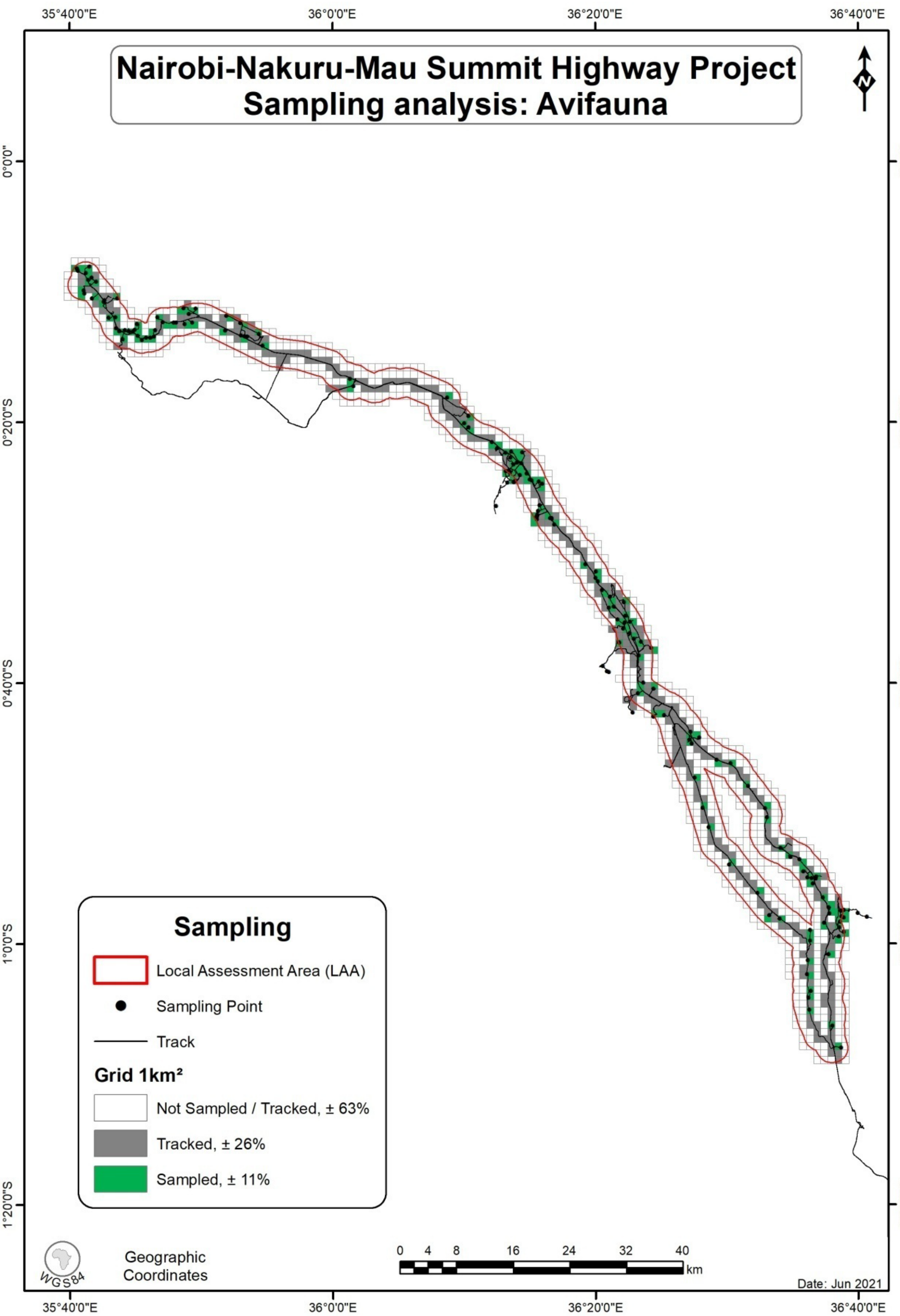


Figure 5-3 Location of bird survey stations in the LAA

REPTILES AND AMPHIBIAN STUDIES

Physical sampling took place in 127 sampling grid cells of the 980 sampling grid cells represented by the study area, thereby exceeding the suggested optimal 10% requirement. A further 245 additional grid cells were visited through the required driving to reach sites and explore the study area. Combined, this means that 38% of the study area was effectively visited and sampled. This spatial overview is summarized in Figure 5-4, with gray grid cells representing areas tracked, green grid cells areas sampled, black dots herpetofaunal observations, yellow circles the 12 trap arrays and orange dots all sampling points where herpetofaunal observations were recorded. A range of methods were employed during surveys to ensure the widest possible diversity of species can be encountered. These are described below

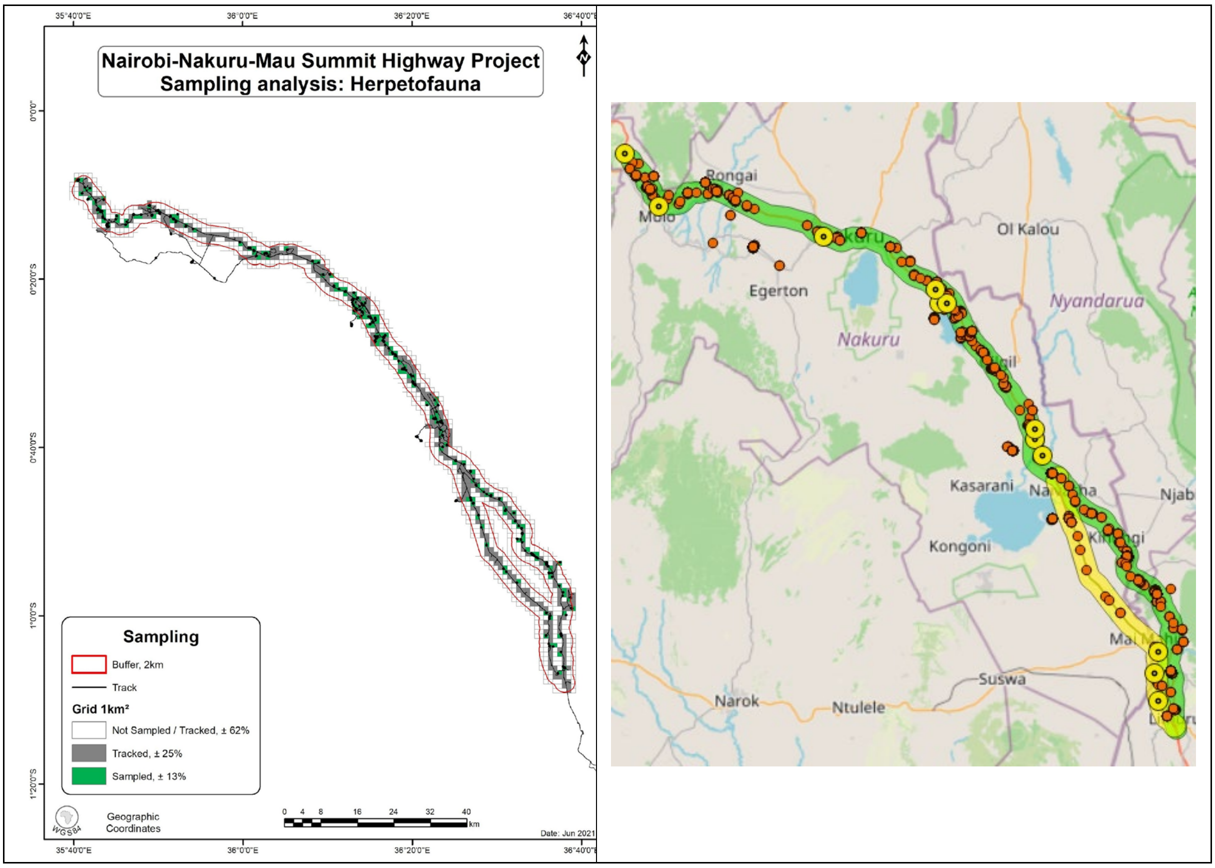


Figure 5-4 Location of Herpetofauna Sampling point

ACTIVE SEARCHING AT SAMPLING POINTS

The general strategy was to spend a minimum of 30 minutes at each sampling site. Some of the more heterogeneous sites took longer (up to two hours) to survey, whereas searches at homogenous sites or sites with radically transformed habitat (e.g. ploughed or fallow fields) were usually concluded within 30 minutes. In addition to surveying examples of predetermined sampling points, several other 'new' sampling sites were also investigated. This was done on an ad hoc basis when potentially productive or otherwise interesting habitat nodes were noticed. These included three transects along road-side rocky ridges and two road-side trenches.

The bulk of active searching took place during the day, but a few sampling points were also surveyed at night. Active searching entailed crisscrossing of the terrain to target varied terrestrial and wetland habitat types, including suitable microhabitats such as rocks and rock cracks, logs on ground, trunks of trees, leaf-litter, burrows, etc. Many of the sites were in inhabited areas, were features like gardens, hedges, buildings, piles of building material and artificial wetlands were investigated.

Searching for reptiles along these transects involved:

- Lifting up and searching under debris (organic/man-made) or rocks (rocks will be returned to their original position);
- Digging up of suitable burrows that appear to be in use (or using a borescope);
- Scanning for any signs of reptiles such as shed skins, the positive identification of which will be taken as an observation of that species;
- Catching any observed reptile by hand (snakes and slow lizards) or using a noose (fast lizards). All captured reptiles will be photographed and released unharmed.

PASSIVE CAPTURE AT SAMPLING POINTS

A series of 12 trap arrays were deployed as passive capture devices during the second field survey. Each trap array consisted of four pitfall (20-litre buckets) and six double-ended funnel traps that were set in conjunction with plastic drift-fences (see Figure 5-5). We opted to use the straight-line type as opposed to the Y-shaped type which is also a popular trap array choice, based on the findings of Mendes et al. (2015) that linear arrays tend to be more productive than the Y-shaped alternative.

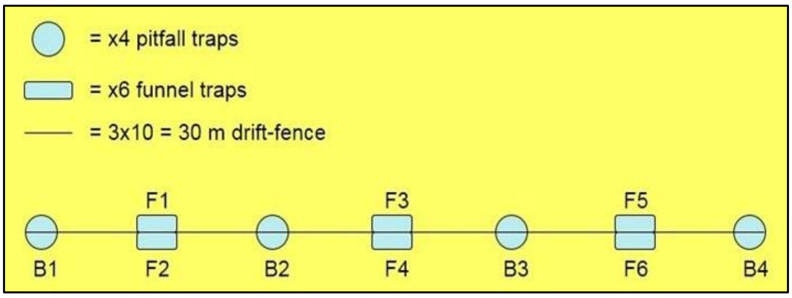


Figure 5-5 A schematic representation of the straight-line trap array design that was used during the second field survey

Leaf-litter was placed in each pitfall trap and funnels were covered with vegetation to provide shade for the captured specimens. Traps were checked each morning to remove and record captured specimens. The first set of six trap arrays was deployed during 14 to 20 April, thus representative of six trap-nights. The northern-most three of these were set in public areas and were somewhat prone to being tampered with or vandalized. The other three traps were set in the more secure Soysambu Conservancy. The second set of six trap arrays was deployed during 21 to 25 April, thus representative of four trap-nights. Three arrays were set within the Marula Estates, and the southern-most arrays were set in public areas along the truck road (B3 & C88). Although the primary aim of these trap arrays is to survey herpetofauna, they also captured several species of rodents and shrews which were supplementary records for the mammal survey. Trap array locations are plotted in Figure 5-5 above. Photos of some trap arrays are presented in Figure 5-6 below.

Figure 5-6 Examples of trap arrays that were deployed in the LAA

INCIDENTAL RECORDS

Various members of the biodiversity team encountered reptiles or amphibians whilst conducting their respective fieldwork. Such incidental observations were usually recorded in the form of photographs or sometimes specimens that were handed to the herpetology team. The most productive source of incidental records was the by-catch of tadpoles and frogs from the freshwater team.

INTERVIEWS WITH LOCAL PEOPLE

The occurrence of a few reptile species that were not recorded during the two 2021 surveys were confirmed in conversation with Henry Ole Sano, a field officer at Soysambu Conservancy. These were incorporated in the reptile checklist.

DATA RECORDING

Geographical coordinates were recorded for each observation, together with other relevant field data such as abundance, age-class and habitat. These observations were recorded in the following ways:

1. Sight records: Where specimens were observed and identified in the field, but no evidence was collected to verify such observations.
2. Photo records: Most specimens observed in the field were photographed, usually in situ.
3. Sound records: Digital recordings of frog calls were made for a few species. Such recordings are useful for the identification of cryptic or taxonomically problematic species.

4 Voucher records: A number of specimens (including tadpoles) were collected as reference material and were deposited with the Nairobi National Museum (NNM).

5 Genetic records: Tissue samples were taken of the voucher material, for future molecular analyses.

SPECIES IDENTIFICATION

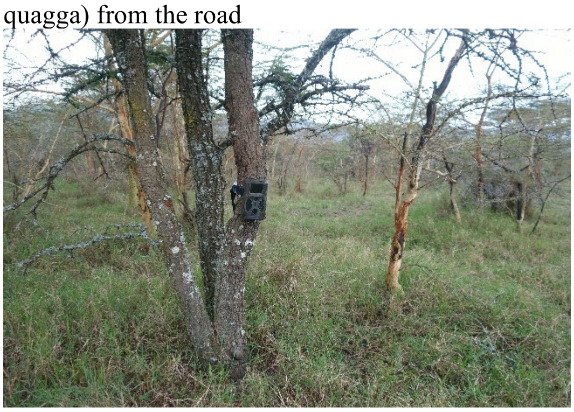
In addition to the species identifications that were made in the field and the subsequent examination of the voucher specimens that were deposited with the NNM, digital images and sound-clips of problematic taxa were sent to a number of international herpetologists.

MAMMAL SURVEYS

A total of 241 km^2, or 20% of the study area was sampled as part of the mammal survey. Direct and indirect observations were undertaken. Moreover, the techniques described below were applied, Figure 5-7 shows examples of some collection methods. Figure 5-8 presents the coverage of the sampling effort for mammals.

a) Direct observation of a plain's zebra (Equus quagga) from the road

b) Position of a lethal trap for small mammal capture



c) Dörr camera trap in place for short-term observation of three to five days

d) Syke's monkey (Cercopithecus albogularis) captured by a camera trap.

Figure 5-7 Examples of the collection methods used during the mammal survey

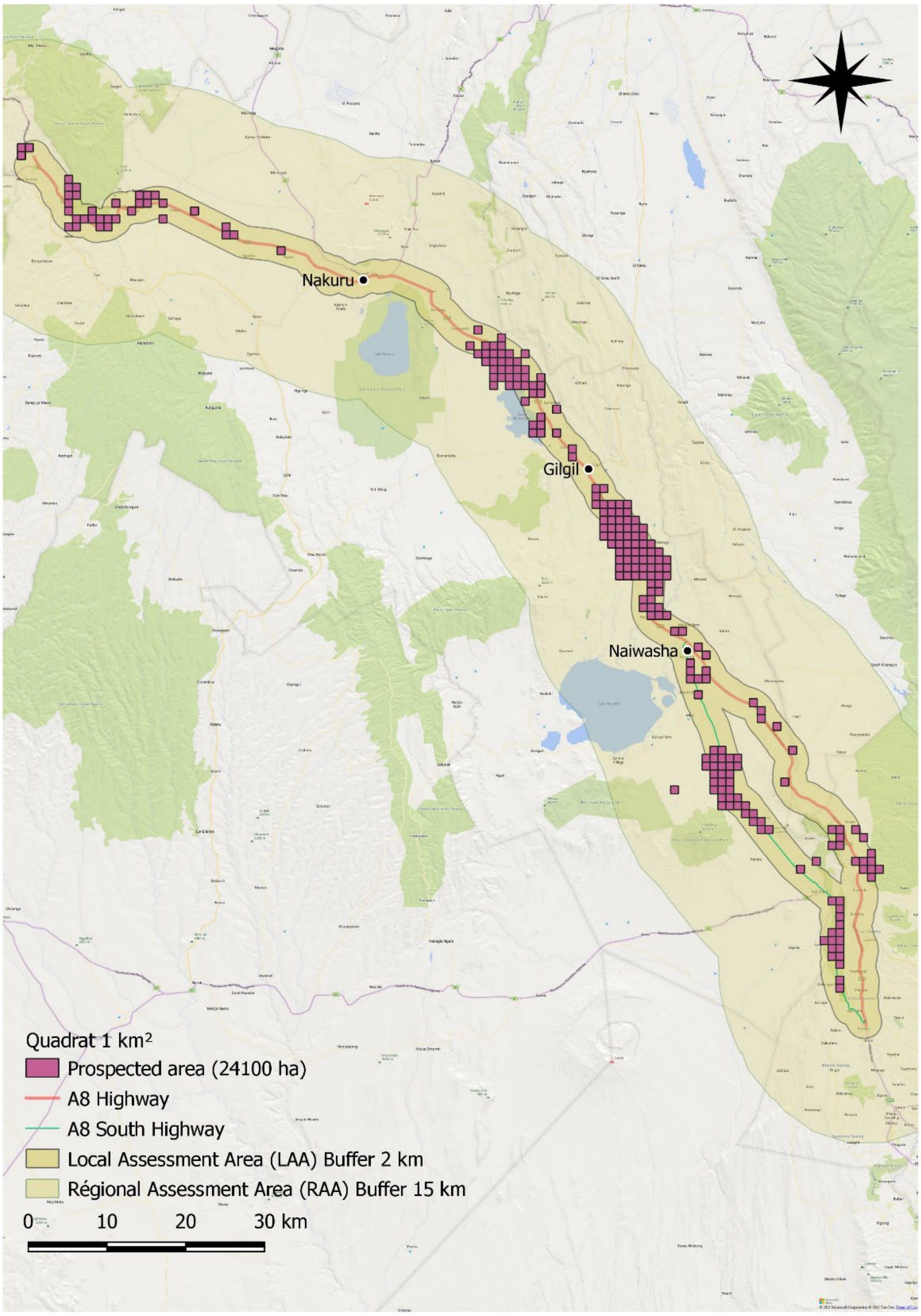


Figure 5-8 Coverage of the sampling effort for mammals

ACTIVE SEARCHING FOR PRESENCE INDICES AND DIRECT OBSERVATIONS AT SAMPLING POINTS

Active searching for tracks and signs indicating mammal presence and direct observations were carried out at a selection of points based on indicative mapping of potential original natural habitats carried out prior to the field surveys. Each point (3 to 5 ha) was surveyed on foot, for about 30 minutes with some variability depending on the richness of the site. Ninety-six points were surveyed by active searching by the mammal team (42 in February, 54 in April and four in both missions),

DIRECT OBSERVATIONS BY ROAD

For the Soysambu Conservancy and Marula Estates conservation areas, as well as for the plateau south of Naivasha, observations were recorded while traveling along roads. This method is well adapted to open landscapes easily accessible by vehicle or traversed by a network of roads. It allows for an understanding of the presence and precise location of mammalian fauna in an area. It is mainly suitable for medium to large-sized species and is ineffective for detecting small species. Different routes were traveled by car at low speeds and any observed mammals were geolocated by GPS point. Counts of the number of individuals of each species present were recorded. Where possible, when the conservation areas were returned to, alternative roads were driven on in order to cover as large an area as possible. This method was effective in assessing the numbers and geographical range of large and medium-bodied herbivores.

Three routes were followed in Soysambu Conservancy, four in Marula Estates and four on the plateau south of Naivasha, covering about 12,800 ha (2700 ha in Soysambu Conservancy, 6700 ha in Marula Estates, 3400 ha south plateau).

CAMERA TRAPPING

A major camera trapping effort was undertaken in the study area. A total of 100 camera traps were deployed initially, from five different brands (Dörr, Denver, Bushnell, Spypoint and Vosker). These automatic motion-detection cameras allow for species to be recorded 24 hours a day, with images taken in both the daytime and the nighttime. The detection distance varies from 10 to 20 meters depending on the model and the environmental conditions (i.e. outside temperature).

Long-term camera trapping

A set of 50 camera traps with LTE connectivity (VOSKER V200 LTE Wireless Outdoor Security Camera) was used for a long-term camera trapping effort. These cameras were deployed during the first survey period in February 2021 and data for the use of this ESIA was gathered until the beginning of June.

The positioning of the cameras focused on the areas where there is large fauna and giraffe and where wildlife crossings are planned. To reduce risks of camera theft, it was decided to circumscribe the deployment of cameras to the Soysambu and Marula conservancies, where there is less population and a minimum of surveillance is ensured. A systematic grid was applied with a bias towards the planned wildlife crossing sites and trying to respect a separation of 2 km between cameras.

The cameras were originally meant to be located on both sides of the road. However, due to the close proximity to human settlements to the East of Soysambu, the cameras were more prone to vandalism (camera V13-S went missing after 4 days of deployment). Hence, the final location for the cameras deployed in Soysambu were nearly all located on the West of the road. Camera locations are presented on Figure 5-9.

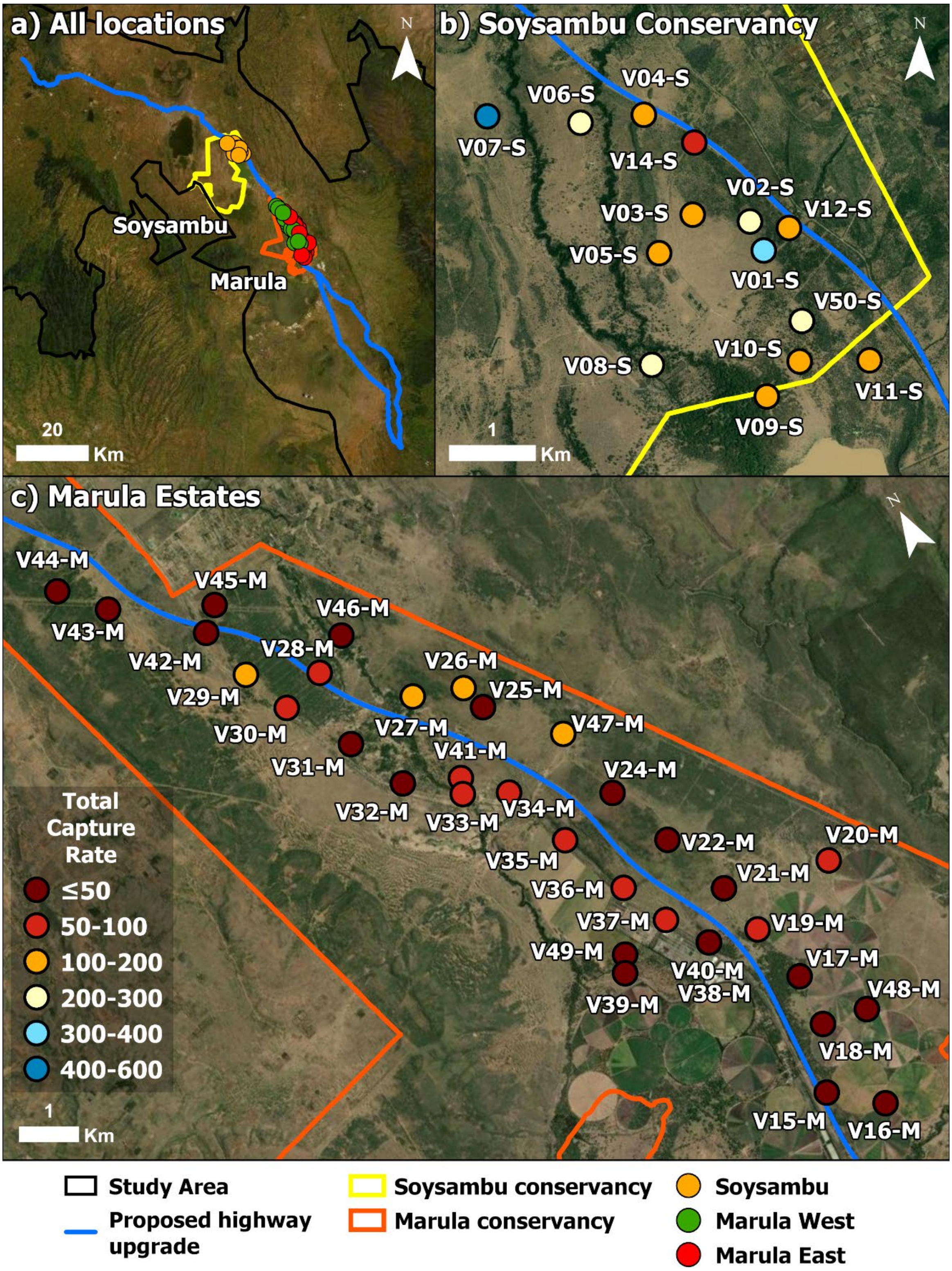


Figure 5-9 Location of the fixed camera-traps

The cameras were set to automatically take images every 15 minutes. In addition, the movement-detection trigger function remained active throughout. To improve the chances of capturing giraffe images, the traps were positioned in such a way to have the widest possible range and shooting field. Cameras were visited for maintenance every 4 to 6 weeks, to validate battery status and replace as required, validate SD card and replace as required, validate cellular reception and reposition cameras that could have been moved.

There were multiple technical issues, several cameras were stolen or vandalized, and a further two were damaged by wildlife and domestic animals. By the end of May 2021, 9 units were considered as lost, one was vandalized, and one got damaged by battery leakage.

Nevertheless, the total sampling period was 113 days, with a combined total of 3415 active camera trap days. Hundreds of thousands of pictures, 642,291 to be exact, were generated by the installed camera-traps from February 17th to June 10th. Each picture was identified by its location as well as the precise moment at which it was taken.

The processing of the images was the object of an automatic analysis focusing on four key species because of their conservation concern and their proneness to collision with vehicles: African Buffalo (*Syncerus caffer*), Giraffe (*Giraffa camelopardalis*), Plains zebra (*Equus quagga*) and Spotted Hyena (*Crocuta Crocuta*). For other species, the pictures were analyzed manually to identify species presence only.

The automated processing includes multiple steps of deep learning neural network assisted by experts to perform detection and identification of target species. A combination of publicly available deep learning neural networks was used. The first one, Microsoft Mega Detector (MS-MD, v4.1, 2020.04.27 release), identifies pictures with animals on them and locates the animals on the picture, discriminating them from cars and humans. The second one is developed by Google (CtxRCNN) and aims to identify the animal species. MS-MD has been trained on a very large set of camera-trap photographs from across the world and performed very well on the pictures gathered from the fixed-camera traps deployed. For its part, CtxRCNN is trained on Snapshot Serengeti dataset (SS), which includes data from hundreds of camera traps in the Serengeti National Park, Tanzania, where wildlife species are similar to those found in the project study area. This network performed well on some species captured by the fixed camera-traps, and very poorly on others.

An iterative process was used to validate the specific discriminative performance of the network on the identification of the selected target wildlife species (giraffe, buffalo, zebra, hyena). A first pre-filtering of the images was done using MS-MD to eliminate empty images and identify only images with animals on them, which resulted in a total of 55,535 pictures. The process then went as follows:

- Perform manual identification of a random subsample of the data;
- Adjust filtering parameters to minimize error;
- Execute model;
- Perform manual identification of a random subsample of the data to validate the performance of the model.

The development cycle used to execute and train the model is schematized in Figure 5-10.

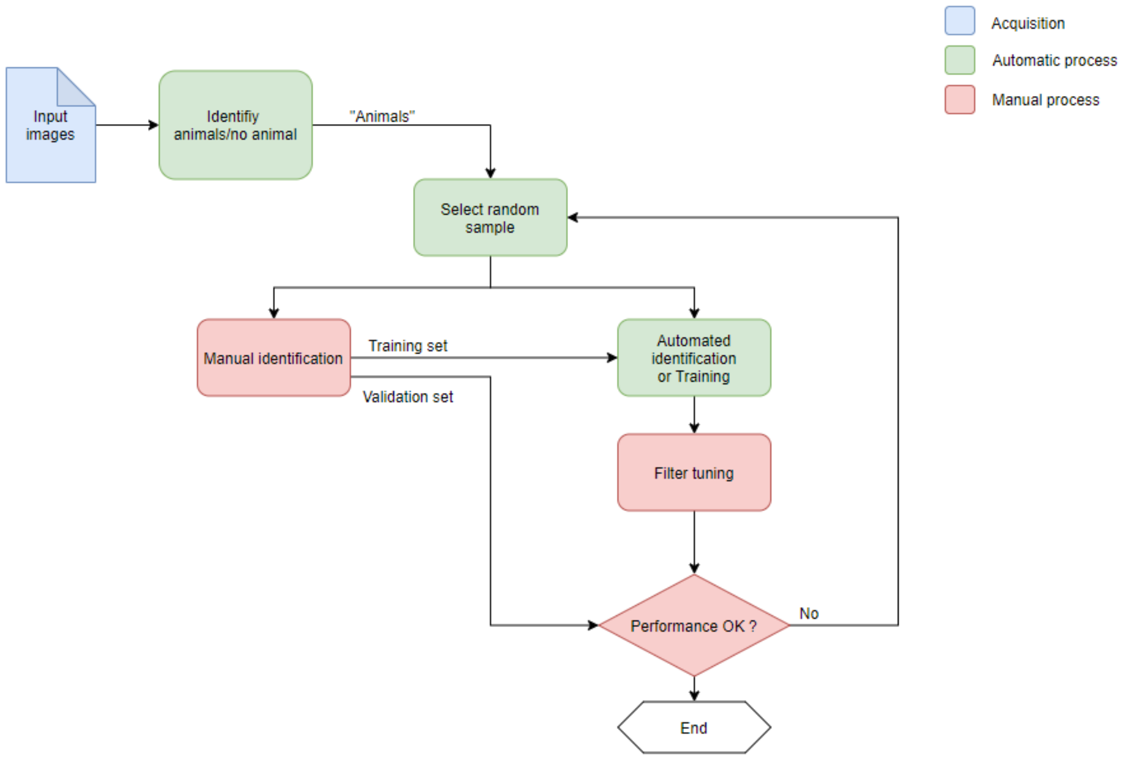


Figure 5-10 Development cycle for automated processing of pictures

This process highlighted some confusion of the CtxRCNN network with the automated identification of cattle, which is not present in the SS dataset. As a workaround, a specific detector was trained to compute an indicator for each picture that was named the "cattleness indicator". This indicator was used to discard pictures with too much cattle in them, that would confuse the CtxRCNN detector. After elimination on pictures with high cattleness indices, a total of 40,348 pictures with animals remained.

To extract the relevant information from the automatically generated identification database, a custom data filtering engine was developed. It queries the identification database and returns only high confidence records of selected animals . The metrics considered were the positive predictive value (PPV), True Positive Rate (TPR) and the Classification Error Rate (CER). This engine was thoroughly tested against manually identified images. Select classes were double-checked throughout different months to account for seasonal changes. Confusion matrices were used to explain the detection power of the whole setup.

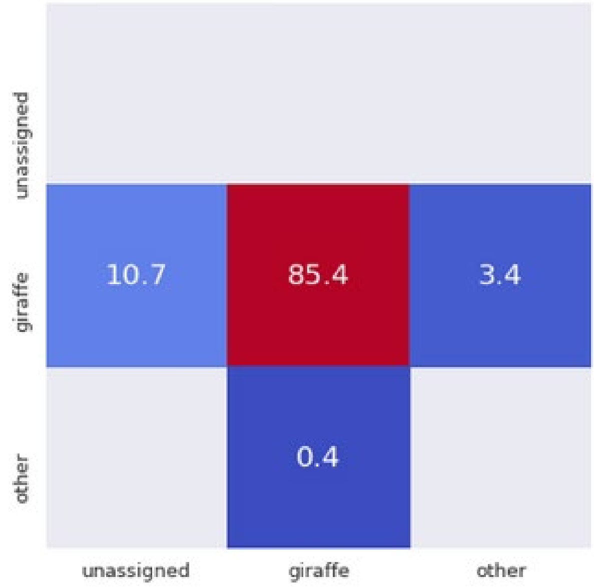


Figure 5-11 Example confusion matrix (giraffe) rows = ground truth, columns = model output

Finally, the activity output for each target species was created from the database.

Short-term camera trapping

Another set of 50 camera traps was used for the general detection of mammals, over the entire study area. Small and medium-sized mammals were targeted by this set of camera traps. To best cover the study area and all types of landscapes and habitats, the traps were arranged in clusters of five (initially) for periods of deployment in a location ranging in duration from three to five days. The clusters of five units were deployed as a loose trapping grid within 100 m of a predetermined sampling location to ensure the coverage of the sampling location in enough details and maximise chances of picking up species of relevance for the site. As the study unfolded and units were removed due to theft of functionality loss, some clusters of four units were deployed.

A total of five traps were stolen in February and one unit became defective. The traps were set in photographic mode and three images were taken with each movement detection. A time interval of 5 seconds was used to separate consecutive events. In the combined two survey periods, a total of 45 sampling locations were sampled for a total of 638 trap days.

SMALL MAMMAL TRAPPING

Initially, non-lethal sampling of small mammals using "Sherman" traps was attempted using a set of 120 Sherman traps. The initial deployment approach called for a total of 3 Lines of 40 baited (peanut butter and seeds) sherman traps each was placed in three separate locations for three successive nights for each line. However, the theft of 52 sherman traps and the destruction of 28 others by a troop of Olive Baboons led to the suspension of the sherman trap-based operation during the February survey period.

Based on available local alternatives, lethal trapping was then used as an alternative towards the end of the first survey period and during the April field survey. A set of 35 snap traps was purchased and used during the second half of the February field season, while a set of 120 snap traps was deployed during the second field season of April. The deployment was based on the planned approach contemplated for Sherman traps, with 3 lines of 40 traps each. Traps were baited with small balls of paste made from peanut butter mixed with oats and shredded wheat. A total of six sampling locations for a total of 299 trap nights were sampled with Sherman traps and 12 sampling locations for a total of 1,269 trap nights were sampled with the snap traps.

ADDITIONAL DATA

Supplementary data were provided by team members working on other taxa. Notably the herpetology team provided data regarding small mammals which were incidentally captured in their trapping devices.

FRESHWATER ECOLOGY

39 sampling sites were assessed for habitat integrity, water quality, diatoms, aquatic macroinvertebrates and fish to establish baseline conditions. Sites were selected based on the road alignment and areas of direct impact from road works. Sites were divided into different lotic[7] and lentic[8] habitat types according to their geographical situation, flow, channel geomorphology and topography. As some sites were dry during the surveys, only inundated sites could be sampled for most parameters. Sampling point locations are illustrated in Figures 5-12 and 5-13.

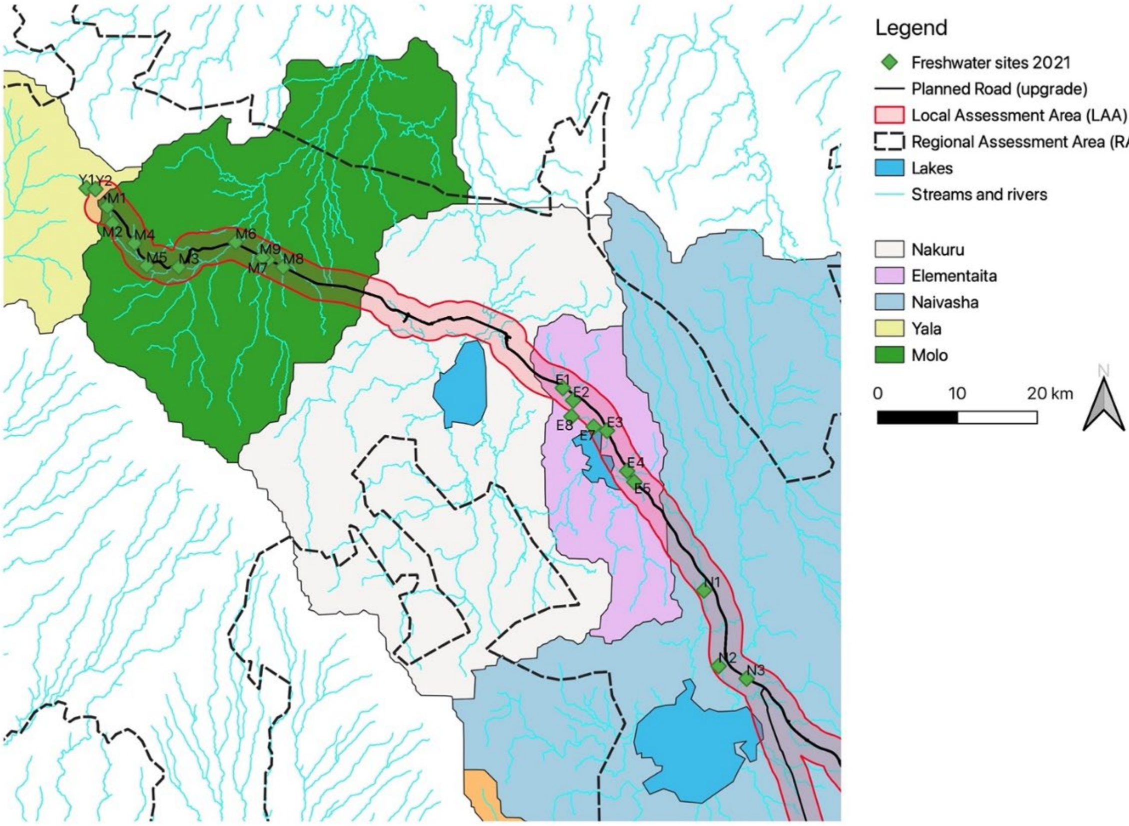


Figure 5-12 Location of Freshwater Ecology Sampling Points (North)

7 Situated in moving freshwater.
8 Situated in still freshwater.

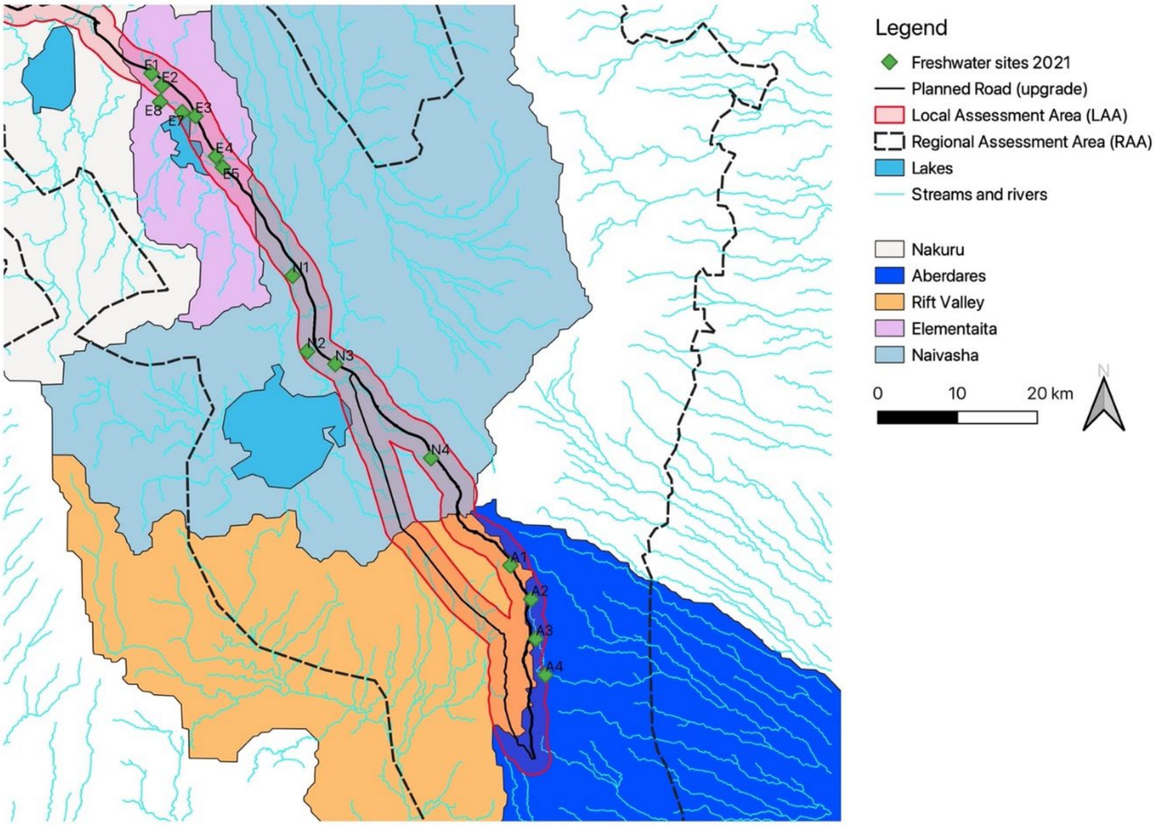


Figure 5-13 Location of Freshwater Ecology Sampling Points (South)

HABITAT INTEGRITY (QUALITY):

The intermediate Index of Habitat Integrity (IHI) was applied on a site level basis to ascertain the change of instream and riparian habitat from natural conditions (Kemper, 1999). The habitat integrity assessment provides a tool for assessing instream and riparian habitat by incorporating factors and potential impacts (Kleynhans, 1996).

The IHI assessment is based on two different components of riverine systems, namely, the riparian zone and instream channel. Separate assessments are done for both aspects; however, the data for the riparian zone is primarily interpreted in terms of the potential impact on the instream component (Kemper, 1999). The rating system is based on differing weights for each criterion (Table 5-12).

Table 5-12 Criteria and weights used for the assessment of habitat integrity (adapted from Kleynhans, 1996)

Instream Criteria	Weight	Riparian Zone Criteria	Weight
Water abstraction	14	Bank erosion	14
Water quality	14	Indigenous vegetation removal	13
Bed modification	13	Water abstraction	13
Channel modification	13	Water quality	13
Flow modification	13	Channel modification	12
Inundation	10	Exotic vegetation encroachment	2
Exotic macrophytes	9	Flow modification	12
Exotic fauna	8	Inundation	11
Solid waste disposal	6		
TOTAL	**100**	**TOTAL**	**100**

MACROINVERTEBRATE HABITAT

Macroinvertebrate habitat availability was assessed using the Invertebrate Habitat Assessment System version 2 (IHAS v.2) methodology (McMillan, 1998). The IHAS is a quantitative and comparable description of habitat availability for aquatic macroinvertebrates. The IHAS reflects the quantity, quality, and diversity of biotopes available for habitation by aquatic macroinvertebrates.

FISH HABITAT

The fish habitat assessment followed the method as outlined by Kleynhans (2007). The assessment is site specific and takes into consideration the diversity of velocity-depth classes, and the occurrence of various cover types at each velocity-depth class. This habitat assessment forms part of the fish assessment and presents a means within which the actual fish data and frequency of occurrence of species can be understood and interpreted.

DIATOMS

Benthic diatoms (diatoms attached to substrate) were sampled in inundated systems according to the protocol of Taylor et al. (2005). Samples were preserved in the field using formaldehyde to prevent decomposition. Ecological water quality preferences for diatom species were used from Taylor et al. (2007).

The present diatom assemblages and the spatial variation per catchment in diatom assemblages were determined. Subsequent inferences of baseline ecological water quality preferences per site and catchment were made based on diatom species' ecological water quality preferences.

The Specific Pollution Sensitivity Index (SPI) was used in this diatom assessment and is an inclusive index and takes factors such as salinity, eutrophication, and organic pollution into account (CEMAGREF, 1982). This index comprises 2,035 taxa (Taylor, 2005) and is recognized as the broadest species base of any index currently in use and has been adapted to include taxa endemic to and commonly found in South Africa, thus increasing the accuracy of diatom-based water quality assessments, and is known as the South African Diatom Index (SADI) (Harding & Taylor, 2011). The limit values and associated ecological water quality classes adapted from Eloranta & Soininen (2002), in conjunction with the new adjusted class limits that are provided in (Taylor & Koekemoer, in press), were used for interpretation of the SPI scores. The SPI index is based on a score between 0 – 20, where a score of 20 indicates no pollution and a score of zero indicates an increasing level of pollution or eutrophication.

The Percentage Pollution Tolerant Valves (%PTV) was also used. It is part of the Trophic Diatom Index (TDI) (Kelly and Whitton, 1995) and was developed for monitoring organic pollution (sewage outfall-orthophosphate-phosphorus concentrations), and not general stream quality. The %PTV has a maximum score of 100, where a score less than 20 indicates no organic pollution and a score of 100 indicates definite and severe organic pollution.

MACROINVERTEBRATE DIVERSITY

Aquatic macroinvertebrates were collected using the sampling protocol of the SASS5 method (Dickens & Graham, 2002). The protocol is divided between three biotopes, namely Vegetation (VEG), Stones-In-Current (SIC) and Gravel-Sand-Mud (GSM). Samples were collected in an invertebrate net with a pore size of 1000 microns on a 30 cm x 30 cm frame by kick sampling of SIC and GSM and sweeping of VEG for a standardized time or area. The deep-water sampling was limited to the VEG biotope as other biotopes were not available for sampling. Macroinvertebrates were identified to family level using relative reference guides (Dickens & Graham, 2002; Gerber & Gabriel, 2002).

Univariate diversity and evenness indices were used to describe macroinvertebrate family-abundance relations using PRIMER version 7.0. The univariate analyses undertaken were the Shannon-Wiener diversity index ($H'log_e$), Pielou's evenness (J') and total number of species (S) and number of individuals per site.

The sensitivities of taxa as per Dickens & Graham (2002) and Mereta et al. (2013) were used to calculate Average Score Per Taxon (ASPT) and to make ecological inferences based on the macroinvertebrate community per site. Average diversity per catchment type was calculated to compare between the macroinvertebrate communities. The ASPT values were used to make ecological inferences based on the macroinvertebrate communities per site, and average ASPT values were used to compare between the various catchments (Dickens & Graham, 2002).

Community data collected in the field was used to populate the Percentage Ephemeroptera-Plecoptera-Trichoptera (%EPT) based on the EPT method to assess macroinvertebrate integrity (MACS, 1996). This metric measures the abundance of the generally sensitive insect orders of Ephemeroptera-Plecoptera-Trichoptera Taxa from these orders are sensitive to environmental alterations and occur in clean and well oxygenated waters (Keci et al. 2012). The EPT assemblages are commonly considered to be good indicators of water quality (Rosenberg & Resh, 1993).

Emphasis was placed on the presence of sensitive taxa (the % of Ephemeroptera-Plecoptera-Trichoptera) and the presence of snail species at sites due to the potential presence of *Bulinus permembranaceus*, which is a vulnerable restricted range species. Each freshwater site was physically searched for gastropod species for 20 minutes of effort by turning stones, sweeping through vegetation, and scraping bedrock and substrate to assess the presence of this species in the study area.

FISH DIVERSITY

Where sites were inundated, sampling effort was site specific and based on habitat type and accessibility. Sampling techniques included electro-shocking and seine nets. Electro-shocking was undertaken at sites where conductivity was suitable. A description of the equipment used and the fish sampling effort per unit are listed in Table 5-13. Sampling namely targeted in suitable habitats for Critically Endangered fish species potentially present in the regional assessment area, Fish community and diversity analyses were conducted per catchment.

Table 5-13 Fish sampling equipment used, and the sampling effort followed during surveys.

Sampling type	Quantity	Sampling Effort	Mesh Size	Depth	Length/Size
Electro-shocking	1	40 min	N/A	N/A	N/A
Small Seine Net	1	Pulls	30 mm	1 m	50 m

ADDITIONNAL STUDIES

Additional specific analysis and modeling to better characterize biodiversity in the RAA were completed based on field survey data and literature review. These include:

- Land use and land use change analysis (LULUCA) (Appendix 6-13);
- Habitat suitability and ecological connectivity modeling (Appendix 6-20);
- Standardized biodiversity sensitivity analysis (Appendix 6-22);
- IFC Performance Standard 6 Habitat Analysis, including Critical Habitat Assessment (Appendix 6-23).
- Ecosystem Services Assessment (Appendix 6-24).

The methodology for each of these analyses can be found in the detailed reports appended to this ESIA.

5.4.2.7 SOCIOECONOMIC SURVEYS

Prior to socioeconomic surveys, a reconnaissance site visit was carried out in November 2020 by the Social Lead in order to get an overview of the type of livelihood activities taking place along the road, of the various rural and urban areas and of sensitive sites (market and road junctions), as well as meet with County Commissioners who provided advice on areas to survey.

Socioeconomic surveys were aimed at the following categories of people:

- Social surveys with chiefs and key informants;
- Social surveys with community members.

Dedicated socioeconomic surveys did not take place in VMGs communities (Maasai and Ogiek) since they are not located along the highway. However, whenever Maasai were encountered (close to Mai Mahiu and Longonot) they were surveyed as well. In addition, specific stakeholder meetings were held with the representatives of these communities to inform them about the Project and collect some information on the communities and on their expectations in relation to the Project.

Socioeconomic surveys were completed with the use of tablets hosting a dedicated survey program (SNAP Survey). In the field, the social survey team was divided in two groups:

- One-person administrating questionnaires at Chiefs and key informants;
- Two groups administrating questionnaires at randomly selecting people using the ROW (street vendors, herders, shops) (composed of 4 surveyors).

The social survey teams progressed together; the teams worked in the same location at the same time. For safety reasons, surveyors worked in pairs (1 man and 1 woman).

SURVEY AREAS AND SURVEY EFFORT

Selection of survey areas was based on a preliminary assessment of site sensitivities, taking into account the following aspects:

- The fact that the A8 will be subject to more significant impacts than the A8 South. This is because the A8 will be doubled while the A8 South will remain the same width and will only be subject to specific improvements;
- The repartition of the 174.9 km of the A8 through the three Counties traversed:
  - Kiambu county for 29.6 km (17%);
  - Nyandarua county for 3.9 km (2%);
  - Nakuru county for 141.2 km (81%).
- The repartition of the 57.2 km the A8 South through the two Counties traversed:
  - Kiambu county for 18.9 km (33%);
  - Nakuru county along 38.3 km (67%).
- The fact that the most important cities and towns are in Nakuru County;
- The fact that the bigger towns and cities should be more extensively surveyed.

Therefore, the proposed effort was divided as follows:

- 15% of the survey effort invested in Kiambu County;
- 5% of the survey effort invested in Nyandarua County;
- 80% of the survey effort invested in Nakuru County.

In order to ensure that a good coverage of the PDA was completed, the areas to survey were identified and georeferenced during the reconnaissance site visit. The detail of survey localities as well as the effective effort after completion of the study are presented in Table 5-14.

Table 5-14 WSP survey locations and effective effort by county traversed by the Project

County	Locality	Number of Participants	% Effective Effort
Kiambu	Limuru Town	13	17,44%
	Shop area (near Mathore Viewpoint)	4	
	Shop area (near Mai Mahiu Longonot Viewpoint)	4	
	Kimende Township	5	
	Magina Town	4	
Nyandarua	Soko Mjinga and Soko Mpya markets	13	6,59%
	Shop area (near Flyover)	4	
Nakuru	Mai Mahiu	17	75,97%
	Longonot	10	
	Kinungi	5	
	Karagita	8	
	Naivasha	23	
	KCC Jambi Mbao (locality of internally displaced people)	4	
	Gilgil Town	23	
	Kikopey Town	8	
	Mbaruk location	1	
	Nakuru City	72	
	Salgaa	5	
	Ngata	1	
	Sachang'wan/Mukinyai	8	
	Molo/Kibunja	8	
	Plant vendors	3	
Total		n=258	100%

METHODS

A total of 258 questionnaires were conducted between February 5th to March 11, 2021. Surveys were done using the Snap Survey program, and data was converted to Excel to generate descriptive statistics. Pictures were also taken to help visualize the survey areas.

In total, 6 different survey questionnaires were developed based on different stakeholder groups expected to be met. Survey questionnaires are presented in Appendix 5-2. They are each composed of 40 to 70 open and closed questions. The focus was not only placed on collecting baseline information but also to capture the everyday challenges of people, their opinions on the highway, their grievances and to gauge social acceptability of the Project. The various questionnaires were designed for the following groups:

- Key informants and chiefs (20 questionnaires completed);
- Households living close to the road (60 questionnaires completed);

- Street vendors (informal street vendors in or around well-demarcated markets or with small informal structures in the Right of Way (ROW) or at transport junctions). Surveyors captured gender differences by selecting both women street vendors and men street vendors (71 questionnaires completed);
- Shops with physical infrastructures (in a building) (68 questionnaires completed);
- Livestock owners bringing their animals in the ROW for grazing (33 questionnaires completed);
- Maasai pastoralists crossing the road (4 questionnaires completed, Maasai pastoralists were rarely encountered along the road).

Except for the questionnaire for key informants and chiefs, social surveyors remained in the Project's Right of Way (ROW) or its vicinity (first rows of houses after the ROW). The ROW is physically delineated along the road and easily identified since concrete beacons are installed along its limit. The rationale for maintaining the social survey in the ROW or its vicinity was to focus on impact, perceived impact and social acceptability in addition to collecting basic socioeconomic indicators.

Surveyors were trained to use the tablets along with the questionnaires. A pilot area along the highway was selected to test the questionnaires and make required adjustments.

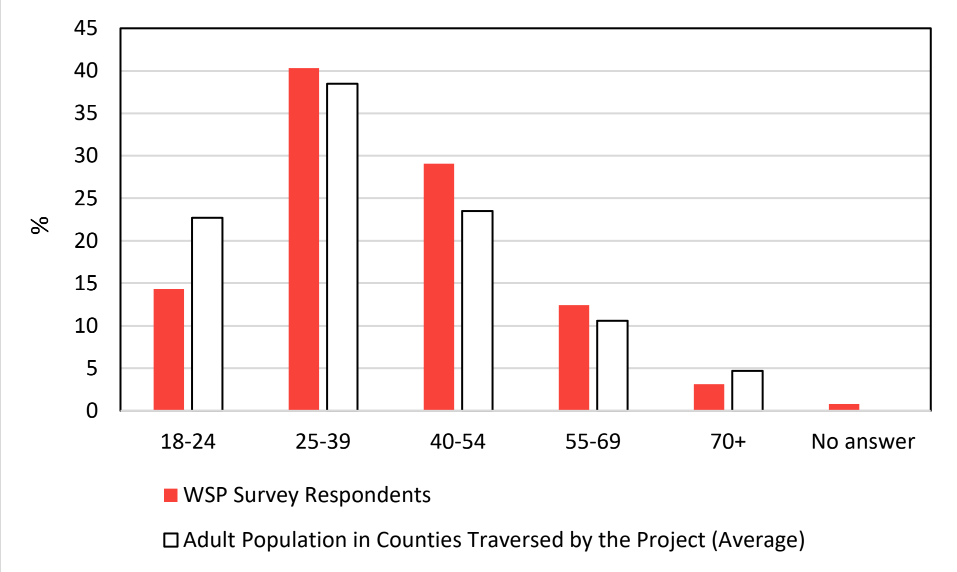
SURVEY RESPONDENTS

The distribution of survey participants by stakeholder group and by gender is presented in Table 5-15. The distribution by gender varies according to the stakeholder group with more women being interviewed for the three following categories: households close to the RoW, street vendors, and shops. Overall, the survey is slightly biased towards men with approximately 55% of male participants versus 45% of female.

Table 5-15 WSP survey participants by stakeholder group and gender

Stakeholder Group	Male	Female	Total
Key informants & chiefs	17	3	20
Livestock owners/caretakers	30	3	33
Maasai pastoralists	4	0	4
Shop owners/keepers	33	35	68
Street vendors	32	39	71
Households close to the RoW	26	36	62
Total	142	116	258

Figure 5-14 shows the distribution of respondents surveyed by age group. The sample closely reflects the distribution of the adult population. Surveyed persons aged 25 to 39 years old are the highest group represented, followed by the 40 to 54 years old group. The 18-24 age group is under-represented compared to the age distribution in the three counties traversed by the Project, but this is to be expected as 4 out 6 questionnaires targeted specific occupations and that this age group is the most affected by unemployment (see Section 6.4.6). The 40-54 age group is over-represented compared to the age distribution in the three counties traversed by the Project. However, this probably represents the distribution of power in the region as key informants and chiefs were all 40 years old or above.



Source: WSP Survey and KNBS, 2019

Figure 5-14 Distribution of WSP survey participants by age group (n=258) compared to the average adult population by age group in the Counties traversed by the Project (Kiambu, Nakuru, and Nyandarua)

Figure 5-15 shows the distribution of respondents surveyed by stakeholder group. The only available statistics on ethnicity distribution are at the National level. It is therefore impossible to assess if the distribution of respondents by ethnicity is representative of that of the region.

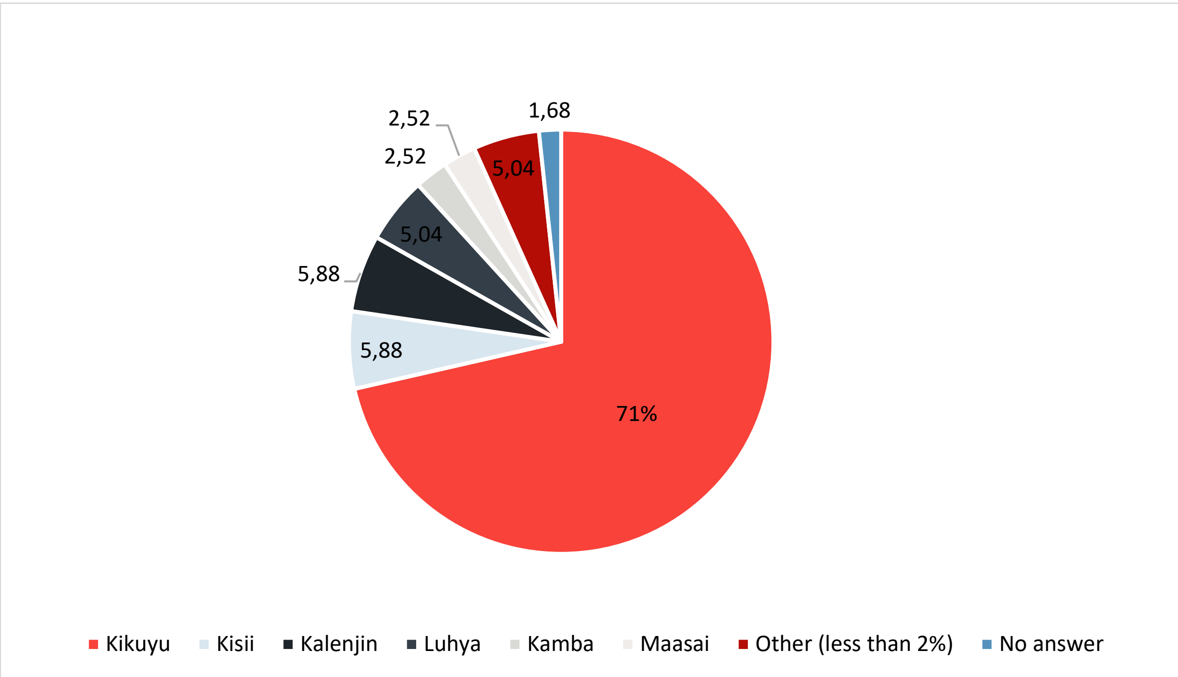


Figure 5-15 Distribution of WSP survey participants by ethnic group (n=238). Number of respondents is lower than the total surveyed because ethnicity was not requested from key informants and chiefs.

5.5 ASSESSMENT OF PROJECT IMPACT

This section describes the step-by-step impact assessment process that leads to the final assessment of the significance of the residual impact.

The method used to identify and assess the Project impact rely primarily on extensive knowledge of the Project and its environment, as well as on experience in conducting environmental and social impact assessments for similar projects. Lessons learned from previous experiences provide relevant information on the nature and intensity of impact associated with this type of project, as well as on the real effectiveness of mitigation and compensation measures generally applied.

5.5.1 SOURCES OF IMPACT CONSIDERED

A systematic evaluation was conducted to determine what Project activities of the Project may induce direct or indirect effects on the selected VECs. Table 5-16 outlines the Project sources of impact by Project phase: pre-construction, construction and operation (including maintenance).

Table 5-16 Sources of Impact

Sources of Impact	Description
Pre-Construction	
Land acquisition Resettlement and Compensation	Procedures relating to agreements with landowners outside the road reserve. Resettlement and Compensation of Persons Affected by the Project (PAPs) and economic activities affected by the Project. This activity is evaluated although it will be managed by KeNHA outside the scope of the ESIA.
Implementation of temporary construction facilities	Establishment of equipment storage yards, work facilities and access roads, ground water wells, crushing plant, concrete plant, asphalt mixing plant.
Construction	
Transportation and circulation	Transportation of materials, equipment, and workers to and from the site, including fueling and maintenance of vehicles and machinery. This source of impact is the same for the construction phase and as such it will be treated globally for the Pre-Construction and Construction phases.
Site preparation	Site preparation activities, including, clearing and grubbing, excavation, and earthworks.
Use of borrow pits and quarries	Opening of new or previously used borrow pits and their exploitation. Use of existing borrow pits.
Drainage and stormwater management	Implementation of ditches, culverts and channels to ensure proper drainage of the road which implies works in water and riverbanks.
Structural work	Installation of viaducts, interchanges, bridges, underpasses, overpasses for pedestrians, wildlife, vehicles and the railway.
Base layer and pavement work	Road works, including, mounting, fine grading, laying of aggregate base, asphalt paving.
Road furniture work	Installation of lighting, road signs, guard rails, rumble strips, etc.
Waste and hazardous materials management	Management and storage of waste, hazardous substances, and other materials to be removed, including hydrocarbons.

Sources of Impact	Description
Purchase of materials, goods, and services	Purchases required for the construction of the road from suppliers.
Presence of workers and influx of job seekers	Workers present along the road. These include informal workers (daily laborers, migrant workers, formal workers, subcontractors).
Operation	
Presence of the new infrastructure and use of the highway	Presence of the highway and its use by motorized and non-motorized traffic.
Operation & routine maintenance	Including services such as survey patrols, rescue and towing, fire brigade, ambulances, traffic supervision & management. Including work such as road & drainage cleaning, greenery maintenance, minor repairs of pavement, structures & equipment.
Heavy maintenance & rehabilitation	Including work such as pavement replacement, structures and drainage repair, replacement of road equipment (furniture and information system).

5.5.2 IMPACT CONSIDERED

The identification of the direct, indirect, positive, negative impact considered as part of the ESIA is completed by using a "matrix" which shows along one axis, the Project sources of impact and on the other axis, the list of selected VECs (Table 5-17).

5.5.3 MITIGATION MEASURES

General and specific management measures (avoidance, mitigation, compensation, and enhancement) will be identified using the mitigation hierarchy (avoid, mitigate, compensate), in order to reduce adverse impact and improve environmental and social acceptability for the Project. These measures will be incorporated into the Environmental and Social Management System (ESMS) and associated action plans developed for the Nairobi-Nakuru-Mau Summit Highway Project. Effective use of this ESMS will promote improved RVH environmental and social performance, as required by IFC PS 1.

Note that a pre-mitigation impact characterized as minor will generally only be associated with general measures.

5.5.4 CHARACTERIZATION OF IMPACT

For each potential impact, the intensity, geographical extent and duration of the impact is established considering the proposed mitigation measures following the guidance below.

Table 5-17 Impact Identification Matrix

Sources of Impact	Physical Environment								Biological Environment						Socioeconomic Environment									
	Ambient Air Quality	GHG Emissions	Ambient noise	Surface Water Quality and Management	Groundwater Quality and Quantity	Soil Stability/Erosion	Soil Quality	Sediment Quality	Habitat and Flora	Birds	Reptiles and Amphibians	Small Mammals	Large Mammals	Freshwater Ecology	Population and Land Tenure	Community Well-being and Safety	House, Social Amenities and Community Assets	Livelihood Strategies and Economic Activities	Labor Conditions	Vulnerable and Marginalized Groups (VMGs)	Gender Aspects	Public Infrastructure and Services	Archaeology and Cultural Heritage	Visual Environment
Pre-Construction																								
Land acquisition Resettlement and Compensation															N		N	N			N	N		
Implementation of temporary construction facilities	N	N	N	N	N	N	N	N	N	N	N	N	N	N		N		N/P	N/P	N/P		N		
Construction																								
Transportation and circulation	N	N	N	N		N	N			N	N	N	N	N		N		N/P	N/P*	N				N
Site preparation	N	N	N	N	N	N	N	N	N	N	N	N	N	N		N		N/P	N/P	N/P		N	N	
Use of borrow pits and quarries	N	N	N	N	N	N				N	N	N			N	N		N	N/P	P			N	N
Drainage and stormwater management				N/P				N/P			N/P			N/P		N/P	N/P	N/P	N/P	N/P		N/P		
Structural work	N	N	N	N		N					N			N		N/P		N/P	N/P	N/P		N		N
Base layer and pavement work	N	N					N									N		N/P	N/P	N/P				
Road furniture work						N										P		N/P	N/P					
Waste and hazardous materials management				N	N		N		N					N		N			N/P					
Purchase of materials, goods, and services																N/P		P	N/P	P	P			
Presence of workers and influx of job seekers										N	N	N	N	N		N		P	N/P	N/P	N			
Operation																								
Presence of new infrastructures and use of the highway	N/P	N/P	N	N/P	N/P		N	N/P	N		N	N	N/P	N/P		N/P	N/P	N/P		N/P		P		N/P
Operation and routine maintenance	N	N		N	N		N									P	P	P	N/P	P	P	P		P
Heavy maintenance and rehabilitation	N	N	N	N	N		N	N		N				N		N/	N/P	P	N/P	N/P		P		

Notes: N = Negative impact
P = Positive impact
N/P = both negative and positive impact.

5.5.4.1 INTENSITY

The intensity of the impact indicates the degree to which the assessed VECs is disturbed. The analysis shall consider the VECs sensitivity and capacity to accommodate to changes (apprehended impact), as well as its estimated value. Impact intensity is described at three levels:

- **High**: the impact damages the concerned VEC permanently, jeopardizes significantly its integrity, or changes substantially or irreversibly its environmental distribution or role;
- **Medium**: the impact alters the concerned VEC s quality, and its environmental distribution or role, without damaging its integrity;
- **Low**: the impact slightly alters the concerned VEC without changing substantially its quality, and environmental distribution or role.

As for positive impact, the same levels are considered while replacing “damage” and “alter” by “improve.”

5.5.4.2 GEOGRAPHIC EXTENT

The extent of an impact refers to the geographic area over which the impact can express itself. The geographic extent is described as limited, local, or regional based on the following definitions:

- **Limited**: the impact is restricted to the road reserve and direct Project footprint (PDA);
- **Local**: the impact will extend beyond the PDA, thus affecting the vicinity and neighboring areas. This area corresponds to the LAA defined in section 5.1;
- **Regional**: the impact will be felt within a greater area than the LAA which corresponds to the RAA defined in section 5.1.

5.5.4.3 DURATION

The duration of the residual impact refers to the period during which the impact will be felt and whether the impact will occur intermittently. The duration of an impact is described as long-term, medium-term, or short-term based on the following definitions:

- **Long-term**: the impact is considered permanent or irreversible;
- **Medium-term**: the impact is felt continuously during the entire construction period of the Project (estimated to 30 months) and/or for the full or partial duration of operation;
- **Short term**: the impact is felt temporarily or intermittently for a limited period corresponding to one or a few construction activities/phases.

5.5.4.4 MAGNITUDE OF IMPACT

The magnitude of the impact reflects the intensity of the impact, its extent, and its duration. Impact magnitude is ranked as minor, moderate, or major and obtained using Table 5-18. This magnitude will be evaluated twice that is first without considering mitigation measures and secondly as a residual impact following application of mitigation measures.

A summary table is used to present the assessment of both pre-mitigation and residual impact as presented in Table 5-19. The one for residual impact is similar but for the title of the first line which will be “Assessment and Justification of Residual Impacts”.

Table 5-18 Magnitude Assessment Matrix

Assessment Parameters			Magnitude
Intensity	**Geographic Extent**	**Duration**	
High	Regional	Long-term	Major
		Medium-term	Major
		Short-term	Moderate
	Local	Long-term	Major
		Medium-term	Major
		Short-term	Moderate
	Limited	Long-term	Major
		Medium-term	Moderate
		Short-term	Moderate
Medium	Regional	Long-term	Major
		Medium-term	Moderate
		Short-term	Moderate
	Local	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Moderate
	Limited	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Minor
Low	Regional	Long-term	Moderate
		Medium-term	Moderate
		Short-term	Minor
	Local	Long-term	Moderate
		Medium-term	Minor
		Short-term	Minor
	Limited	Long-term	Minor
		Medium-term	Minor
		Short-term	Minor

Table 5-19 Example of the Pre-Mitigation Impact Summary Table Completed for each VEC

Assessment of Pre-mitigation Impact			
Direction	☒ Positive	☐ Negative	
Intensity	☐ Low	☐ Medium	☐ High
Geographical Extent	☐ Limited	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☐ Moderate	☐ Major

5.5.5 SOCIAL ACCEPTABILITY ASSESSMENT

Social acceptability is a concept which evolves as the Project progresses and is influenced by the information communicated to and the expectations of the concerned population. During the environmental and social impact assessment process, information on the project was communicated and insights on social acceptability were obtained during:

- Day-to-day contact with the various stakeholders that is during informal meetings, work meetings, encounters during biophysical survey activities, etc.;
- The specific socioeconomic survey which collected some information on the way people perceive the highway and the Project. In fact, several questions of the survey were aimed at gauging social acceptability of the Project with questions on perceived impacts from nuisances, on safety issues and road accidents, on the risk of gender-based violence and workers influx. In addition, people were asked specific open question on their perception of the Project allowing them to explain how they believe the Project would bring positive outcomes or negative impacts;
- The three rounds of public consultation which always included a specific period for questions and comments from the participants. Effectively, several the comments received supply a good indication of the acceptability of the Project.

Assessment of social acceptability is a difficult task since, according to the socioeconomic survey most people have mixed feelings about the Project. Typically, surveyed people have great expectations about the Project, and it is common to see that people often mix their expectations with reality. This situation can initially be positive for the Project but if community expectations are not met, social acceptability can greatly deteriorate. Surveyed people also have fears, especially regarding their safety, their ability to cross the highway and regarding the various social risks associated with construction activities. Other surveyed people have mentioned issues with the compensation process.

Therefore, assessment of social acceptability of the Project will be a continuous process and will be better gauged in the ESIA report when final sets of mitigations and community infrastructures will be developed and presented to community (pedestrian overpass and underpass, etc.). The assessment of social acceptability will also be influenced by the way resettlement and compensation are addressed by KeNHA and by the way construction activities will be handled (management of risks and local employment). Lastly, it is possible that social acceptability is attained at some locations or by some categories of people only and, in other areas, communities could be more strongly opposed to the Project. Return of experience has shown that trust by communities is the most important factor contributing to social acceptability.

The determination of the Social Licence to operate will be evaluated at the end of the public consultation process. A short questionnaire or evaluation form will be developed by the Consultant and handed to participants at the end of the second and third round of the ESIA consultation process. The evaluation forms will be anonymously collected in ballots in each consultation venue. Outcome of this evaluation will be used to further propose engagement activities in the stakeholder engagement plan (SEP) to be carried out during project preparation and construction activities.

With regards to the Maasai and Ogiek communities, it is through the FPIC process that social acceptability is determined for these communities.

5.5.6 CUMULATIVE IMPACT ASSESSMENT

Cumulative impact is defined as "changes to the environment that are caused by an action in combination with other past, present, and future human actions" (Hegmann, G. *et al.*, 1999). This definition suggests that all effects linked to a project can interfere, both in time or in space, with the effects of other past, present, or future projects to generate direct or indirect consequences to one or more environmental components.

The Project's cumulative impact assessment will help consider its possible interactions with other activities and projects, which might affect the environmental and social components. This will be a combined evaluation of the project impact together with those of other projects that have occurred in the past in the sector, and of existing projects or of projects that are currently planned in the area and its surroundings. This aspect is particularly relevant for transport-related components as the Nairobi-Mau Summit project will be part of a network of transport infrastructures.

Specific consultations with constituency and county-level authorities have helped to identify projects susceptible to generate cumulative impact and reach a better understanding of their individual associated environmental and social impact.

To facilitate consideration of cumulative impact, the following conditions should be met:

- The extent of the study area should be large enough to allow for the evaluation of the effects of key projects on VECs when combined with activities of other past, present, or future projects;
- The baseline description of the VECs (Chapter 6) should include past environmental issues;
- The projects expected to be susceptible to interaction with the impact of the main Project should be known.

It is therefore appropriate, based on available information or logical assumptions by professional judgement, to list the environmental effects that can be combined with the impact of the Project, resulting in cumulative impact.

The purpose of cumulative impact assessments is to describe the evolution of VECs of the receiving environment, taking into consideration reasonably foreseeable future developments. The cumulative impact assessment is based on available baseline information and foreseeable impact of future projects. Unless accurate data is available, the environmental effects of projects, other than the main Project, are estimated based on the typical effects resulting from similar projects.

6 DESCRIPTION OF BASELINE CONDITIONS

6.1 PREAMBLE

This chapter describes the baseline conditions for the valued environmental components (VEC) selected (See Chapter 5 – Section 5.2 for details about VECs selection) for the Project. The main objective of this chapter is to expose the time zero environmental and social characteristics and conditions before the Project is implemented. This chapter emphasis on describing the sensitive and important features present alongside the six roads sections considered that are likely to be affected by the Project as well as providing relevant contextual information. The qualitative and quantitative description presented hereafter is based on:

- Existing desktop data, mapping and information;
- Some early reconnaissance visits;
- Some technical meetings with relevant authorities and organizations;
- Public consultations meetings;
- Specific biophysical baseline surveys completed as part of the ESIA;
- Information obtained during detailed socio-economic surveys;
- Some specific calculation, analysis and simulations.

The detailed data collection methodologies specific to each VECs are presented in Chapter 5 of this ESIA. To ease reading, relevant high-level methodological considerations are summarized at the beginning of each section. The detailed list of references considered is provided in Chapter 12.

6.2 PHYSICAL ENVIRONMENT

This section describes the baseline conditions for the valued environmental components (VEC) of the physical environment selected (See Chapter 5 – Section 5.2 for details about VECs selection) for the Project.

6.2.1 ATMOSPHERIC ENVIRONMENT

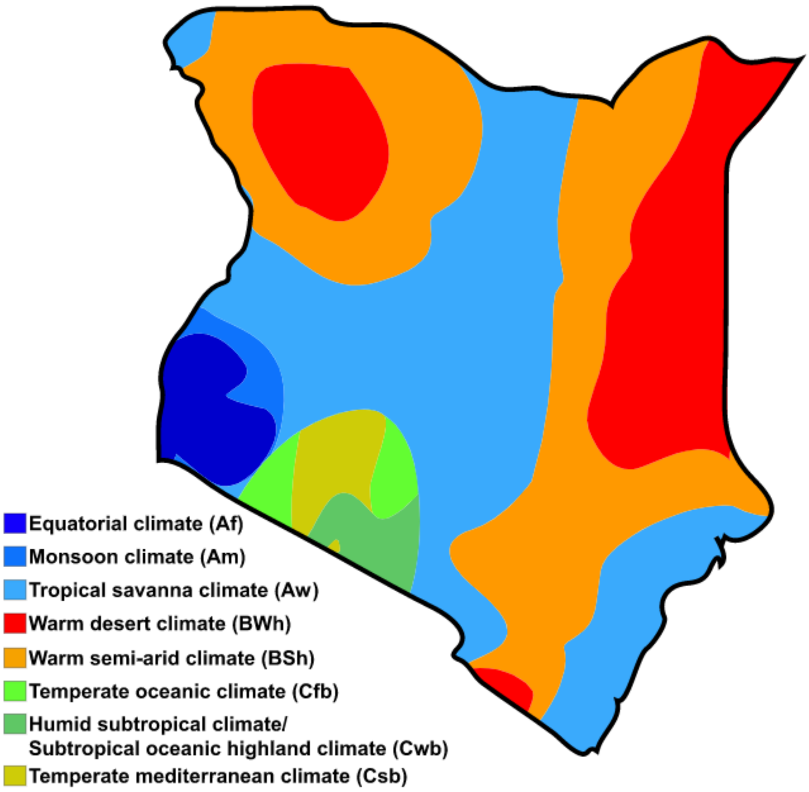
6.2.1.1 METEOROLOGICAL CONDITIONS

Kenya is located in Eastern Africa and is bisected by the equator. It is predominated by three main general types of climate: hot and humid along the coast, temperate in the west and south-west where there are mountains and plateaus, and hot and dry climate in the north and east. The Project is entirely located within the temperate climate area.

Two complex phenomena and their interaction mainly influence the climate of the Country; that is the Intertropical Convergence Zone (ITCZ) and the Indian Ocean Dipole (IOD). The ITCZ, corresponds to a narrow belt of very low pressure and heavy precipitation that forms near the equator. Depending on the season, the ITCZ shifts from north to south creating a bimodal pattern of rainfall known as the long rain season and the short rain season. The long rain season generally extends from March to May while the short rain season ranges from October to December. In parallel, the IOD, also known as the Indian Ocean El Nino, is related to surface temperature changes of the ocean. This can affect and alter the onset and duration of the rainy and dry seasons triggering events such as drought and flooding.

CLIMATIC REGIONS

Kenya is generally known to offer a tropical climate. However, this climate is moderated by varying topography which rises from the coastal plains to the East African Plateau and the Great Rift Valley. The central highland regions are known to be much cooler than the coastal area. According to Nicholson (1996), Kenya's climate is heavily influenced by three major air streams which determine the Kenyan climate. These airstreams are the Congo airstream with westerly and south-westerly flow, and the north-east trade winds and the south-east trade winds. From November to March, Kenya is under the influence of the north-east trade winds which brings rain mainly to the coastal area. In April, many of the central, southern and eastern parts of the country fall under the influence of the south-east trade winds from the Indian Ocean, which brings major rain events to Kenya until about August. Starting around July, the Congo airstream penetrates from the west generating highly unstable conditions associated with the frequent development of storms in the western part of the country. The Koppen-Geiger classification confirms 8 different types of climatic regions illustrating the combined effect of topography and air streams in characterizing the Kenyan climate. These climatic regions are presented in Figure 6-1.



Source: http://earthwise.bgs.ac.uk/index.php/Climate_of_Kenya

Figure 6-1 Climatic Regions of Kenya According to the Koppen-Geiger Classification

The Project is mainly located in the Kiambu and Nakuru Counties but also crosses the southern tip of the Nayandarua County. According to the Climate-Data.Org web site (consulted in April 2021), Kiambu County is characterized by three main climatic regions including the temperate oceanic climate (Cfb), the subtropical highland oceanic climate (Cwb), and the temperate Mediterranean climate (Csb). The Project is essentially present in the Cfb and Cwb climatic region for this County. In Nayandarua County, the climatic regions encountered include the Cfb and Csb and the Project is essentially located within the Cfb climatic region. In Nakuru County, three climatic regions are present with the Csb and Cfb dominant while the northern part is under the influence of the tropical savanna climate (Aw). The Project is essentially present within the Csb and Cfb climatic region.

Overall, the Project crosses three climatic regions from south to north that is Cwb, Cfb, and Csb which are briefly described below:

- Cwb: Generally, features warm but not hot summers and cool, but not cold winters. Annual temperature variation is relatively stable with precipitation marked by slightly dryer and wetter seasons;
- Cfb: Generally, features warm although not hot summers and cool but not cold winters. Annual temperature variation is relatively stable with precipitation generally evenly distributed throughout the year;
- Csb: Generally, features warm although not hot summers and cool but not cold winters. Annual temperature variation is relatively stable with precipitation generally characterized by well demarcated dry and rainy seasons.

METEOROLOGICAL CONDITIONS

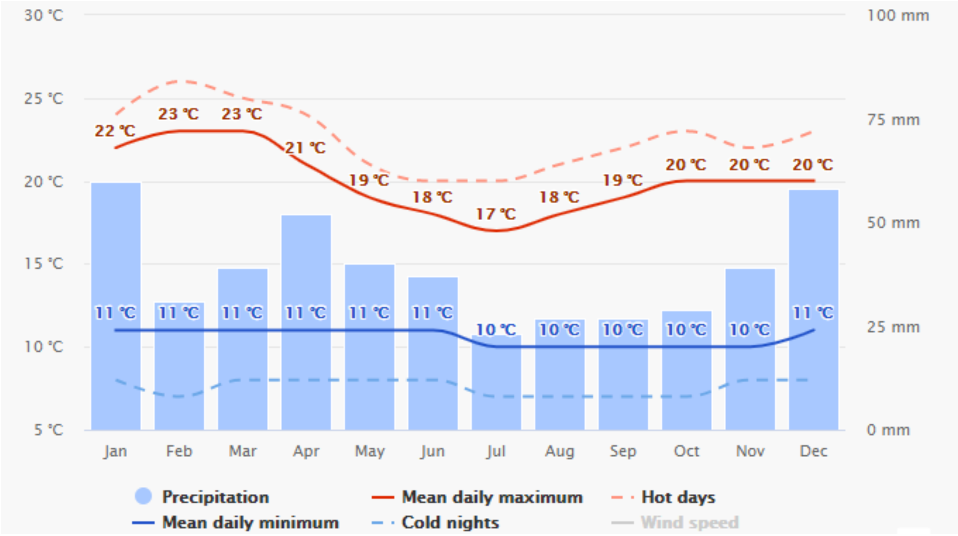
NATIONAL OVERVIEW

Meteorological conditions at the scale of the Country show a high level of complexity both in time and space. The main factors influencing the meteorological conditions were presented in the previous section. They result in a large range of temperature, rain fall, wind, and humidity. As such, during a typical year, temperature can vary from below zero to above 35ºC with the coolest period occurring between June and August and the highest temperature during the month of March (Kenya Meteorological Department, 2020; Obiero and Onyando, 2013). Rainfall is also characterized by a wide range in quantities from 250 mm to 2,500 mm per year depending on the region. Most of this rain fall is from March to May and from October to December. As previously described, the Country is under the influence of three main wind currents (airstreams): the Congo air streams, the north-east trade winds, and the south-east and mean wind speed vary between 10 km/h and 20 km/h. As for humidity, it is relatively comfortable throughout the year with averages around 70 %, which peaks in line with the main rain seasons.

The following subsections present specific meteorological data for the four main towns within the project area; namely, Limuru, Naivasha, Longonot and Nakuru.

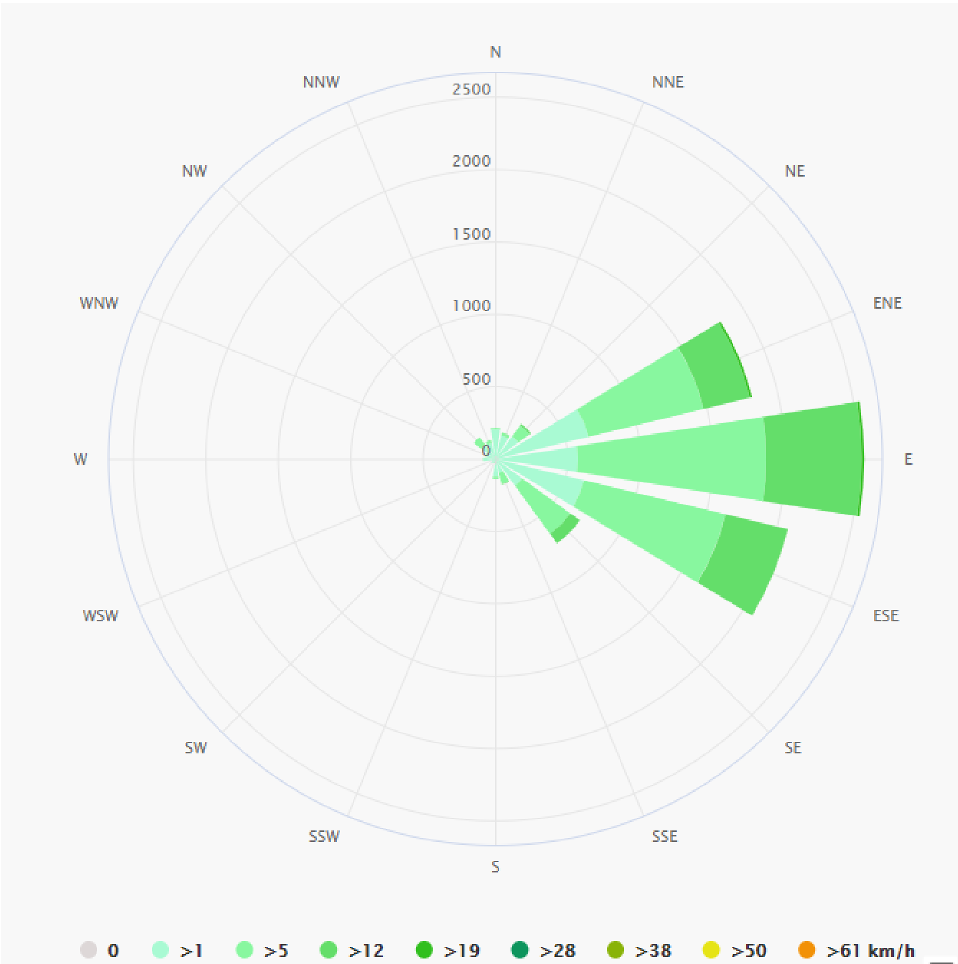
TOWN OF LIMURU

Limuru is located at the southern extremity of the Project near the junction between the A8 and A8 South highways. It is characterized by daily temperature averaging 10 ºC to 23 ºC with some peaks above 25 ºC and lows (at nights) close to 5 ºC. The hottest period is from December to April while the coldest is from June to August. Rain is relatively constant throughout the year with a mean of 462 mm. It shows a clear increase during the months of December (58 mm) and January (60 mm) and another lesser peak around the month of April (58 mm) (Figure 6-2). Based on Kenya Climate Data (2020), average humidity levels in the Limuru area are relatively stable around 70 % with slight peaks in line with the rainy periods of December/January (76 %) and April/May (78 %). Local winds are largely blowing from the east with a strong contribution from the east north-east and east south-east. These winds are relatively calm with average speeds below 12 km/h (Figure 6-3).



Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/limuru_kenya_189386

Figure 6-2 Average Temperature and Rain Fall (Limuru)

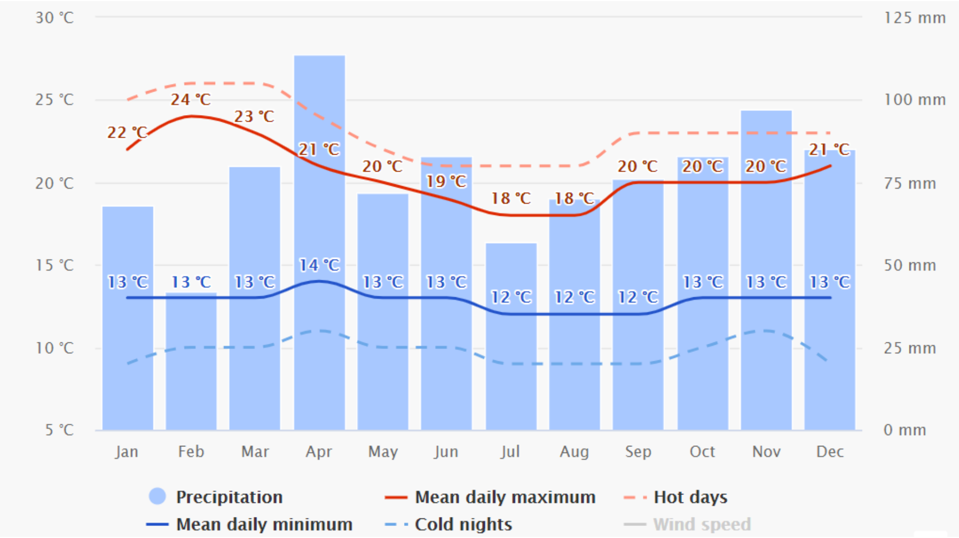


Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/limuru_kenya_189386

Figure 6-3 Average Wind Speed and Direction (Limuru)

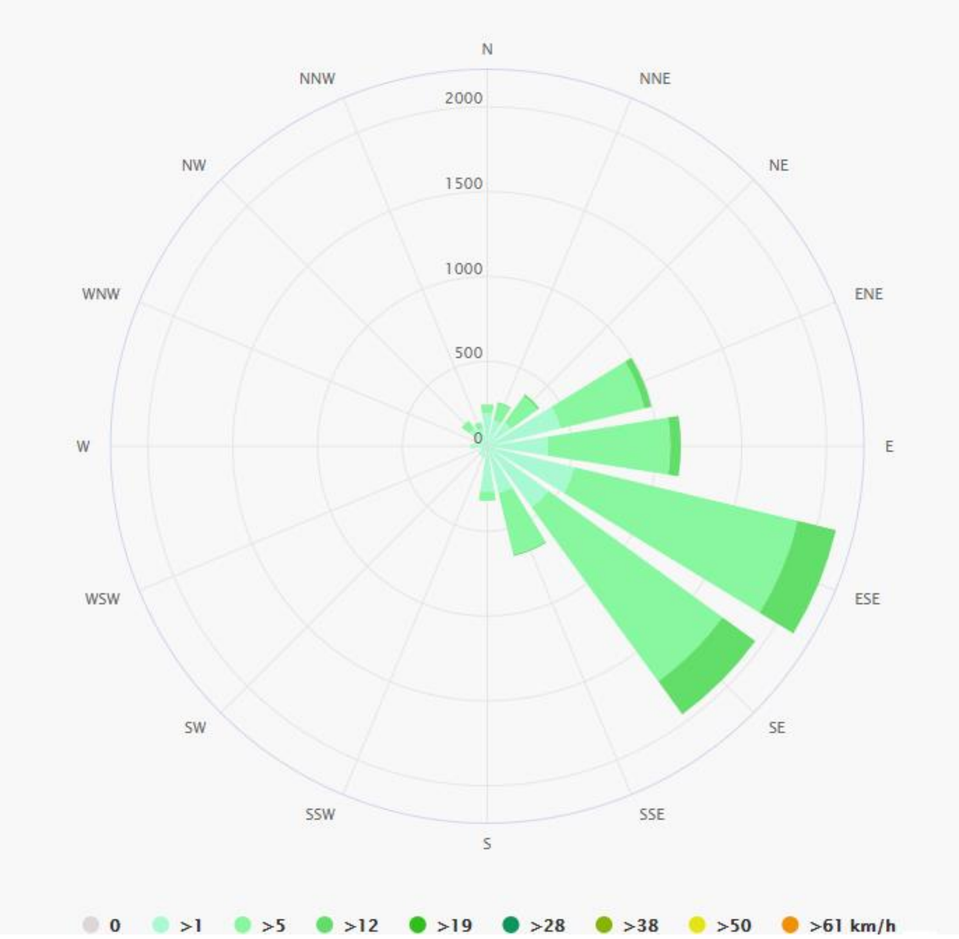
TOWN OF NAIVASHA

Naivasha is located along the A8 Highway near the center area of the Project and is characterized by daily temperature averaging 12 ºC to 24 ºC with some peaks above 25 ºC and lows (at nights) just below 10 ºC. The hottest period is from December to April while the coldest is from June to August. Rain is relatively constant and abundant with a yearly mean of 927 mm and peaks in April (114 mm) and around November (97 mm) (Figure 6-4). Based on Kenya Climate Data (2020), average humidity levels in the Naivasha area are relatively stable around 76 % with peaks more or less in line with the rainy periods of November (80%) and May/June (83%). Local winds are largely blowing from the east with a strong contribution from the east south-east and south-east. These winds are relatively calm with average speeds below 19 km/h (Figure 6-5).



Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/naivasha_kenya_184707

Figure 6-4 Average Temperature and Rain Fall (Naivasha)

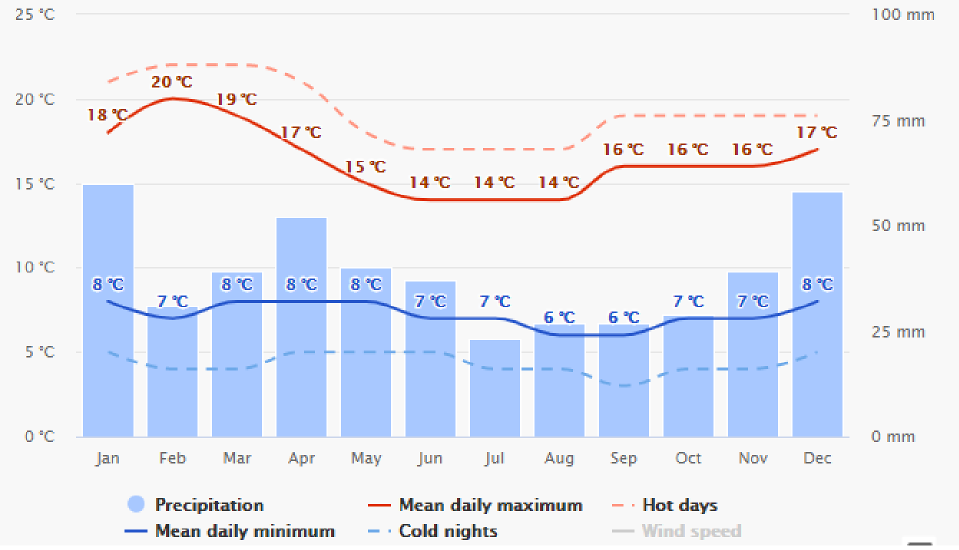


Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/naivasha_kenya_184707

Figure 6-5 Average Wind Speed and Direction (Naivasha)

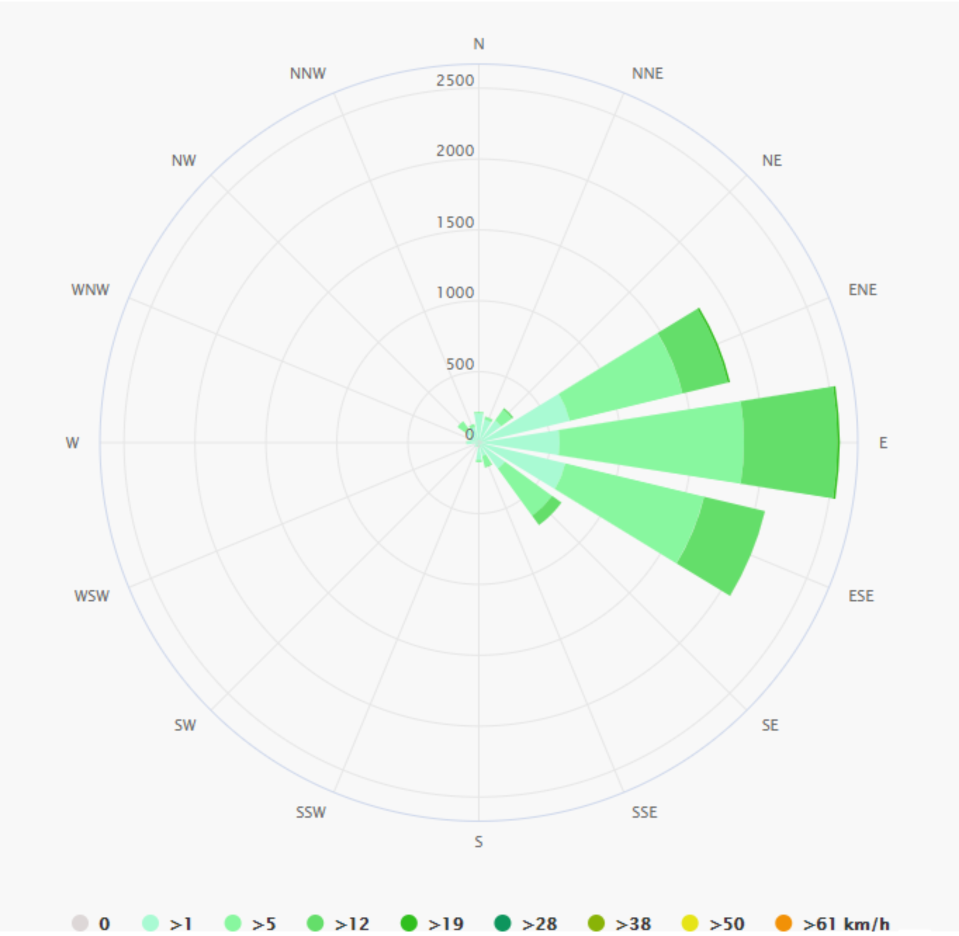
TOWN OF LONGONOT

Longonot is located along the A8 South in the central part of the Project and is characterized by daily temperature averaging between 6 ºC to 20 ºC with some peaks above 20 ºC and lows (at nights) below 5 ºC. The hottest period is from December to April while the coldest is from June to August. Rain is relatively constant throughout the year with a mean of 462 mm and peaks in April (52 mm) and in December (58 mm) and January (60 mm) (Figure 6-6). Based on Kenya Climate Data (2020), average humidity levels in the Longonot area are similar to those of Limuru and relatively stable around 70 % with slight peaks in line with the rainy periods of December/January (76%) and April/May (78%). Local winds are largely blowing from the east with a strong contribution from the east north-east and east south-east. These winds are relatively calm with average speeds below 19 km/h (Figure 6-7).



Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/longonot_kenya_188943

Figure 6-6 Average Temperature and Rain Fall for the Longonot Area

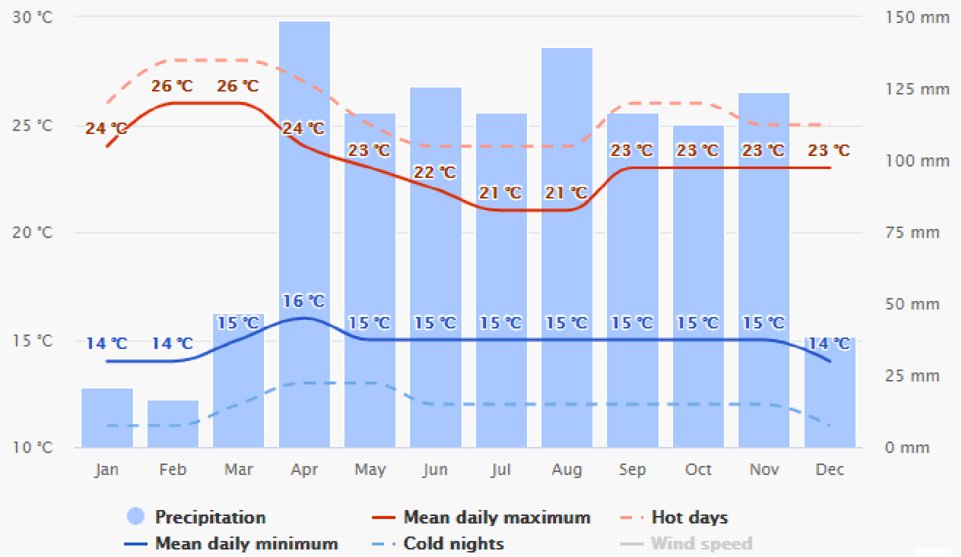


Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/longonot_kenya_188943

Figure 6-7 Average Wind Speed and Direction for the Longonot Area

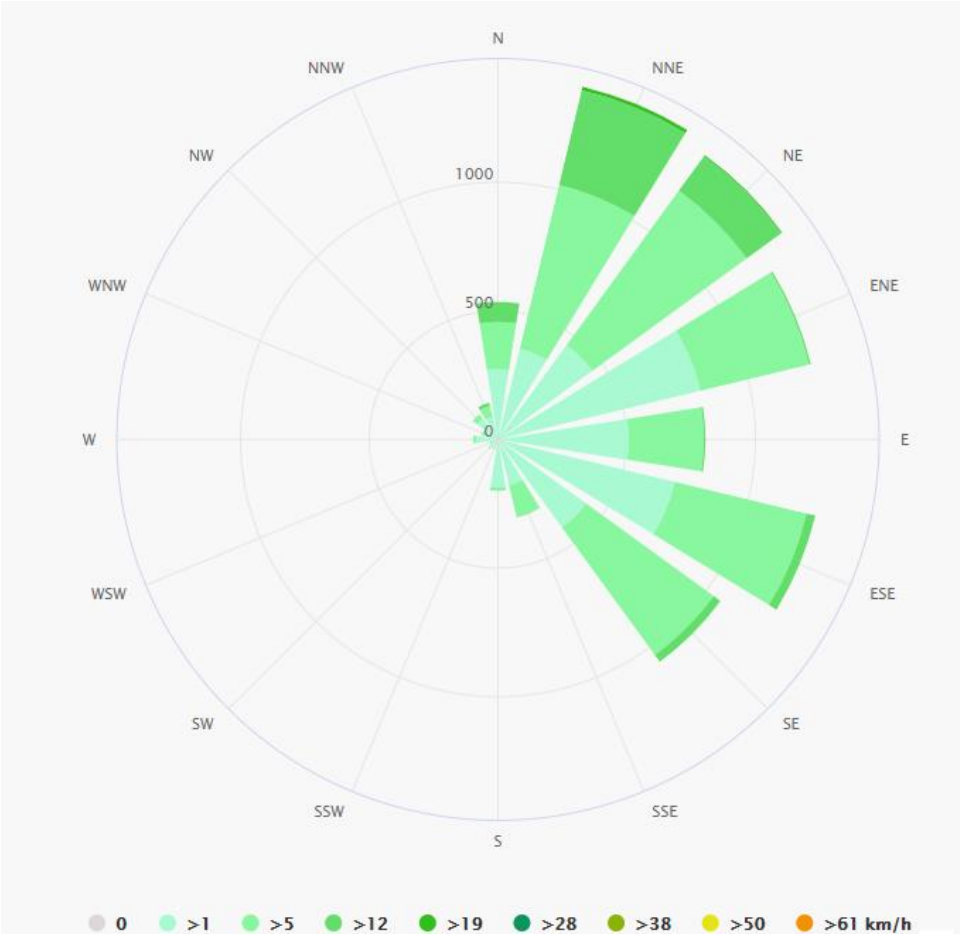
CITY OF NAKURU

Naivasha is located along the A8 Highway in the northern area of the Project and is characterized by daily temperature ranging from 14 ºC to 26 ºC with some peaks to near 30 ºC and lows (at nights) just above 10 ºC. The hottest period is from January to April while the coldest is from July to August. Rain is concentrated between the months of April to November with an average of 125 mm per while the other months average 31 mm (Figure 6-8). Annual rain falls average 1127 mm. Based on Kenya Climate Data (2020), average humidity levels in the Naivasha area are relatively stable around 60 % and 70% from April to November and around 50 % from December to March. Local winds show important variation as they vary throughout the year from the north-east to the south-east. These winds are relatively calm with average speeds below 28 km/h (Figure 6-9).



Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/nakuru_kenya_184622

Figure 6-8 Average Temperature and Rain Fall (Nakuru)



Source: Meteoblue (2021), based on past 30 years data https://www.meteoblue.com/en/weather/historyclimate/climatemodelled/nakuru_kenya_184622

Figure 6-9 Average Wind Speed and Direction (Nakuru Area)

6.2.1.2 AMBIENT AIR QUALITY

METHODOLOGICAL CONSIDERATIONS

The detailed methodology followed to assess baseline air quality is presented in Chapter 5 - Section 5.3.2.1. Furthermore Appendix 5-1 described the air quality sampling/monitoring protocol. Particulate matter and other contaminants were sampled at three different locations: Station A1 (Limuru Area), Station A2 (Nakuru City) and Station A3 (Sobea Area). The specific locations of the ambient air quality sampling stations are illustrated on Map 5-3.

As part of the ESIA, particulate matter was sampled an average of five times per station, each sample covering a period of 24 hours, over a period of 2 months (February-March) during the short dry season. Furthermore, passive gas sampling was conducted for NO_2, SO_2, O_3, and VOCs, using an exposition duration of 18 days.

Appendix 6-1 presents a series of photographs illustrating the specific site conditions at each of the station's location and installation.

Specific COVID 19 considerations are exposed in Chapter 5 – Section5.1.

STANDARDS CONSIDERED

The standards considered for assessing ambient air quality are those from the International Finance Corporation (IFC) Environmental, Health and Safety Guidelines and the National Environment Management Authority of Kenya (NEMA) as presented in Table 6-1. The more stringent standards of the IFC were generally considered except for TSP (24h), NO_2 (24 h) and TVOC (24 h) for which, in absence of an IFC standard, the NEMA standards were used.

Table 6-1 Ambient Air Quality Considered as part of the ESIA

Contaminants	Period	IFC EHS Guidelines (µg/m³)	NEMA (µg/m³)
PARTICULATE MATTER			
TSP	24 h	-	200
PM_{10}	24 h	50	100
$PM_{2.5}$	24 h	25	75
OTHER			
NO_2	**24 h**	**-**	**80**
SO_2	**24 h**	**20**	**125**
O_3	**8 h**	**100**	**120**
TVOC	**24 h**	**-**	**600**

Source : IFC : https://www.ifc.org/wps/wcm/connect/4e01e089-ad1a-4986-b955-e19e1f305ff0/1-1%2BAir%2BEmissions%2Band%2BAmbient%2BAir%2BQuality.pdf?MOD=AJPERES&CVID=ls0KF2J
NEMA : https://www.nema.go.ke/index.php?option=com_content&view=article&id=31&Itemid=171

PARTICULATE MATTER

Tables 6-2, 6-3 and 6-4 outlines the results of the ambient air quality sampling completed for particulate matter cells colored in red outlines exceedance to standards considered and previously described in Table 6-1. Particulate matter is typically more important during the dry season. Results collected as part of the ESIA demonstrate that particulate matter is exceeded at all stations for the PM_{10} and $PM_{2.5}$ and these are more important at the A2 station located in the dense urban setting of the city of Nakuru. As for the total suspended particles (TSP), exceedances were recorded at the A2 station.

Table 6-2 Ambient Air Quality Results for A1 (Limuru Area) – Particulate Matter

Sampling		Parameter		
Start date	**End date**	**$PM_{2.5}$ (µg/m³)**	**PM_{10} (µg/m³)**	**TSP (µg/m³)**
February 9, 2021	February 10, 2021	38	55	95
February 10, 2021	February 11, 2021	36	48	81
February 11, 2021	February 12, 2021	29	44	67
February 12, 2021	February 13, 2021	25	68	88

Table 6-3 Ambient Air Quality Results for A2 (Nakuru City) – Particulate Matter

Sampling		Parameter		
Start date	End date	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	TSP (µg/m³)
February 14· 2021	February 16· 2021	70	125	236
February 16· 2021	February 17· 2021	59	115	198
February 17· 2021	February 18· 2021	61	138	260
February 18· 2021	February 19· 2021	69	128	277
February 19· 2021	February 20· 2021	65	162	290

Table 6-4 Ambient Air Quality Results for A3 (Sobea Area) – Particulate Matter

Sampling		Parameter		
Start date	End date	$PM_{2.5}$ (µg/m³)	PM10 (µg/m³)	TSP (µg/m³)
February 25, 2021	February 26, 2021	na	89	121
February 26, 2021	February 27, 2021	38	82	107
February 27, 2021	February 28, 2021	46	77	99
February 28, 2021	March 1, 2021	na	81	121
March 1, 2021	March 2, 2021	35	85	129
March 2, 2021	March 3, 2021	41	na	na
March 3, 2021	March 4, 2021	36	na	na

AIR CONTAMINANT (NO_2, SO_2, O_3, VOCS)

Tables 6-5, 6-6 and 6-7 outlines the results of the ambient air quality sampling for the other ambient air contaminant (NO_2, SO_2, O_3, VOCs). Cells colored in red outlines exceedance to standards considered are previously described in Table 6-1. Standards are met at stations A2 and A3 but exceeds for TVOCs at sampling site A3. The sampling team noticed that some painting works were ongoing near a residence three days after the beginning of the sampling. The application of paints is a known source of TVOCs. This activity is considered non-recurrent as it is linked to residential maintenance. Therefore, the determined concentration is likely not fully representative of the typical local concentration of TVOCs which, in normal conditions probably would have been similar to the results recorded at the A1 and A2 stations.

Table 6-5 Ambient Air Quality Results for A1 (Limuru Area)– other contaminants

Sampling		Parameter			
Start date	End date	NO_2 (µg/m³)	SO_2 (µg/m³)	O_3 (µg/m³)	TVOCS (µg/m³)
February 13· 2021	March 7· 2021		<1.64	89	34
February 18· 2021	March 7· 2021	13			

Table 6-6 Results for A2 (Nakuru City) – other contaminants

Sampling		Parameter			
Start date	End date	NO_2 (µg/m³)	SO_2 (µg/m³)	O_3 (µg/m³)	TVOCS (µg/m³)
February 15· 2021	March 6· 2021	34	<1.90	72	54

Table 6-7 Results for A3 (Sobea Area) – other contaminants

Sampling		Parameter			
Start date	**End date**	**NO_2 (µg/m³)**	**SO_2 (µg/m³)**	**O_3 (µg/m³)**	**TVOCS (µg/m³)**
February 17, 2021	March 6, 2021	13	<2.16	86	2266

6.2.1.3 GHG EMISSIONS

METHODOLOGICAL CONSIDERATIONS

The detailed methodology followed to assess baseline GHG emissions is presented in Chapter 5 - Section 5.4.1.3. GHG calculations are based on the GHG protocol[1] included in Equator Principles[2] and IPCC rules, in accordance with IFC Performance Standard 3 which refers to IPCC methodologies. IFC EHS Guidelines do not refer to any GHG quantification methodology.

As part of the ESIA, available desktop information regarding current GHG emissions was obtained from the Climate Watch[3]. Furthermore, baseline GHG emissions associated with highways A8 and A8 south were calculated using 2017 traffic count results which were actualized to proposed baseline time zero set to 2025, corresponding to the moment just before the Project enters operation phase. The traffic data was entered using the MOVES software to calculate GHG emission rates. The Project road length was subdivided into 6 sections. MOVES calculated the emissions for a selected typical 1 km road stretch for each of the road sections.

Specific COVID 19 considerations are exposed in Chapter 5 – Section5.1.

NATIONAL GHG EMISSIONS

According to Climate Watch, total Kenyan GHG emissions in 2018 was 71,21 MT CO_2e. General breakdown by activity sectors of these emissions is presented in Table 6-8. Table 6-8 shows that agriculture-related activities and energy production/consumption are the two main contributors in Kenya. It is also interesting to note the negative emission rate for land-use change and forestry. This is due to significant reforestation efforts which allows for the sequestration of large amounts of GHG transforming this sector into a carbon sink.

Table 6-8 GHG by Sectors – 2018

Sectors	**Emission (MTCO_2e)**
Agriculture	44,70
Energy	28,46
Industrial Processes	4,32
Land-use change and forestry	-7,62
Waste	1,35
Total	**71,21**

Table 6-9 outlines the specific GHG emissions for the Energy Sub Sectors. Transport activities are considered within the energy sector which can be broken down into the following sub sectors. Table 6-9 shows that transport activities represent 33 % of the energy related GHG emissions and 13% of the country's overall GHG emission.

---

1 The Greenhouse Gas Protocol : A Corporate Accounting and Reporting Standard, 2004. https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf
2 Equator Principles (EP4), 2020. https://equator-principles.com/app/uploads/The-Equator-Principles_EP4_July2020.pdf
3 Climate Watch. 2019. Washington, D.C.: World Resources Institute. Available online at: www.Climatewatchdata.org.

Table 6-9 GHG Emissions for Energy by Sub Sectors – 2018

Sectors	Emission ($MTCO_2e$)
Buildings	1,23
Heat	1,90
Fugitive emissions	0,02
Construction	3,19
Other fuel combustion	12,83
Transport	9,29
Total	**28,46**

REGIONAL GHG EMISSIONS ASSOCIATED WITH A8 AND A8 SOUTH

Table 6-10 presents the emission rates in grams per second and kilometer at time zero corrected for the effective full length of each segment. In order to calculate the emission rates for the Highway A8 and A8 South, each emission rate must be multiplied by the correspondent length and added or each GHG. Table 6-11 outlines a summary pf GHG Emission Rates at Time Zero (2025) for each contaminant and each highway segment

Table 6-10 GHG Emission Rates at Time Zero (2025) by km for each Road Sections considered

Segment	Section	Length (km)	Contaminant	Emission Rate per km (g/s-km)	Emission Rate (g/s) per section
1 A8 Rironi to Mau Summit	1	58,7	Methane (CH_4)	5,96E-04	3,50E-02
			Nitrous Oxide (N_2O)	7,72E-05	4,53E-03
			Carbon dioxide (CO_2)	2,17E+01	1,27E+03
	2	55,3	Methane (CH_4)	4,09E-04	2,26E-02
			Nitrous Oxide (N_2O)	4,72E-05	2,61E-03
			Carbon dioxide (CO_2)	1,98E+01	1,09E+03
	3	15,5	Methane (CH_4)	2,10E-03	3,26E-02
			Nitrous Oxide (N_2O)	1,81E-04	2,81E-03
			Carbon dioxide (CO_2)	6,82E+01	1,06E+03
	4	45,5	Methane (CH_4)	3,06E-04	1,39E-02
			Nitrous Oxide (N_2O)	3,67E-05	1,67E-03
			Carbon dioxide (CO_2)	1,57E+01	7,14E+02
2 A8-South Rironi Interchange to Naivasha Interchange	5	19,9	Methane (CH_4)	6,41E-04	1,28E-02
			Nitrous Oxide (N_2O)	7,13E-05	1,42E-03
			Carbon dioxide (CO_2)	2,58E+01	5,13E+02
	6	37,3	Methane (CH_4)	2,74E-04	1,02E-02
			Nitrous Oxide (N_2O)	3,16E-05	1,18E-03
			Carbon dioxide (CO_2)	1,53E+01	5,71E+02

Table 6-11 Summary of GHG Emission Rates at Time Zero (2025) for each contaminant and for each Highway Segment

Contaminant	Segment 1 - Highway A8 Sections 1 to 4 (g/s)	Segment 2 - Highway A8 South Sections 5 to 6 (g/s)
Methane (CH_4)	1,04E-01	2,30E-02
Nitrous Oxide (N_2O)	1,16E-02	2,60E-03
Carbon dioxide (CO_2)	4,14E+03	1,08E+03

By multiplying the emission rates with a representative traffic ratio (number of vehicles per hour)[4], the annual GHG emissions along A8 and A8 South is obtained (Table 6-12).

Table 6-12 Summary of Annual GHG emissions at Time Zero (2025) by contaminants and for each Highway Segment

Contaminant	Segment 1 Highway A8 (g/year)	Segment 2 Highway A8 South (g/year)
Methane (CH_4)	2,16E+06	6,13E+05
Nitrous Oxide (N_2O)	2,42E+05	6,92E+04
Carbon dioxide (CO_2)	8,61E+10	2,89E+10

Table 6-13 gives the CO_2 equivalent (CO_2e) emission for the 2025 baseline and by using the Global Warning Potential (GWP). The total CO_2 equivalent (CO_2e) emission for the 2025 baseline associated with highways A8 and A8 South thus totalized 115 kT CO2e. In 2018, the total Kenyan GHG emissions relating to the transport sector was 9,29 Mt CO_2e. The 2025 baseline emission associated with highways A8 and A8 South represents approximately 1,2 % of the existing baseline GHG.

Table 6-13 Total Yearly Baseline GHG Emission Rates at Time Zero (2025)

Project	A8 (kT CO_2e)	A8 South (kT CO_2e)
Yearly Time Zero Emissions	86	29

6.2.2 AMBIENT NOISE

METHODOLOGICAL CONSIDERATIONS

The detailed methodology followed to assess baseline noise levels is presented in Chapter 5 - Section 5.3.2.2. Furthermore, the acoustic protocol is presented in Appendix 5-1 and the specific receptors considered for the noise baseline study are illustrated on Map 5-4.

As part of the ESIA, baseline noise measurements were completed at ten stations (S1 to S10) strategically dispersed along highways A8 and A8 south for 24 hours, with audio recording and a 1-hour vehicle count, by direction and with classification. Furthermore, model-based surveys were conducted using the TNM calculation module, version 2.5 (Traffic Noise Model) from the Federal Highway Administration of the United States using traffic counts and projected incremental traffic. Calculations were made to estimate ambient noise levels with the current highway configuration's right-of-way for 2025 (estimated year 0 for starting operation of Project) and 2040 (target year to assess sound impact). For these calculations, 2017 traffic counts actualized to 2025 were used, as well as 2017 traffic counts projected in 2040 with the current highway configuration. Thirty-one (31) residential receptors (R1 to R31) primary located along the A8 's right-of-way were considered by the model in addition to the ten stations effectively measured on this highway.

[4] Vinci Concessions, 2018. Nairobi-Nakuru-Mau Summit Highway in Kenya – Traffic study. Figure 36.

Hourly data from an official online source was used to collect basic weather data including temperature, wind speed and direction as well as humidity, are presented in Appendix 6-2.

Specific COVID 19 considerations are exposed in Chapter 5 – Section5.1.

STANDARDS CONSIDERED

The standards considered for the ambient noise levels are those from the International Finance Corporation (IFC) and are presented in Table 6-14. Noise impacts should not exceed the levels presented in Table 6-14, or result in a maximum increase in background levels of 3 dBA the nearest receptor location off-site.

Table 6-14 Ambient Noise Standards Considered as part of the ESIA

Receptor	One Hour L_{Aeq} (dBA)	
	Day time 07 :00 – 22 :00	Night-time 22 :00 – 07 :00
Residential; institutional; educational	55	45
Industrial, commercial	70	70

Source: IFC : https://www.ifc.org/wps/wcm/connect/4a4db1c5-ee97-43ba-99dd-8b120b22ea32/1-7%2BNoise.pdf?MOD=AJPERES&CVID=ls4XYBw

REGIONAL NOISE LEVELS

Regional ambient noise levels are expected to be mainly influenced by existing traffic, agricultural activities, some industrial activities and exploitation of quarries and noise generated by natural phenomena such as wind and insects.

LOCAL AMBIENT NOISE LEVELS AT PERIPHERY OF HIGHWAYS A8 AND A8 SOUTH

Baseline ambient noise surveys as well as model-based simulation are required to establish the baseline ambient noise levels along the road sections considered. Furthermore, traffic counts were completed by direction and with classification to document circulation. This section described the results of the ambient noise characterization completed as part of the ESIA.

TRAFFIC COUNT

Table 6-15 indicate counting results for each sound survey. Receptor S2 was associated to A8 South Highway whereas S1 and S3 to S10 were associated to A8 Highway.

Table 6-15 2021 Traffic Counts Results

Receptors	Counting period	Direction	Motorcycles	Cars	Mid-size trucks	Heavy trucks
S1	2021-03-03 From 14:30 to 15:30	Limuru to Nakuru	25	416	75	4
		Nakuru to Limuru	31	490	80	4
S2	2021-03-05 From 09:00 to 10:00	Mai Mahiu to Naivasha	79	94	30	70
		Naivasha to Mai Mahiu	116	110	29	85
S3	2021-03-05 From 14:30 to 15:30	Nakuru to Naivasha	64	584	60	5
		Naivasha to Nakuru	25	455	110	4
S4	2021-02-25 From 13:00 to 14:00	Nakuru to Naivasha	38	282	61	77
		Naivasha to Nakuru	22	340	68	105
S5	2021-03-03 From 14:30 to 15:30	Nakuru to Naivasha	18	318	75	85
		Naivasha to Nakuru	7	375	90	100
S6	2021-02-27 From 12:15 to 13:15	Nakuru to Naivasha	184	1430	228	287
		Naivasha to Nakuru	87	917	110	98
S7	2021-02-18 From 12:15 to 13:15	Mau to Nakuru	352	625	99	82
		Nakuru to Mau	413	803	122	194
S8	2021-02-19 From 10:05 to 11:05	Mau to Nakuru	117	586	63	89
		Nakuru to Mau	218	980	133	173
S9	2021-03-02 From 09:35 to 10:35	Nakuru to Mau	37	327	44	89
		Mau to Nakuru	37	296	38	66
S10	2021-02-22 From 12:20 to 13:20	Mau to Nakuru	38	285	73	90
		Nakuru to Mau	33	215	35	71

EXISTING 2021 SOUND LEVEL RESULTS AND MODEL VALIDATION

The results of the ambient noise measurements made during the 2021 survey campaign are presented in the column “**Measured**” of Table 6-16 while the valued calculated with the SoundPLAN software are presented in the column “**Simulated**” of the same table. The sound propagation model was validated with the LAeq, 1h measurements corresponding to the sound levels during traffic counting periods all along the A8 and A8 South Highways. Cells outline in red demonstrate exceedance to standard considered and presented in Table 6-14.

Comparison of the noise differences between the model and measurements shows that most of the points have a deviation of less than 2 dBA which is considered acceptable. These results are coherent considering the proximity of the buildings with the road. For reference, it is common to have noise levels greater than 55 dBA in homes adjacent to an urban boulevard.

Table 6-16 Existing Measured and Simulated Baseline Mean Hourly Sound Levels

Receptors	Mean Hourly Sound level L_{Aeq} (dBA)[a]		
	Measured in 2021	Simulated	Deviation
S1 (Residential home & a church)	68,4	67,5	-0,9
S2 (Residential home)	58,1	58,2	0,1
S3 (Church)	61,1	61,9	0,8
S4 (Church)	66,9	66,0	-0,9
S5 (Residential home)	58,2	60,0	1,8
S6 (Church and college)	60,6	61,5	0,9
S7 (Commercial building)	70,0	69,4	-0,6
S8 (Church)	59,0	61,7	2,7
S9 (Residential home)	60,0	61,9	1,9
S10 (Residential home)	61,0	62,9	1,9

Notes: [a] Sound pressure level rounded to 0,1 dBA, referenced to 20 µPa.

PROJECTED NOISE LEVELS WITHOUT THE PROJECT IN 2025 AND 2040

The noise results obtained for each considered receptor set along the highway are presented in Table 6-17 for years 2025 and 2040. It is interesting to note that most results for 2025 with the current road configuration show levels exceeding IFC criteria for daytime noise levels for residential, institutional, and educational. Three readings also show levels equivalent and above the daytime criteria for industrial and commercial areas. The other interesting aspect to note is that by 2040, an increase of 2 to 3 dBA is to be expected along the entire existing highway with the current highway configuration.

Table 6-17 Mean Daily (24h) Sound Levels Calculated in Current Road Configuration Projected in 2025 and 2040

Section	Receptors	Sound level (dBA) $L_{Aeq,24h}$ Evaluated	
		2025 (Time Zero)	2040
Section 1	R1	49	54
	S1	66	71
	R2	69	73
	R3	67	72
	R4	65	70
	R5	67	71
	R6	65	68
	R7	60	64
	S3	64	68
Section 2	R8	70	78
	R9	51	56
	S4	72	78
	R10	45	51
	R11	70	76
	R12	63	67
	S5	60	67

Section	Receptors	Sound level (dBA) $L_{Aeq,24h}$ Evaluated	
		2025 (Time Zero)	2040
	R13	64	70
	R14	55	65
Section S	R15	57	59
	R16	50	53
	R17	53	56
	R18	56	59
	R19	48	51
	S6	57	60
	S7	66	69
	S8	63	66
Section 4	R20	63	70
	R21	63	74
	R22	60	65
	R23	57	74
	R24	62	71
	S9	62	76
	R25	62	70
	R26	59	68
	R27	57	66
	R28	65	70
	R29	66	74
	R30	63	69
	S10	66	71
	R31	64	70
Section 5	S2	59	61

Note: [a] Sound pressure level rounded to the nearest dBA, referenced to 20 µPa.

6.2.3 GEOLOGY, VOLCANISM AND SEISMICITY

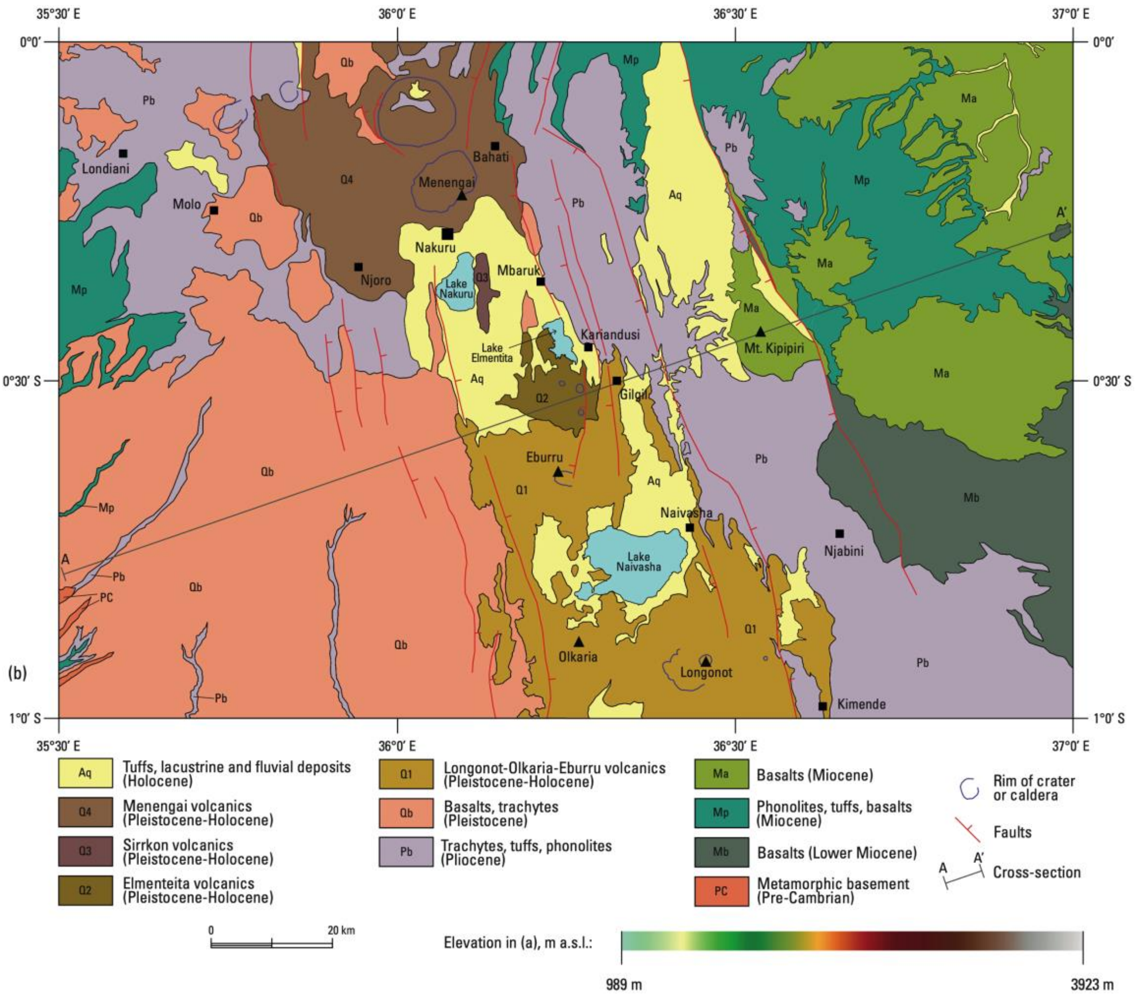
6.2.3.1 GEOLOGY

METHODOLOGICAL CONSIDERATIONS

The description of baseline geological conditions was prepared based on information from Conti et al. (2021).

GEOLOGICAL CONTEXT

The route sections considered are located in the Kenya Rift (also known as the Rift Valley of Kenya or the Gregory Rift Valley), which is part of the East African Rift System. The geology along the alignments is dominated by Tertiary (Paleogene and Neogene) and Quaternary Volcanics with lesser Quaternary Sediments associated with the historic extent of what is now Lake Nakuru, Lake Elmentaita and Lake Naivasha (McCall, 2007). The units encountered along the routes are mostly Pleistocene-Holocene volcanics and are described in the following sections, starting from the southern tip and moving to the north. The simplified geological setting is shown in Figure 6-10 with Kimende (south-east) being close to the start of the alignments and Molo in the north-west being close to the end of the route.



Source: Conti et al. (2021).

Figure 6-10 Simplified Geological Map of Wider Project Area

The main geological units encountered in the Project Area and as described by Conti et al. (2021) include:

- **Lumuru Trachytes:** These represent the final outpourings of lava and volcanic ejectament from this part of the Rift zone. They consist of intercalated trachytic and agglomerate tuffs, derived by eruptions along fault zones connected with rift faulting rather than from central volcanoes (Saggerson, 1991).
- **Kedong Valley Tuff:** The trachyte ignimbrites associated with early Longonot caldera collapses (Guth, 2014). These occur as small inliers within the areas covered by Longonot Trachyte and along the edge of the eastern escarpment.
- **Longonot Trachyte:** This volcanic unit originated from Mount Longonot located just 5 km from the A8-South route and covers most of the Rift Valley floor before sedimentary units around Lake Naivasha is encountered (Saggerson, 1991).
- **Sedimentary Units around Lake Naivasha:** For at least 21 km along the Highway A8 route (and along parts of the Highway A8-South route prior to the junction) no volcanics are mapped due to the sedimentary units associated with the previous extent(s) of Lake Naivasha (McCall, 2007). There seems to be a lack of well-mapped distributions of these sediments, and they are described as being volcanic grits, reworked tuffs, clay, and diatomite. Other references (e.g., Thompson and Dodson, 1963) refer to lacustrine deposits but true varved shale low energy lake deposits of significant thinness are not expected.
- **Eburru and Elmentaita Volcanics:** Between Lake Naivasha and Lake Elmentaita sedimentary units and Lake Nakuru equivalent surface sediments are volcanic rocks of Eburru and Elmentaita Volcanic Series. The Eburru Volcanic series (from the large twin peak Volcano named Eburru) includes trachyte lava and trashy obsidian, while the Elmentaita Series was from a cluster of smaller volcanoes and consists of basaltic rocks (McCall, 2007). All these units are of limited extent along the route and are covered in places by sedimentary units. This area characterised by the Eburru and Elmentaita Volcanic Series is, therefore, likely to encounter variable and alternate sedimentary and volcanic geological conditions compared to other areas where more consistent units are mapped over long lengths of the alignment.
- **Lake Nakuru Area Sediments and Pleistocene Volcanics:** The area between Lake Elmentaita and Nakuru is covered by sediments similar to those described in the section on the sedimentary units around Lake Naivasha (see above) but here, local outcrops of unnamed Trachytic Pleistocene Volcanics are present. Close to Lake Elmentaita the highway runs along the contact with the large area mapped as the Kinangop Tuff (to the north-east). Google Street View images in this area show a high scarp to the east of the alignment, likely formed by the Kinangop Tuff. The Kinangop Tuff is described as trachyte pumice tuffs with minor basalt and trachyte lava while the Pleistocene Volcanics are Trachytic Lavas (Guth, 2014).
- **Menengai Volcanics:** The volcanics associated with one of the largest volcanos in the area (Menengai, located north of Nakuru) cover approximately 27 km of the route up until the Mau escarpment is encountered. These volcanics are mainly trachytic tuff deposits and ash tuff flows (rather than lava) and are described as including soil horizons (Guth, 2014).
- **Mau Escarpment Units:** The units encountered on the Mau Escarpment are both Pliocene age deposits, mapped as either volcanic deposits (again Trachytic) and Mau Tuffs (ash falls and flows) (Guth, 2014).

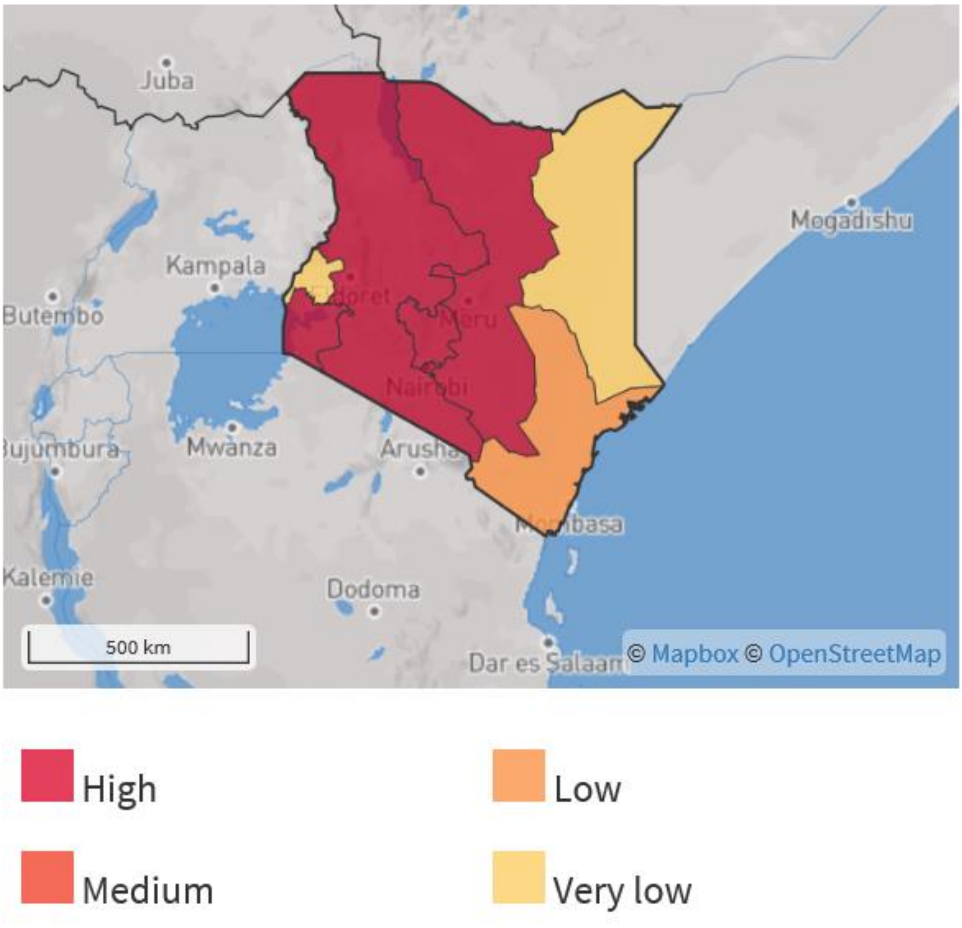
6.2.3.2 VOLCANISM

METHODOLOGICAL CONSIDERATIONS

The description of baseline geological conditions was prepared based on various sources of existing information including the ThinkHazard web interface (World Bank and GFDRR) and the Smithsonian Institution National Museum History Global Volcanism Program.

VOLCANIC ACTIVITY

The Rift Valley area is marked by volcanic activity and this area has been active from the Miocene times to present day. On the basis of their morphology and evidence of recent geological activity, twenty-one volcanoes in Kenya are believed to have been active since the start of the Holocene, approximately 11,650 years ago (Global Volcanism Program, 2013). According to the World Bank's Global Facility for Disaster Reduction and Recovery (GFDRR) risk assessment tool ThinkHazard, the Rift Valley, along with the counties of Nakuru and Kiambu are regions of high hazard level (ThinkHazard, 2021) (Figure 6-11). The region is considered active and this even though no eruptions have been registered in the area for over a century.



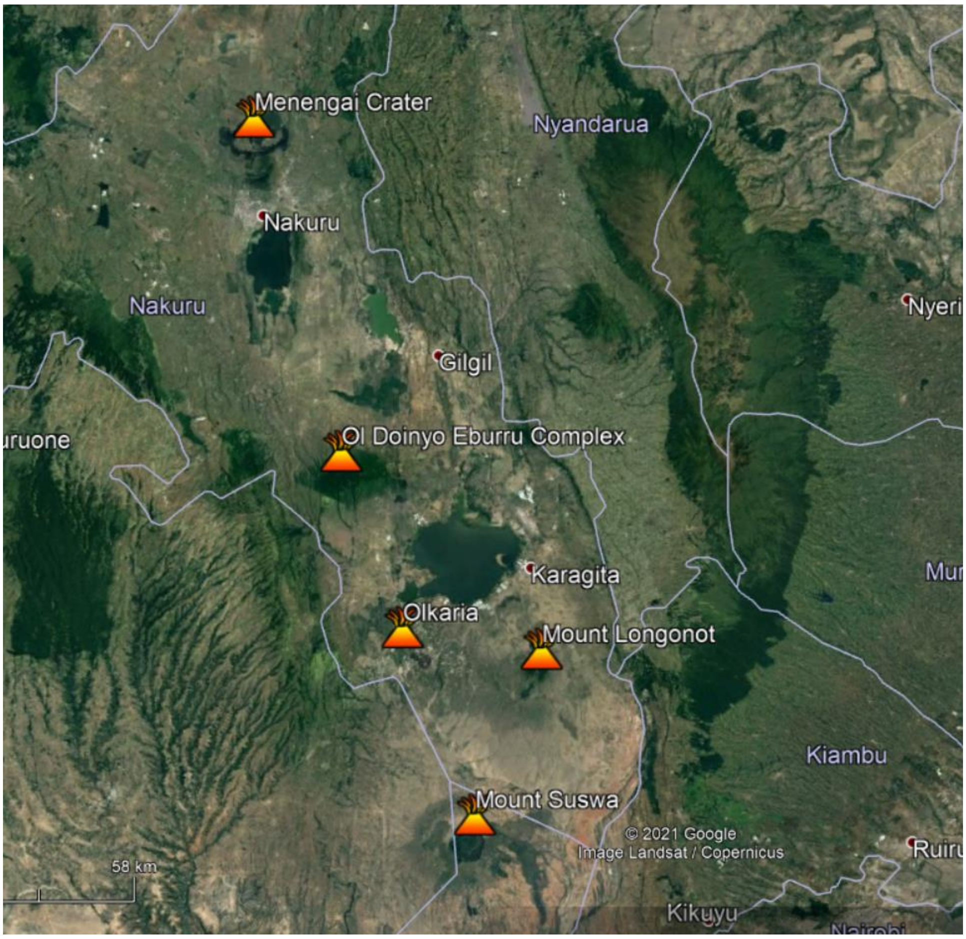
Source: https://thinkhazard.org/en/report/133-kenya/VA

Figure 6-11 Overview of Volcano Hazard Levels in Kenya According to World Bank ThinkHazard Risk Assessment Tool

VOLCANIC FORMATIONS

There are some 199 volcanic formations recorded on the Smithsonian Institution Website for Kenya and five are present at a relatively close distance from the Project (Figure 6-12), namely:

- The **Menengai Crate**r which is located less than 10 km to the north of the City of Nakuru. This site houses a geothermal 1600 MW electricity production project which is scheduled to start production in 2021. The last major eruption dates back some 8000 years but some lava flows occurred more than 70 times since, the most recent being a few hundred years old;
- The **Ol Doinyo Eburru Complex** which is approximately 15 km north-west from Lake Naivasha. The youngest formations of this volcano complex are believed to be from the Holocene age (Smithsonian Institution, 2021);
- The **Olkaria** is located in Hell’s Gate National Park some 25 km west of the A8 South section of the Project. The youngest known eruption, which produced some 5 km^3 of lava flow was dated from about 180 years ago;
- **Mount Longonot** which is located within Mount Longonot National Park and less than 6 km from the A8 South section of the Project. The most recent signs of activities are associated with lava flow and dating from the 19th century, is located;
- The **Mount Suswa** which is located more than 25 km south-west of the A8 South section of the Project has shown evidence of erupting through satellitic vents no more than a century ago.



Source: Built from information obtained at https://volcano.si.edu/volcano.cfm?vn=222110

Figure 6-12 Location of Main Volcanic Formation in the Project Area

Given the timescale to which volcanoes of the Project area were active (over a century and more) and the nature of this activity (essentially some lava flows), the risks to the Project are considered to be low and will most likely result in localised damage.

6.2.3.3 SEISMICITY

METHODOLOGICAL CONSIDERATIONS

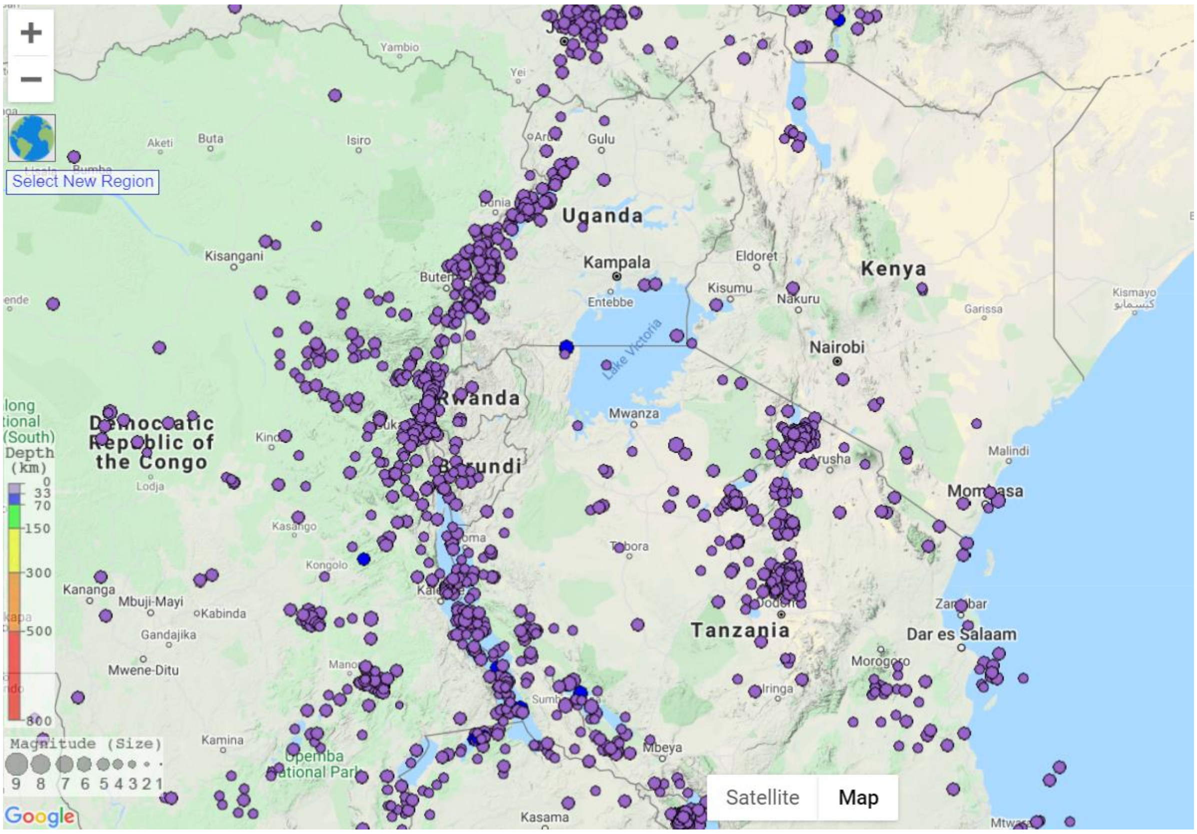
The description of baseline seismicity conditions was prepared based on various existing sources of information including the Incorporated Research Institutions for Seismology (IRIS) and the ThinkHazard web interface (World Bank and GFDRR) amongst other sources of information.

SEISMICITY CONTEXT

The Project site is located on the East African Rift, a seismically active area where a new divergent plate margin is developing (Conti et al., 2021). Within Kenya the rift has an eastern branch known as the Kenya Rift, a graben structure bisecting the Kenya Dome. The western branch occurs outside Kenya, from the northern end of Lake Nyasa (Lake Malawi) in a great arc that includes Lakes Rukwa, Tanganyika, Kivu, Edward, and Albert (Britannica, 2017). The rift has been forming for some 30 million years and has been accompanied by extensive volcanism along parts of its length, producing such massifs as Kilimanjaro and Mount Kenya (Britannica, 2017).

DISTRIBUTION, INTENSITY AND DEPTH OF EARTHQUAKE HAZARDS

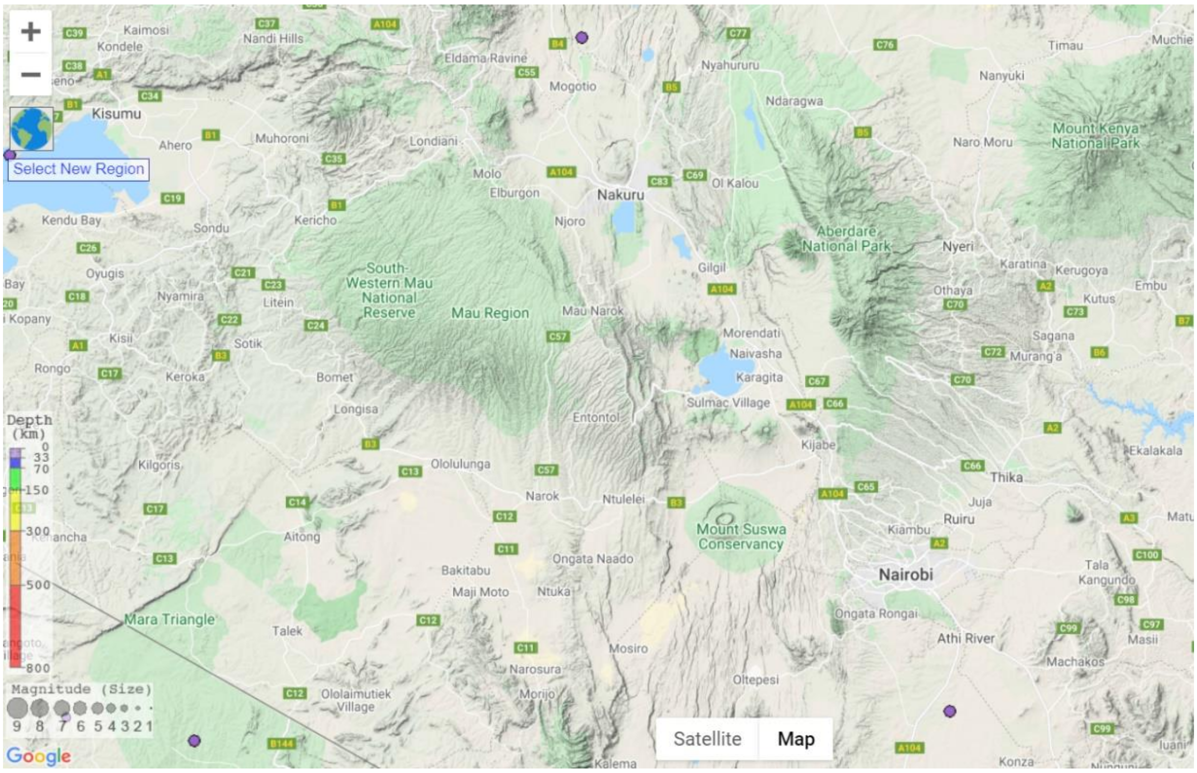
IRIS (Incorporated Research Institutions for Seismology) is a consortium of over 120 US universities dedicated to the operation of science facilities for the acquisition, management, and distribution of seismological data. IRIS has multiple online tools that allow you to learn about global and regional seismicity including the IRIS Earthquake Browser. Figure 6-13 outlines the distribution, magnitude, and depth of the 1 000 most recent earthquakes in the project area. Figure 6-13 shows how the western branch seismicity is more concentrated while the eastern branch is less defined and recent events are mostly in Tanzania. It is also clear that recorded events are mostly shallower than 33 km, as would be expected from divergent continental settings, and that most events have a Richter scale magnitude of less than 5.



Source: IRIS Earthquake Browser available on-line at http://ds.iris.edu/.

Figure 6-13 The distribution of the 1000 most recent earthquakes in Kenya and surrounding countries along the African Rift Valley

According to IRIS data, within the Project region very few seismic events have been recorded recently (since 1970) and none exceeded a Richter scale magnitude of 5.0 (Figure 6-14). Seismic events are shown as a purple dot in Figure 6-14. Nonetheless, the generally active rift system to the south of the study area (in Tanzania) and the ongoing activity of the East African Rift as a whole, results in there being a possibility of the faults in the Kenyan parts of the eastern branch Rift Valley becoming active.

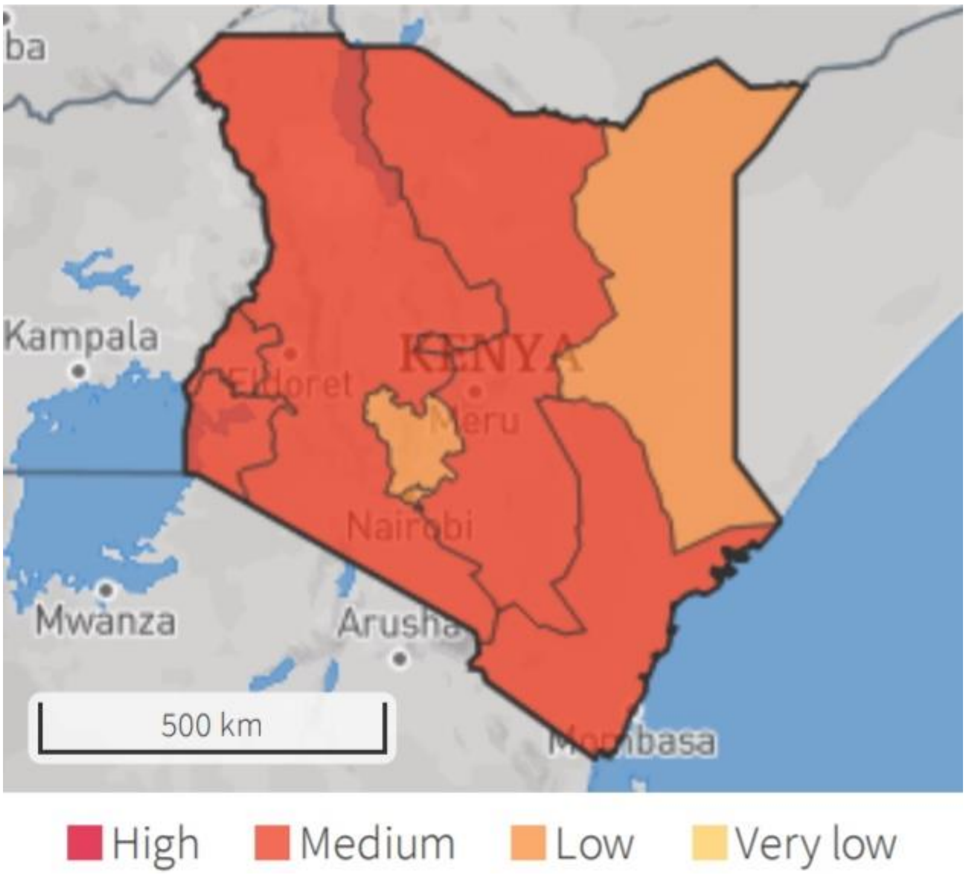


Source: IRIS Earthquake Browser available on-line at http://ds.iris.edu/.

Figure 6-14 Distribution of Earthquakes Recorded since 1970 in the Project Area

LIKELIHOOD OF EARTHQUAKE HAZARDS

ThinkHazard, a collaborative Web interface between the World Bank Group and the Global Facility for Disaster Reduction and Recovery (GFDRR), provides a general view of the hazards, for a given location, that should be considered in the Project design and implementation to promote disaster and climate resilience. The tool highlights the likelihood of different natural hazards affecting project areas (very low, low, medium, and high), provides guidance on how to reduce the impact of these hazards, and where to find more information. The hazard levels provided are based on published hazard data, provided by a range of private, academic, and public organisations. According to the GFDRR ThinkHazard System, the earthquake hazard level for Kenya and for the (former) Rift Valley Province of Kenya is medium (Figure 6-15), meaning that there is a 10 % chance of a potentially damaging earthquake in the next fifty years. A similar rating is given for the Nakuru and Kericho Counties while the Kiambu, Uasin Gishu and Nyandarua Counties are considered to have a low hazard level (2% chance of potentially damaging earthquake in the next fifty years).



Source: https://thinkhazard.org/en/report/133-kenya

Figure 6-15 Overview of the Earthquake Hazards in Kenya

DAMAGE ASSOCIATED WITH SEISMIC EVENTS

The damage associated with seismic events is related to the actual ground acceleration experienced by foundations and can, therefore, not be estimated directly and solely from Richter scale data. General descriptions of Richter scale magnitudes and associated Mercalli intensity scale descriptions indicate that below a Richter scale magnitude of 5.0 damage rarely occurs to buildings. However, magnitudes of between 5.0 and 6.0 may damage poorly constructed buildings (e.g., UPSeis, 2021, Federal Reserve Bank of Kansas City, 2016).

The Kenyan seismic code has not been updated since 1973 (Worku, 2014) and uses the Modified Mercalli intensity (MMI) scale to map the seismic hazard of the country. This map places the majority of the route into Zone VIII–IX, with the east and western ends of the route being in Zone VII. A VII intensity event will produce very strong shaking, but generally negligible damage will occur to well designed and built structures. VIII–IX events will be violent and result in destruction of some structures. As these events are generally associated with Richter scale magnitudes of larger than 6.0, the likelihood of such events in the project area (given recent data) is low.

Seismic risks are relevant to the pavement structure in that ground movements may result in road surface disturbances and even the development of fault scarps. The consequences of such risks are, however, relatively minimal as most damage to pavements would be repaired at low cost. The main seismic risk to the proposed development is, therefore, associated with the foundations and structural integrity of related structures such as bridges and culverts. Based on a report by the U.S. Department of State (2007), the greatest expected ground surface accelerations across the entire route (with a 10 % chance of exceedance in a fifty-year time interval) approach is $1.2 m/s^2$ in the westernmost parts of the project area. This report also concluded that within the Horn of Africa, the largest earthquakes (greater than magnitude 6.0 on the Richter scale) are most likely to occur along the Rift Valley regions of Djibouti, southern Eritrea, and north-east Ethiopia. They also note that, since large damaging earthquakes occur infrequently in the area, the risk from seismic hazard is not an annual concern like the other hazard types (with flooding being the most probable risk in the project area).

In conclusion, the Project is considered to have a 10 % chance of a potentially damaging earthquake in the next fifty years. The risk to the Project due to seismic events is considered to be very low with any event likely resulting in only localised damage.

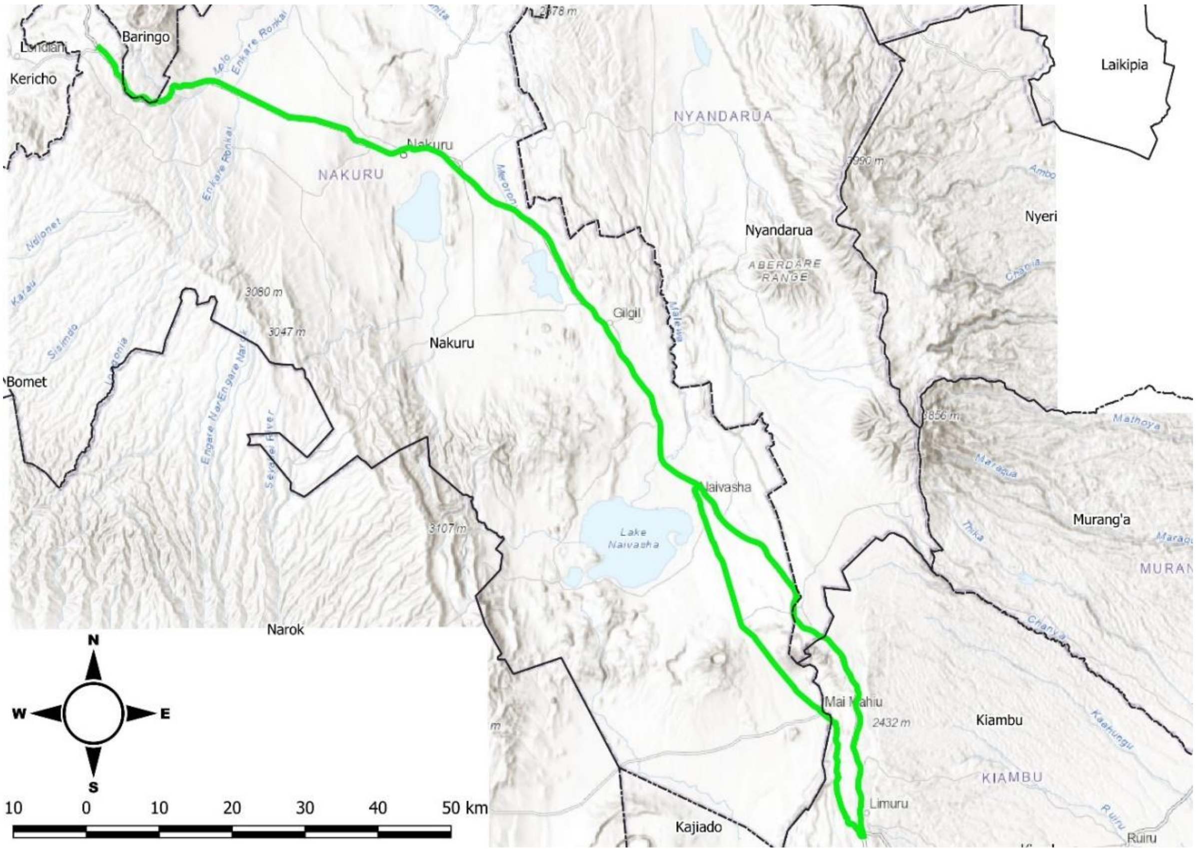
6.2.4 TOPOGRAPHY

METHODOLOGICAL CONSIDERATIONS

Information on topography presented hereafter was obtained based on a literature search. Furthermore, gradients perpendicular to the slope were obtained from GIS interpretation of NASA's Shuttle Radar Topography Mission (SRTM) 90 m x 90 m elevation data.

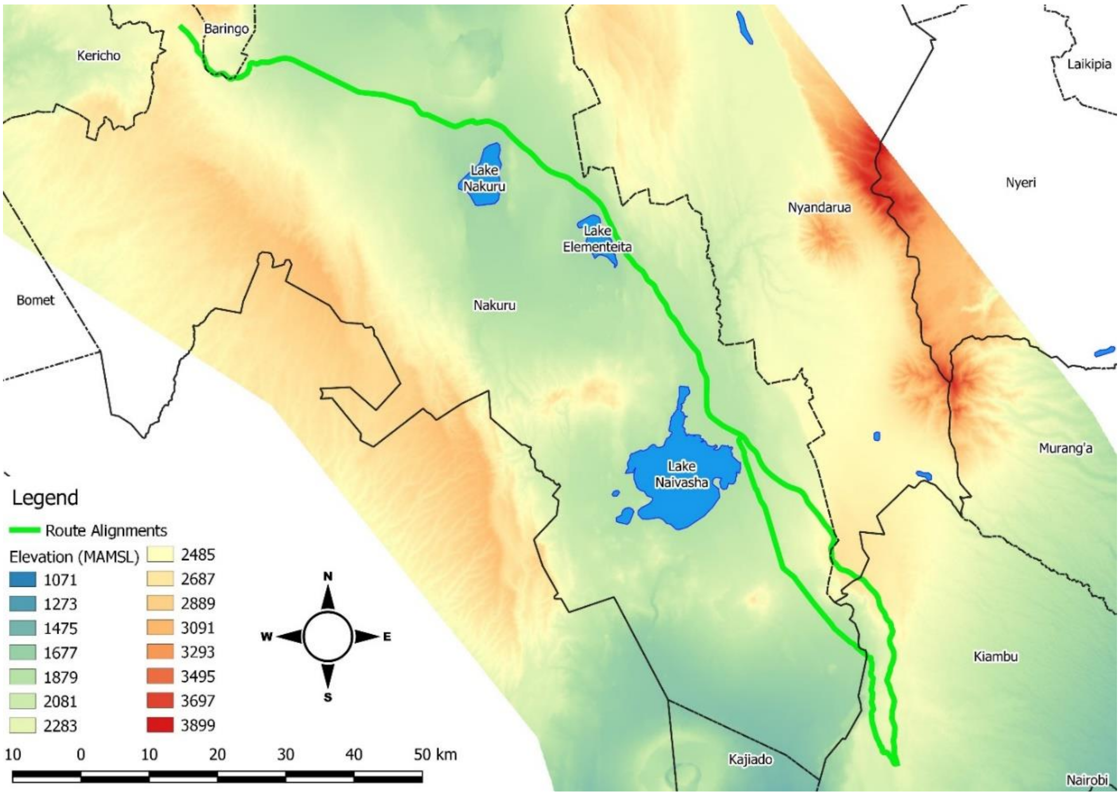
TOPOGRAPHICAL CONTEXT

Highway A8 and A8-South are located primarily in the Nakuru County with lesser parts in the Kiambu and Nyandarua Counties. Figures 6-16 and 6-17 show an overview of the relief and the elevation in the Regional Assessment Area while Figure 6-18 shows the main regional topographic features in the Project Area.



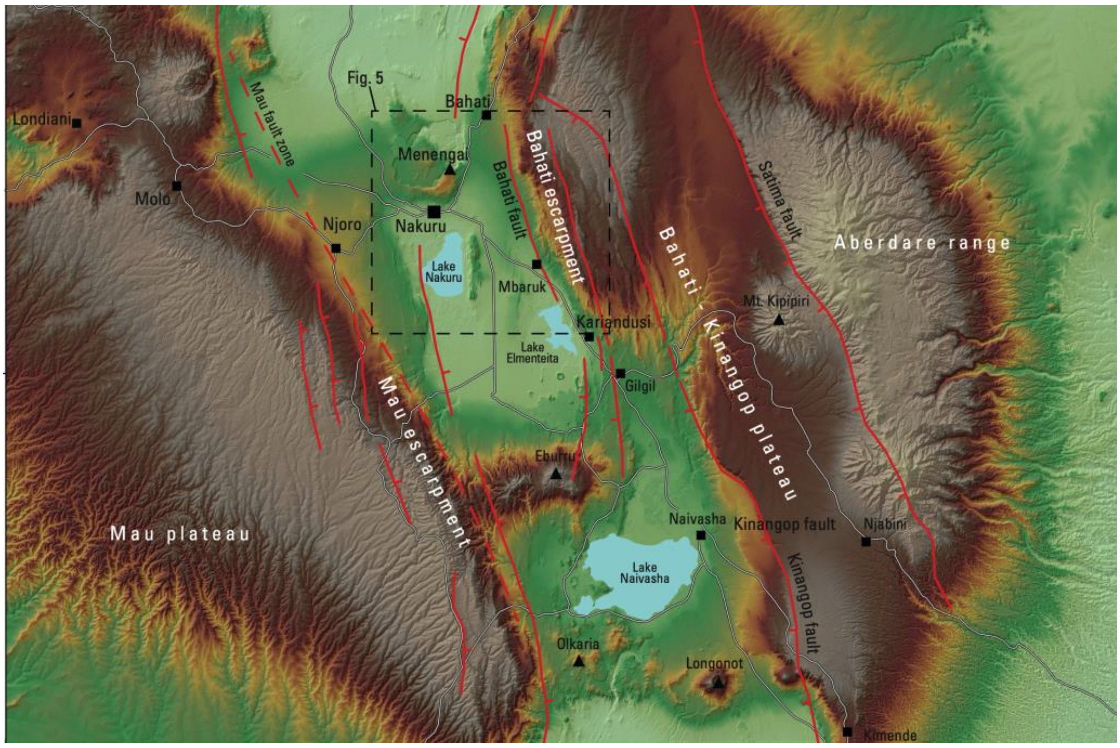
Source: https://portal.opentopography.org/datasets

Figure 6-16 Relief Map outlining County Boundaries and the Road Segments included in the Project



Elevation data source: 90m SRTM data

Figure 6-17 Elevation map outlining County Boundaries and the Road Segments included in the Project



Source: Conti et al. (2021)

Figure 6-18 Distribution of regional topographic features in the Project Area

The elevation along the road segments considered ranges between 1500 and 2500 meters. As mentioned in Chapter 4, climbing lanes will be implemented at steep gradient locations based on prevalent Kenyan standards. No climbing lanes are required on A8 South, whereas 41 kms of climbing lanes are planned on A8.

RELATED EROSION POTENTIAL

The slope gradient perpendicular to the Project's alignment is a good indication of potential erosion risks which could cause potential failures due to slope movements both below and above the Project's alignment possibly resulting in catastrophic consequences or significant road infrastructure losses. Gradients perpendicular to the slope were obtained from GIS interpretation of NASA's SRTM 90 m x 90 m elevation data.

The gradient 200 m to either side of the Project was calculated for a cross section every 500 m along both alignments (A8 and A8 South) were obtained (Figures 6-19 and 6-20). The slopes along the sections where both highways run in parallel (Figure 6-19) show similar trends with the first 10 km having slopes of <15% followed by 10 km where the slopes are regularly >15% and as much as 45%. This second section has potentially significant slope stability and associated safety concerns. The last stretch of the section shows slopes essentially below 15% except for a short section of the A8 in the area of CH 33+000 to 34+000. As for the rest of the A8 alignment (from CH 58+000 to 175+000), most of the alignment crosses slopes of less than 10% except for the areas comprised between CH 88+000 and 97+000 and between CH 161+000 to 163+000 where slopes with gradients above 10% are crossed.

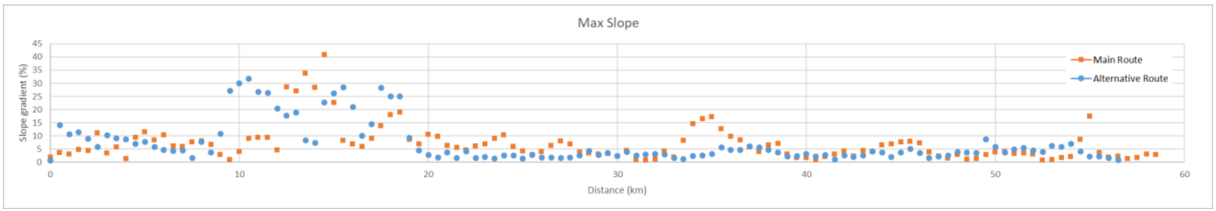


Figure 6-19 **Maximum slope perpendicular to road alignments over first 58.5 km (measured at 500 m intervals over distance 200 m either side of the alignment)**

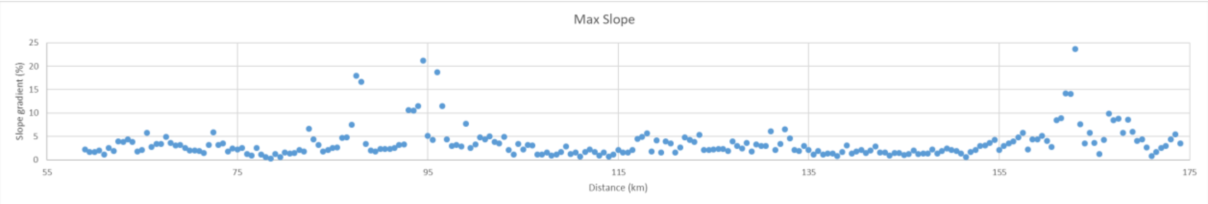


Figure 6-20 **Maximum slope perpendicular to road alignment from 59.0 km to end of the route (measured at 500 m intervals over distance 200 m either side of the alignment)**

6.2.5 WATER RESOURCES

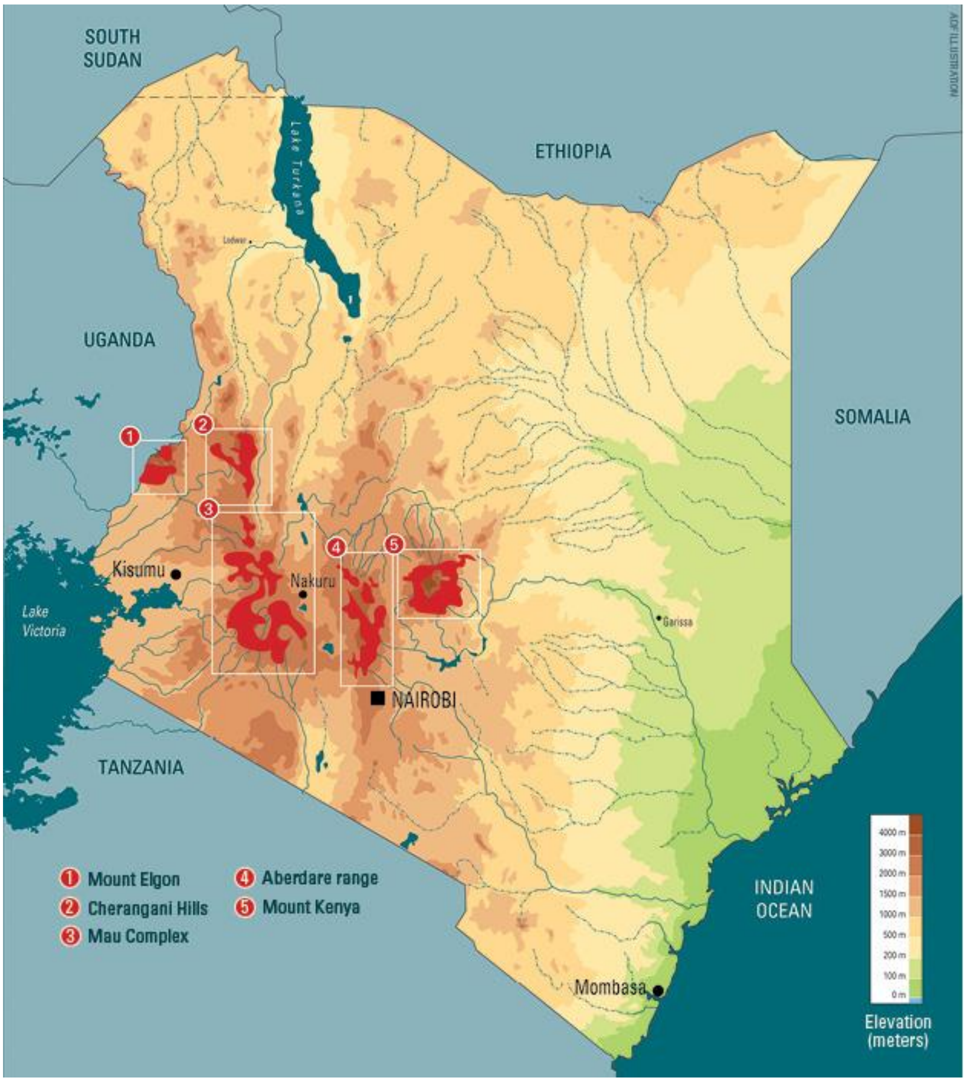
6.2.5.1 HYDROGRAPHY

METHODOLOGICAL CONSIDERATIONS

This section is based on existing desktop data and information acquired primarily from the Water Resources Authority (WRA) of Kenya.

KENYA'S MAIN WATER TOWERS AND CATCHMENT AREAS

According to the WRA, the Kenyan territory is subdivided into six primary water catchment areas which are further separated into 52 sub-areas (United Nations, 1989) for water management purposes. These water catchment areas are mainly fed by five specific forested mountainous areas referred to as "water towers" namely Mt. Elgon, Cherangany Hills, Mau Forest Complex, Aberdares range and Mt. Kenya, as shown in Figure 6-21. These water towers are located in the central highlands of the country and in the southern foothills of the Ethiopian highlands, providing for over 75 % of the country's water resources (GoK, 2013).

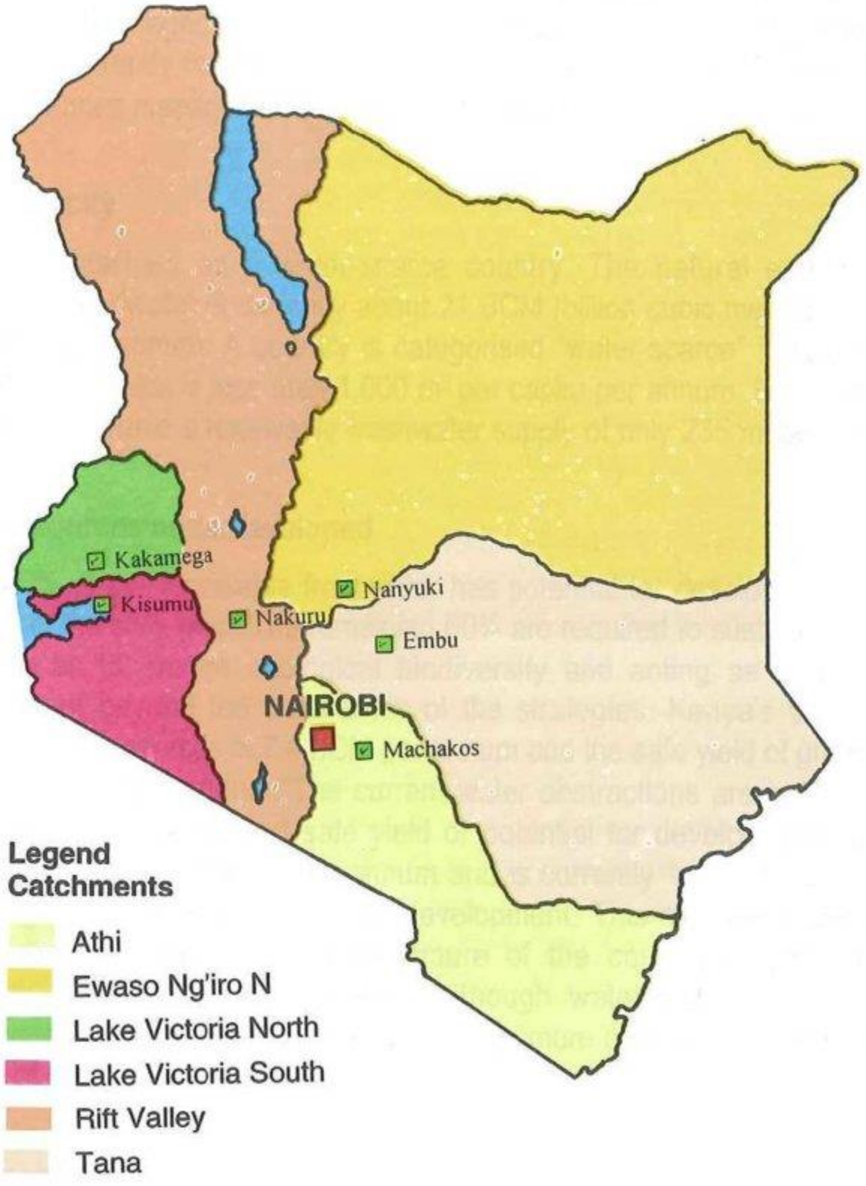


Source: https://adf-magazine.com/2019/10/kenyas-environmental-warriors/

Figure 6-21 Location of Main Water Towers of Kenya

The six main water basins originate from these water towers are shown in Figure 6-22 and include:

- **Athi Catchment Area** (ACA: 58,639 km^2): The Athi Catchment Area drains the south-western part of the country towards the Indian Ocean. It collects water from the southern slopes of the Aberdare Ranges and flanks of the Rift Valley south of the Athi River. This river drains 65 % of the catchment covering its entire north-west half and the northern part of the south-eastern half of the catchment. The rest is captured by various smaller rivers flowing directly into the Indian Ocean including the Rare, Mwache, Pemba and Ramisi rivers.
- **Ewaso Ng'iro North Catchment Area** (ENNCA: 210,226 km^2): The main river of this catchment area is the Ewaso Ng'iro North River draining most of the catchment area. The Ewaso Ng'iro river itself flows in the southern part of the catchment area. It originates from the Mount Kenya area and flows northwards before turning to the east and then disappearing into the Lorian swamp before surging a new to flow towards the south-east into Somalia joining the Jubba River towards the Indian Ocean. The north and north-eastern parts of the catchment area are drained by tributaries of the Ewaso Ng'iro (the Bogal, Bor and Kutulo rivers) which connect with it after crossing into Somalia. One last river drains the upper north-east section of the catchment area, the Daua River which forms part of the border between Kenya and Ethiopia. This river is a direct tributary to the Jubba river of Somalia and connects with it at the border between Somalia and Ethiopia.
- **Lake Victoria North Catchment Area** (LVNCA: 18,374 km^2): This catchment is drained by two major rivers flowing from east to west into Lake Victoria. The main water course is the Nzioa River, which accounts for approximately 70 % of the total flow from this catchment. This river is permanent and prone to bursting its banks and flooding the lower plains of the catchment during the two annual rainy seasons. The second river is the Yala River which provides approximately 18 % of the total flow. This catchment is also the head of another river, the Sio River, which flows across the border with Uganda before reaching Lake Victoria within this country.
- **Lake Victoria South Catchment Area** (LVSCA: 31,734 km^2): This catchment is drained by the Nyando, Sondu and Kuja rivers which amount to approximately 44% of the catchment's outflow into Lake Victoria. Various other smaller rivers complete the outflow of this catchment area, and many drains into the Winam Gulf of Lake Victoria.
- **Rift Valley Catchment Area** (RVCA: 130,452 km^2): This catchment comprises a series of saline lakes and freshwater lakes and 3 major river basins, with 5 of the lakes designated as wetlands of international importance by the RAMSAR convention (RAMSAR sites) namely Lake Bogoria, Lake Nakuru, Lake Naivasha, Lake Elmentaita and Lake Baringo. The other major lakes in the basin are Lake Turkana and Magadi and other minor lakes are Logipi, Kamnarok, Kijirtit, Solai, Ol Bolossat, Kwenia and Kabogo. The lakes in this basin have no surface outflows but some are interconnected by the ground water system and others recharged by ground water flows from permanent and seasonal swamps and marshes and streams from the adjoining highlands. The Major River basins in this catchment are the Tarash River which feeds the Lotikipi Swamp; the Suguta River and the perennial Ewaso Ng'iro South River which flows southwards and empties into Lake Natron.
- **Tana Catchment Area** (TCA: 126,026 km^2): River Tana is the largest river in Kenya, it drains a good two thirds of the catchment area including the eastern slopes of the Aberdare Ranges, the southern slopes of Mt. Kenya and the Nyambene Ranges. The river has various important tributaries draining the western half of the catchment area, including namely the Nihunguthu, Maua and Kakani rivers. The Tana River eventually discharges into the Indian Ocean. The rest of the catchment area is drained by various smaller rivers either flowing towards Somalia or directly into the Indian Ocean.



Source: file:///C:/Users/CAGP061185/Downloads/Review_for_the_Green_Water_Credits_Pilot_Operation.pdf

Figure 6-22 Water Catchment Areas of Kenya

The Project is located entirely within the rift valley basin area, specifically within the sub-catchment areas of lakes Naivasha, Elmentaita and Naivasha (Central part of the Rift Valley Basin). These catchments are served by two of the previously described water towers: the Aberdares tower which is the source for Malewa river that drains into Lake Naivasha and the Mau Forest Complex tower that forms headwaters for Njoro River, Makalia River, which feeds into Lake Nakuru and Molo River which feeds into Lake Bogoria. As for Lake Elmentaita, its sub-catchment area is squeezed between the two other lakes and is fed only by minor independent water courses. The rivers in these sub-catchment areas have elevated flows between April and September, emanating from the increased river volumes during the wet months occurring between April and August. The driest season occurs during January to March.

Generally, in the Lake Nakuru and Naivasha catchments there is a higher demand for water than the current water supply capacity, especially in corresponding major towns like Nakuru and Naivasha that are characterised by high population density. The main water demands in these catchments are mainly for domestic use, industrial use, irrigation and livestock. According to the Kenya ISC Rift valley Basin Plan (WRMA, 2019), water demand for irrigation in the Rift Valley Basin is the greatest. It is estimated at 204 Mm^3/a and supports the large scale and commercial farms. The main water resource challenges in these two catchment areas (WRMA, 2019) are mainly related to water quality degradation and over abstraction, which are caused by the intense anthropogenic activities like municipal waste, sedimentation, agrochemicals and lack of monitoring and compliance.

LAKES' SPECIFIC CATCHMENT AREAS

The sections below discuss the specific characteristics of the catchment areas the three main lakes included in the RAA.

LAKE NAIVASHA CATCHMENT AREA (3 130 KM^2)

Lake Naivasha is a freshwater lake, declared as a RAMSAR site in 1995, which has three associated satellite lakes that are hydrologically connected by either surface water or groundwater flow, namely, Crescent Island, Oloiden and Sonachi. The lake is mainly fed by the Malewa and Gilgil rivers that account for 80 % and 20 % of the flow respectively, as illustrated in Figure 6-23. Although it has no surface outlet, it is known to have groundwater outflow northwards towards Lake Elmentaita and to the south towards the Olkaria well field as discussed further in the groundwater section.

The Lake Naivasha catchment economy is anchored in horticulture that is heavily dependent on irrigation. There is intense water abstraction from the lake and other surface and ground water sources in this catchment for smallholders and commercial irrigation purposes. The main challenges facing the basin are the unsustainable agriculture, pollution and encroachment on riparian reserves.

Within the upstream part of the Lake Naivasha catchment area is the main source of water through precipitation while main water use is located downstream towards the lake. Further away, the expansive floriculture is heavily dependent on the easily accessible ground water from the catchment through boreholes. Pollutants and silt from activities upstream and downstream, coupled with the wastewater from domestic use from the sprawling human settlement in Naivasha town compromise the quality and quantity of the surface and ground water of the lake Naivasha catchment.

The Project crosses a number of the watercourses flowing into lake Naivasha from the East and North-east including the Malewa and Gilgil rivers.

Another important component of this catchment area is Mang'uo swamp which is located along the Project in Limuru area and is interconnected with the lake Naivasha basin through ground water. It is a wetland of national interest and is earmarked by WRMA for gazettement due to its importance as a biodiversity hotspot and a major water source for domestic use in the nearby Limuru town. This swamp is itself interconnected to Ondiri swamp located at Kikuyu sub-county, in Kiambu county. The Ondiri swamp functions as an underground outlet for Lake Naivasha through the Mang'uo swamp in Limuru. Covering about 30 hectares, it is the second-deepest swamp in Africa and the only known quaking bog in Kenya. Adjacent to this swamp are the Kikuyu springs which generate up to 6000 m^3 of water feeding some areas of Nairobi through a 10 km pipeline (Nairobi City Water and Sewerage Company, 2021).

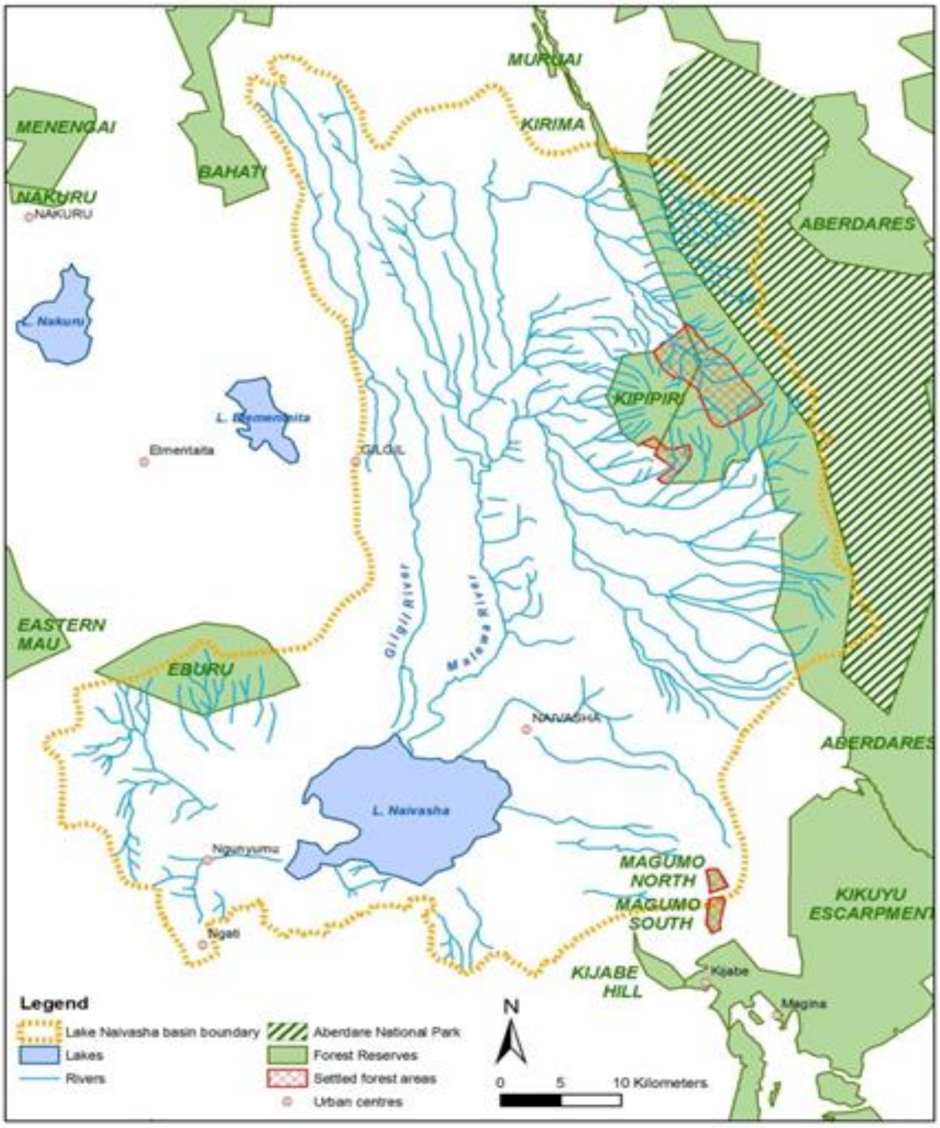


Figure 6-23 Lake Naivasha Catchment Area

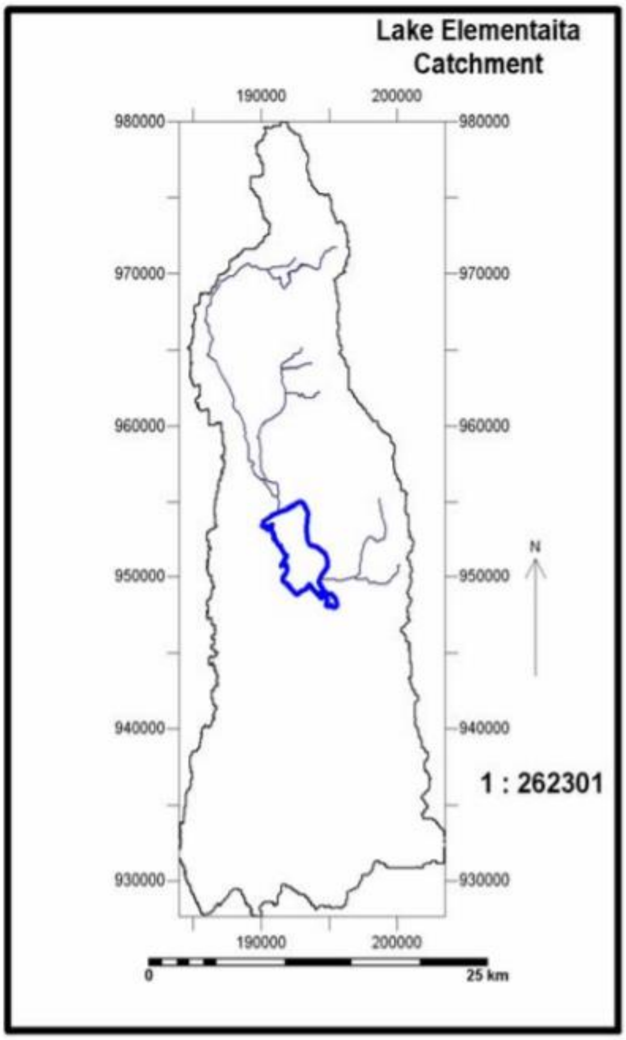
LAKE ELMENTAITA CATCHMENT (543 KM^2)

Lake Elmentaita (Figure 6-24), a World Heritage Site and RAMSAR site designated in 1995, is a shallow, closed, soda lake, that is recharged mainly by:

- the Mbaruk and Mereroni River which drains the Bahati highlands north of the lake;
- subsurface flow from lake Naivasha, and
- inflow from the Kikopey hot springs located on the south-eastern part of the lake.

The lake does not have any surface outflow except through evapotranspiration. According to Adeka et al. (2008), the lake levels fluctuate and has even been known to dry up. Diatomite mining at Kariandusi in Gilgil Sub-County around Lake Elmentaita, is the main source causing water pollution and siltation issues in lake Elmentaita (Nakuru CIDP, 2018)

The lake does not directly interact with the Project, but it is in relatively proximity and at a lower altitude. The Project also crosses two of the water courses flowing into the lake (Mbaruk and Mereroni).



Source: Adeka, J.E. et al., 2008

Figure 6-24 Lake Elmentaita Catchment Area

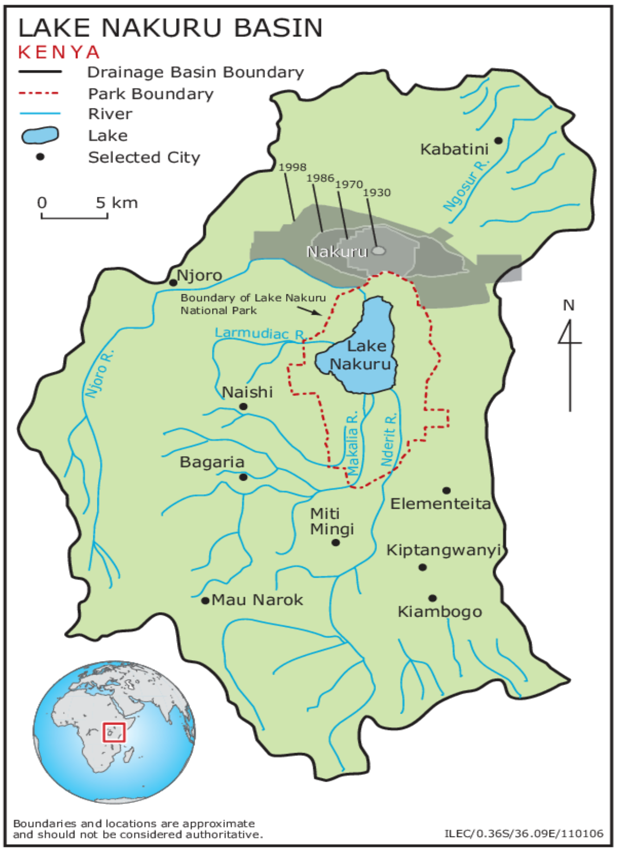
LAKE NAKURU CATCHMENT (1 624 KM^2)

Lake Nakuru (Figure 6-25) also a designated World Heritage Site and RAMSAR site, is a small, shallow, alkaline-saline lake located in a closed basin with no surface outlet. The seasonal Njoro River, flowing from the Mau Forest Complex, is the main river draining into the lake and the other smaller rivers and streams are Ngosur (the only permanent river), the seasonal Nderit, Makalia and Lamudhiak. The lake undergoes major fluctuations influenced by the amount of precipitation received, sometimes almost drying up. The lake has very little recharge through fault systems compared to other lakes within the rift owing to its high elevation (1 770 m above sea level). Since there is no outflow from the Lake, the only water outlet is through evapotranspiration in the catchment area.

The Lake Nakuru catchment economy is anchored in agriculture, manufacturing and tourism that is heavily dependent on the finite water resources. There are intense farming activities along the rivers and wetlands in this catchment which leads to disposal of chemicals into the water bodies. With the presence of the densely populated Nakuru City, demand for water is high and surpasses the current water supply capacity especially for domestic, and industrial use in the Nakuru Municipality (Nakuru IDP 2018).

The main challenges in this basin are surface water pollution from domestic and industrial use, sedimentation from degraded farmlands, and encroachment into riparian zones. Main sources of pollution in the catchment in the upper catchment areas are fertiliser residues and agrochemicals from farms along rivers Njoro, Molo and Perkerra. Within the Nakuru metropolitan, the solid waste management system is not well established. Often, solid waste and effluents from domestic and industrial activities in Nakuru is carried by stormwater and deposited into the rivers, dams and lakes in the basin. Also, there is no proper sewerage system.

The Project does not intersect the lake directly neither the Njoro River as it passes to approximately 2 km to the North. However, since it is located at a higher altitude, it could have some indirect effect.



Source: https://www.semanticscholar.org/paper/Lake-Nakuru%3A-experience-and-lessons-learned-brief-Odada-Raini/7e6ad81b8d594f78e5b7262b2d2b029e72f49767

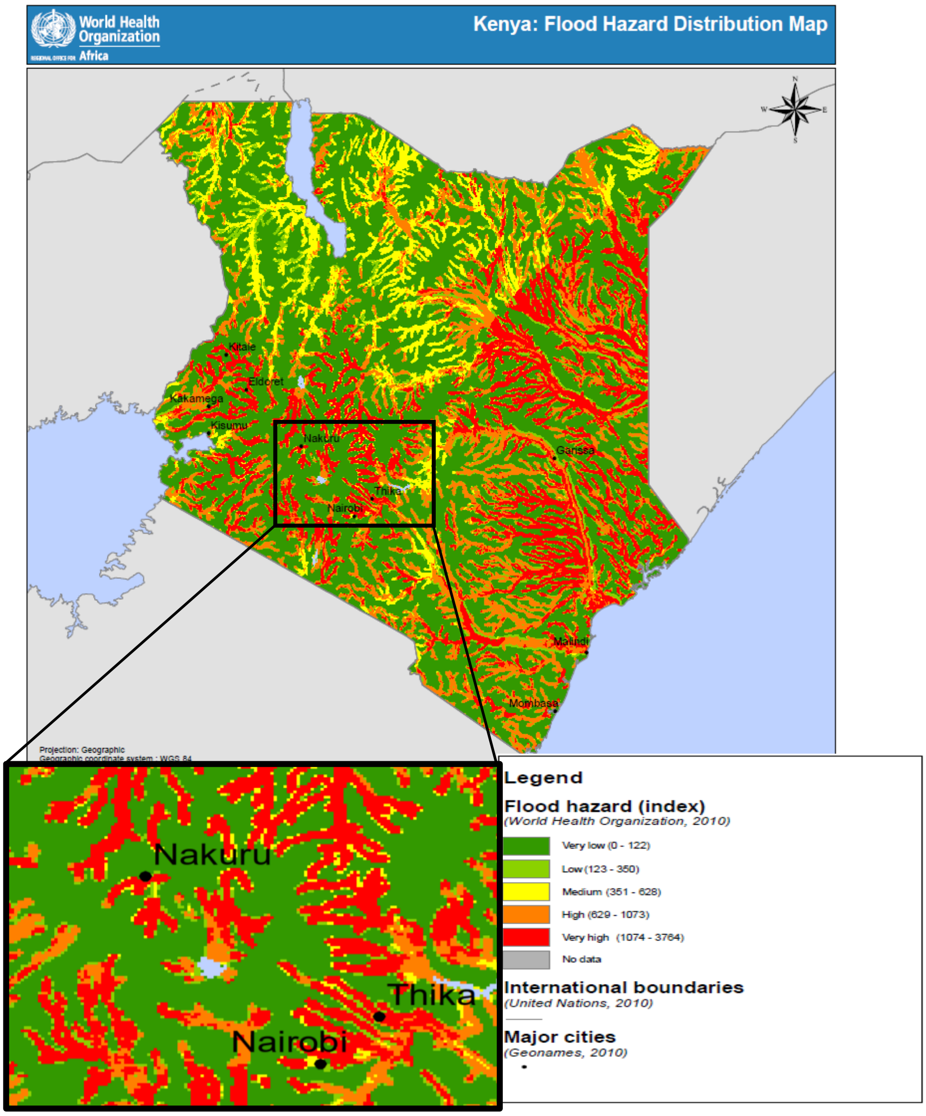
Figure 6-25 Lake Nakuru Catchment Area

FLOOD OCCURRENCE AND MANAGEMENT

Floods hazards in Kenya are a recurrent phenomenon and are associated with extreme climate events. These include El Niño, overflow in riverbanks, intense storms (that produce more run-off than an area can infiltrate and store or a stream can carry within its normal channel), and from dam failure or landslides that temporarily block a channel, negatively impacting almost all socio-economic activities in the affected regions. Floods inundate farms and households and disrupt transportation networks, ultimately affecting food security and market distribution systems.

The most commonly affected places are the floodplains of the major rivers such as the lower Tana River, the lower Nzoia River at Budalang'i plains and the lower Nyando River at Kano Plains. However, in recent years, some of the lakes in the Rift Valley have also been prone to flooding during the annual dual rainy seasons. Intense flooding is being experienced at lakes Bogoria, Baringo, Nakuru and Naivasha.

Figure 6-26 illustrates how the flood hazard is distributed in the country. The blown-up section shows that for the project area, flooding hazards are concentrated around the Naivasha and Nakuru lakes and their tributaries.



Source: https://www.humanitarianlibrary.org/sites/default/files/2013/08/ken-flood.pdf

Figure 6-26 Kenya flood hazard distribution adapted from WHO

In the Rift valley basin, flooding has been mainly due to heavy rainfall that leads to surface runoff volumes that exceed the carrying capacity of the water bodies and drainage systems. According to WRA, chronic flood-prone areas in the rift valley and more specifically, in the catchment areas within the project location are Nakuru and Mogotio town. They experience flash floods due to poor cultivation methods on steep slopes upstream and inadequate and improper urban drainage system.

The key indicators of vulnerability and risks to flooding in the water resources are both natural and anthropogenic factors. The natural factors are climate, topography and geology, while the anthropogenic factors include settlement patterns, land-use patterns and pressures, migration patterns, population pressure, degradation of water catchment areas, and unsustainable water supply. For instance, the type of floods experienced in Nakuru result from the poor drainage system in the municipality, considering the high population density.

According to recent studies by the Regional Centre for Mapping of Resources for Development (RCMRD), the surface extent of the Rift Valley lakes seems to have increased substantially from 2018 to 2020 compared to previous years but this remains to b confirmed. The main cause of the increased surface area would be due to the increase in rainfall over the lake catchments and other secondary factors. These include the lake water balances, climatology, lake catchment land use change, land degradation and sediment yield into the lakes from the catchment, and the role of geological activities such as the status of the many geological fault and fissures in the region.

The rising lake levels and flooding in the Naivasha and Nakuru lakes area will need to be considered by the Project to ensure proper design of surface water runoff management. If associated infrastructure is inadequately designed temporary flooding may occur. This effect could be combined with existing problems such as lower rates of soil infiltration and improper drainage and stormwater collection systems in the Nakuru Municipality, thus increasing local flooding issues.

SPECIFIC CONCERNS RAISED DURING PUBLIC CONSULTATION AND SOCIO-ECONOMIC SURVEYS

Flooding areas located in the RoW have been identified by the stakeholders during the second round of consultation. Key Informants and Chiefs during the social survey, also mentioned that their locations were affected by flooding or drainage issues, from the side of the road to the other. Table 6-18 presents the documented flood risk areas along the Project's Alignment

Table 6-18 Documented Flood Risk Areas along the Project's Alignment

County	Subcounty	Ward	Highway	Chainage (approx.)
Kiambu	Lari	Lari/Kirenga	A8	10+500 to 11+500 (East side of the road)
		Kijabe	A8	17+600 to 18+000 (East side of the road)
	Limuru	Limuru Central	A8	1+300 to 1+600 (both sides of the road) 2+000 (East side of the road) 2+900 to 3+500 (both sides of the road)
			A8 South	2+500 to 2+600 (both sides of the road)
Nakuru	Naivasha South	Mai Mahiu	A8 South	20+800 to 21+100 (both sides of the road) 21+500 to 21+800 (both sides of the road) 22+300 to 22+500 (both sides of the road) 33+000 to 33+300 (both sides of the road
	Naivasha North	Viwandani	A8	55+900 to 56+100 (both sides of the road) 59+400 to 60+000 (both sides of the road) 64+400 to 65+900 (both sides of the road)
		Lake View	A8 South	51+200 to 53+000 (both sides of the road) 54+300 to 54+500 (both sides of the road) 55+000 to 55+200 (both sides of the road)
	Rongai	Mosop Menengai West	A8	130+600 to 131+200 (both sides of the road) 138+400 to 138+800 (both sides of the road) 140+000 to 140+400 (both sides of the road) 141+100 to 141+400 (both sides of the road) 148+800 to 149+000 (both sides of the road)
	Gilgil	Malewa West Gilgil	A8	64+500 to 65+900 (both sides of the road) 85+500 to 85+800 (both sides of the road) 88+500 to 89+700 (both sides of the road) 89+700 to 90+100 (East side of the road)
	Nakuru East	London	A8	112+000 to 114+000 (both sides of the road) 123+800 to 124+100 (both sides of the road)
	Molo	Molo	A8	158+400 to 159+100 (both sides of the road) 165+000 to 166+100 (both sides of the road)
	Kuresoi	Kamara	A8	173+000 to 173+300 (both sides of the road) 173+700 to 173+850 (both sides of the road)
Nyandarua County	Kinangop	Magumu	A8	29+200 to 32+000 (both sides of the road) 33+000 (both sides of the road)

6.2.5.2 SURFACE WATER RESOURCES

METHODOLOGICAL CONSIDERATIONS

This section is based on existing desktop data and information acquired from the Water Resources Authority (WRA) of Kenya as well as from the literature.

RIFT VALLEY BASIN OVERVIEW

The Kenya Water Resources Authority's Rift Valley Basin Plan (WRA, 2019), confirms that general water quality in the Catchment has deteriorated due to increased pressure from anthropogenic activities. Point and non-point sources of pollution combine to increase pressure on access to clean water. The main pollution sources include untreated urban runoff, poorly managed municipal and industrial waste, increased sedimentation and abusive and improper use of agrochemicals. Main known pollution point sources include raw sewage from urban areas in some sub-counties, effluent from horticultural farms and livestock-based industries, leachates and solids from solid waste dumps. As for non-point pollution, it includes atmospheric deposition, stormwater runoff from farms, and soil erosion from areas devoid of vegetation cover. Main known pollutants of the Rift Valley Basin include:

- Industrial Effluents from cities and towns;
- Municipal/Domestic sewage from urban settlements;
- Solid wastes from dump sites;
- Nutrients and Pesticide Residues, from Agro-based industries, Flower and Horticultural farms;
- Sediment loads from degraded farmlands;
- Soil erosion from overgrazed lands;
- Storm runoff from roads and urban centres including oil spills;
- Oil Drilling Wastes;
- Leachates from Pit latrines, Septic tanks and feedlots;
- Acaricides from Cattle dips.

MAIN ISSUES RELATED TO THE NAIVASHA, ELMENTAITA AND NAKURU LAKES CATCHMENT AREAS

These three catchments, which cover most of the project area are generally submitted to the same anthropogenic factors as presented in the previous section. In addition, Elmentaita and Nakuru lakes have no outflows which has gradually transformed them into saline and alkaline lakes in comparison to Naivasha which has a more neutral pH and low salt content. The following summarizes available information on surface water quality associated with the lakes' catchment areas.

LAKE NAIVASHA CATCHMENT AREA

This catchment area is essentially composed of Lake Naivasha and its two main tributaries the Malewa and Gilgil rivers. The inflows from both water courses strongly contribute to the lake's water quality as they bring in organic matter/detritus, inorganic matter/sediments (composed of fine particles and nutrients such as phosphorus and nitrogen) (Ndungu, 2014). These inputs have strong effect on proliferation of algae blooms, availability of dissolved oxygen and turbidity levels. Also, the suspended solids entering the lake also often carry toxic pollutants that are introduced upstream along the various water courses. The lake has no aboveground outflows, but some occur through underground connections towards Elmentaita Lake and Magumo Swamps. According to water quality analysis completed in Naivasha Lake by Ndungu (2014), physico-chemical analysis showed temperatures ranging from 18.1 °C to 24.4 °C and a relatively high pH ranging from 7.85 to 8.98. Turbidity is also quite high with the highest levels near the mouth of the Malewa River, caused by agriculture run-offs, and near Kamere Beach, caused by discharges from informal human settlements. As for nutrient contents (Nitrogen and phosphorus), concentration was much higher near the mouth of the Malewa River and north-east sites and is associated with domestic waste pollution and agricultural runoffs. Main ion presence is characterised by the presence of Ca^{+} and Mg^{+} which were of higher concentration in the Crescent Lake area and due to the volcanic origin of the area. The bulk of the lake, composed of the Kamere Beach, midlake, Hippo Point and south-east areas is more homogenous as significant mixing occurs. Ndungu's spatiotemporal variations of the lake's trophic state (2014) showed that Naivasha Lake varies between a eutrophic and hypereutrophic state.

LAKE ELMENTAITA CATCHMENT AREA

This catchment area is composed of a shallow lake and three small tributaries (Mereroni, Mbaruk and Chamuka rivers). The Lake has no outflows but nonetheless, it is known to undergo significant level fluctuations and is even known to dry up (Adeka et al., 2008). Water quality of the catchment area is affected by anthropogenic activities (salt harvesting, tourism, small-scale peasant farming and cattle rearing) and the presence of geothermal hot springs in the south-east, which are a major source of phosphorus and nitrogen into the lake (Adeka et al., 2008). Mwendwa et al. (2015) also adds that the lake's water quality is threatened by sedimentation (affecting turbidity), livestock wastes and toxic wastes which cause eutrophication originating mainly from domestic sewage, agrochemicals, soil erosion and industrial discharge. According to Ballot et al. (2003), the lakes are characterized by elevated temperatures (between 20 and 30ºC) and pH (between 9.8 and 10.5). The study also confirms the lake salinity, low total phosphorus content (0.02-0.25 mM) and fairly high nitrogen concentration (0.04 to 0.61 mM). Finally, Jirsa et al. (2013) mentions the presence of fluoride with concentrations of 168 mg L^{-1} which is quite elevated since EPA standard for drinking water is 4.0 mg/l.

LAKE NAKURU CATCHMENT AREA

This catchment area is composed of a shallow alkaline-saline lake and various tributaries of which the Njoro River is the most important. The lake has no outflows. According to Okech (2012), the main source of contamination of this catchment area includes domestic and industrial sewage (mainly from the Nakuru City area), agricultural runoffs and soil erosion. Raini's (2006) assessment of the water quality of Lake Nakuru shows that mean long-term dissolved oxygen levels are high but undergoes significant variation depending on the location and water depth. pH is relatively stable with a mean level of 10.24 while temperature was typically between 25 °C and 27 ºC. Salinity is highly variable with electric conductivity of 9.5 mS to 165 mS cm^{-1} (Jirsa et al., 2013). Other results obtained by Jirsa et al. (2013) show elevated dissolved organic carbon, dominance of Na>K>Si>Ca and HCO_3>CO_3>Cl>F>SO_{4+} ions, very high fluoride levels (520 mg to 1370 mg L^{-1}), high nitrate concentrations (up to 40 mg L^{-1}) and significant presence of arsenic (As) and Molybdenum (Mo).

6.2.5.3 SURFACE WATER QUALITY

METHODOLOGICAL CONSIDERATIONS

The detailed methodology followed to assess surface water quality is presented in Chapter 5 - Section 5.3.2.3. Furthermore Appendix 5-1 described the specific surface water quality sampling protocol, and the specific location of the sampling stations are illustrated on Map 5-5.

As part of the ESIA, existing water quality data were obtained from the Kenyan Water Resource Authority. Furthermore, some 20 watercourses were surveyed (13 watercourses during the rainy season and 12 watercourses during the dry season). Sampling sites were first described using watercourse characterization data sheets. A multiparameter probe was also used for *in situ* measurements of physicochemical parameters including temperature, conductivity, dissolved oxygen, pH, salinity and total dissolved solids. Water samples collected, appropriately handled and stored in a temperature-controlled environment were transferred for chemical analysis. Copies of the original field data sheets are provided in Appendix 6-3, and photographs from each sampling site are included in Appendix 6-4. Laboratory certificates of analysis are provided in Appendix 6-5. Analytical water quality results obtained are presented further below along with detailed results and analyses.

Furthermore, as part of the ESIA, a freshwater ecology baseline study was also conducted. Water quality of watercourses crossed by the Project was assessed through *in situ* analysis and water samples analysed in laboratory for various parameters. A total of 39 watercourses in six of the seven catchment areas concerned by the Project were surveyed during February (dry season) and April (rain season) 2021. The Nakuru catchment does not include any watercourses being crossed by the project. Water quality results obtained for the freshwater ecology baseline study are summarized in the Results and Analysis section and presented more comprehensively in Section 6.3.6 of this ESIA report.

STANDARD CONSIDERED

SURFACE WATER QUALITY STUDY

The IFC EHS Guidelines do not recommend specific ambient water quality criteria other than the locally applicable criteria or, in their absence, other sources of ambient water quality criteria. Given that no Kenyan criteria exist for ambient water, the standards considered for the assessment of surface water quality (Table 6-19) are those from the Australian and New Zealand Environment and Conservation Council (ANZECC) – Trigger values for freshwater (2013) and the Canadian Council of Ministers of the Environment (CCME) – Freshwater criteria (2021). Although not typically applicable for freshwater data, the Kenya Bureau of Standards (KEBS) - Natural potable water limit (2018) is also considered, though typically overly conservative. Indeed, potable water quality criteria tend to be more rigorous for human health reasons whereas freshwater criteria are designed to determine what conditions living organisms can sustain. Nevertheless, the various criteria are complementary and intend to cover most parameters analysed.

Table 6-19 Surface Water Quality Standards Considered as part of the ESIA

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]
	99%		95%		Long-term		mg/l
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l	
Field data							
Temperature (°C)	-	-	-	-	-	-	-
Conductivity (µS/cm)	-	-	-	-	-	-	2500
Dissolved oxygen (min value - mg/L)	-	-	-	-	-	5.5	-
pH	5.0-9.0				6.5-9.0		5.5-9.5
Salinity (ppt)	-	-	-	-	-	-	-
Total dissolved solids (mg/L)	-	-	-	-	-	-	1500
Turbidity (NTU)							25
Others							
Color (u. Hazen)	-	-	-	-	-	-	50
Turbidity (NTU)	-	-	-	-	-	-	25
Total suspended solids (mg/l)	-		-	-	-	-	-
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500
Hardness (mg/l)	-	-	-	-	-	-	600
Phenols (mg/l)	-	0,085	-	0,32	-	0,004	2
Nitrate (NO3) (mg/l)	-	0.017	-	-	-	13	45
Phosphate (PO4) (mg/l)	-	-	-	-	-	-	2,2

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]
	99%		95%		Long-term		mg/l
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l	
Petroleum hydrocarbons (mg/l)							
Oil and Greases	-	0.3	-	-	-	-	-
GRO Petroleum hydrocarbons C_6-C_{10}	-	-	-	-	-	-	-
DRO Petroleum hydrocarbons C_{10}-C_{28}	-	-	-	-	-	-	-
Petroleum hydrocarbons C6-C44	-	-	-	-	-	-	-
Oxygen (mg/l)							
Chemical Oxygen Demand	-	-	-	-	-	-	-
BOD 5 at 20°C	-	-	-	-	-	-	-
Other organic compounds							
Total coliforms (MPN*/100 ml)	-	-	-	-	-	-	0
Fecal coliforms (MPN/100 ml)	-	-	-	-	-	-	0
E.coli (MPN/100 ml)	-	-	-	-	-	-	0
Polycyclic aromatic hydrocarbons (mg/l)							
Acenaphtene	-	-	-	-	-	0,0058	-
Acenaphtylene	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	0,000012	-
Benzo (a) anthracene	-	-	-	-	-	-	-
Benzo (a) pyrene	-	-	-	-	-	0,000015	-
Benzo (b) fluoranthene	-	-	-	-	-	-	-
Benzo (g,h,i) perylene	-	-	-	-	-	-	-
Benzo (k) fluoranthene	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-
Dibenzo (a,h) anthracene	-	-	-	-	-	-	-
Fluoranthene	-	-	-	-	-	0,00004	-
Fluorene	-	-	-	-	-	0,003	-
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-
Naphtalene	-	0,0025	-	0,016	-	0,001	-
PAH (sum)							0,70
Phenanthrene	-	-	-	-	-	0,0004	-
Pyrene	-	-	-	-	-	0,000025	-

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]
	99%		95%		Long-term		mg/l
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l	
Volatile Organic Compounds (ug/l)							
Benzene	600		950		370	-	10 *ug/l*
Toluene	-	-	-	-	2	-	700 *ug/l*
Ethybenzene	-	-	-	-	90	-	-
1,2- Dimethylbenzene	-	-	-	-	-	-	-
1,3+1,4- Dimenthylbenzene	-	-	-	-	-	-	-
Xylenes (sum)	-	-	-	-	-	-	500 *ug/l*
Metals and derivatives (mg/l)							
Fluoride	-	-	-	-	-	0.12	1.5
S-Chloride	-	-	-	-	-	120	250
Aluminum	-	0.027	-	0.055	-	0.1	0.2
Calcium	-	-	-	-	-	-	150
Cadmium	-	0.00006	-	0.0002	-	-	0.003
Copper	-	0.001	-	0.0014	-	0.002	1
Iron	-	-	-	-	-	0.3	0.3
Chromium	-	0.00001	-	0.001	-	-	0.05
Nickel	-	0.008	-	0.011	-	0.025	0.02
Cobalt	-	-	-	-	-	-	-
Lead	-	0.001	-	0.0034	-	0.001	0.01
Sodium	-	-	-	-	-	-	200
Zinc	-	0.0024	-	0.008	-	-	5

FRESHWATER ECOLOGY BASELINE STUDY

Water quality data of the freshwater ecology baseline study are compared with the benchmark criteria compiled by Kotze (2002) and consisting of the South African Water Quality Guidelines, Aquatic Ecosystems -Target Water Quality Ranges (1996). These guidelines are assessed to generally be of comparable values (for acute and effect values) with either one of the three criteria references used for the current study (ANZECC, CCME or KEBS). Therefore, results where a parameter concentration recorded exceeds a criterion is deemed comparable between each other.

EXISTING DATA RESULTS

Existing water quality data is summarised in Table 6-20. The Kenyan Water Resource Authority provided data for the Mereronai River and the Malewa River crossed by the Project (corresponding to water samples 8 and 4 of the ESIA water quality survey, respectively). Water quality data recorded for these rivers are all within criteria and limits used for comparison excepted for nitrate in Malewa River and turbidity in Mereronai River, which only has a reference value according to KEBS. In the absence of freshwater criteria, KEBS natural potable water criteria are used although not being the most appropriate reference in the context. Indeed, a low turbidity level criterion for potable water is not necessarily comparable to freshwater criteria designed to assess natural habitats. Nevertheless, KEBS limit values bring an appreciation of relative water quality of watercourses surveyed for parameters where no criteria are provided by the other authorities used as reference. Similarly, the lakes Elmentaita, Naivasha and Nakuru all have values recorded above criteria for turbidity as well as total dissolved solids and conductivity, excepted for Lake Naivasha. This data reflects the great presence of sediments and dissolved matter in surface water at the regional level. The three lakes also exhibit concentrations above water reference criteria for either nitrate, s-chloride and/or iron.

Table 6-20 Summary of Existing Water Quality Data

Parameter	Sampling Location and Date / Analytical Results				
	Mereronai River	Malewa River	Lake Elmentaita	Lake Naivasha	Lake Nakuru
	-0.3583315 36.20194565	-0.55556309 36.402777	-0.318836008 36.0827156	n/a	n/a
	2019-01-25	2019-02-19	2019-03-27	n/a	n/a
Temperature (°C)	22.2	21.1	19.9	22.13	23.2
Conductivity (µS/cm)	274	339	19140	370.9	6490
pH	7.2	-	-	7.9	9.8
Total dissolved solids (mg/l)	169.88	210.18	11867	222.8	4198
Turbidity (NTU)	75	11.22	183	36.04	44.86
Total suspended solids (mg/l)	58	17	415	55.5	-
Hardness (mg/l)	40	106	24	90.2	20.46
Total alkalinity	104	146	4320	157.4	3042
Sulfate (mg/l)	-	-	-	3.07	8.86
Nitrite (mg/l)	-	-	0,235	0,02	-
Nitrate (NO3) (mg/l)	-	0.3	4	0.26	-
Phosphate (PO4) (mg/l)	-	1.26	1.31	0.0275	0.24
S-Chloride (mg/l)	11	23	719	19.1	897
Calcium (mg/l)	7.2	11.2	4.8	11.46	5.7
Magnesium (mg/l)	5,28	18,72	2.88	13.3	2,6
Iron (mg/l)	-	-	2.87	2.1	4.8

Notes: n/a: data not available
Absence of value is identified with –
[1] Australian and New Zealand Environment and Conservation Council – Freshwater criteria -Level of protection (% species) indicating percentage of species expected to be protected
[2] Canadian Council of Ministers of the Environment – Freshwater criteria, long-term exposure
[3] Kenya Bureau of Standards (KEBS) – Natural potable water limit

SURFACE WATER BASELINE CHARACTERIZATION

WATERCOURSE CHARACTERIZATION

All sampling sites were first described using watercourse characterization data sheets. Table 6-21 provides a summary of the main characteristic of the sampling sites.

Table 6-21 Surface Water Sampling Characterization

Watercourse Sampling Site ID	1		1		3		3		4+		4+		5		5		6		6	
	Non-designated watercourse				Karate River				Malewa River				Gilgil River				Lake Elmentaita tributary			
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Date	2020-12-15	2020-12-15	2021-02-19	2021-02-19	2020-12-14	2020-12-14	2021-02-24	2021-02-24	2020-12-13	2020-12-13	2021-02-24	2021-02-24	2020-12-13	2020-12-13	2021-02-24	2021-02-24	2021-05-01	2021-05-01	2021-02-24	2021-02-24
Season	Wet		Dry		Wet		Dry		Wet		Dry		Wet		Dry		Wet		Dry	
Time	12:00	11:20	15:31	14:57	10:16	12:16	16:13	16:29	12:56	13:45	15:34	15:17	10:09	10:30	14:07	14:20	15:36	14:56	13:28	13:19
Latitude	-0,799097	-0,798419	-0,798556	-0,798806	-0,692875	-0,695908	-0,694806	-0,695194	-0,667442	-0,668303	-0,668000	-0,668444	-0,567358	-0,573669	-0,571389	-0,571722	-0,455250	-0,456806	-0,455361	-0,456806
Longitude	36,528917	36,524281	36,527194	36,525722	36,423014	36,421586	36,422750	36,422611	36,389286	36,386039	36,388083	36,387639	36,360617	36,359986	36,360778	36,360472	36,277333	36,277556	36,276806	36,277556
Water Presence	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no
Watercourse Depth (m)	n/a	n/a	1	3	n/a	n/a	2	5	n/a	n/a	5	4	n/a	n/a	1	5	10	10	10	10
Sampling Depth (m)	0.1	0.1	0.1	0.3	0.1	0.1	0.3	0.2	4	4	0.3	0.3	5	5	0.1	0.2	0.05	0.05	n/a	n/a
Width of Floodplain (m)	n/a	n/a	3.5	5	n/a	n/a	10	5	n/a	n/a	50	50	n/a	n/a	10	10	3	1	700	1000
Substrate	Hardrock	Hardrock	Hardrock	Hardrock	Soil and hard rock bed	Soil and hard rock bed	Silt, clay	Hardrock, cobble, silt, clay	Rocks and sediment	Sediments and debris of fallen trees	Clay, silt, cobble, boulder	Clay, silt, cobble, boulder	Rocks	Rocks and sediment	Hardrock, silt, pebble	Boulder, pebble, silt, clay	Boulders, cobble, pebble, sand, silt	Boulders, cobble, pebble, sand, silt	Silt, boulder, hard rock, pebble	Boulder, hard rock, pebble, silt
Site Description	Farmlands on the top of the valley, water floor is hard rock, water passes through a thicket	Farmlands on the top of the valley, water floor is hard rock, water passes through a thicket	Homestead, planted forest	Planted forest, homestead, cattle grazing	Agricultural farms in the surrounding, cattle watering point, car wash, bathing	Agricultural farms in the surrounding, cattle watering point, car wash, bathing	Planted trees, fenced ranch	Fenced ranch, planted hey grass, grazing land, residentials	There is irrigation of small farms adjacent to the river, car washing, bathing and washing of utensils	The land use is mainly agricultural	Fenced, ranch, planted forest	Irrigation, homestead	Surrounded by ranch on both sides	Surrounded by ranch on both sides	Fenced ranch, forest	Fenced ranch, forest	Factory, cultivated land, forest & shrubs	Shrubs and fenced land	Shrubs and fenced ranch, lake	Shrubs and fenced ranch
Possible Contamination Sources	Unclear but possibilities of contamination from small farms	Unclear but possibilities of contamination from small farms	Grazing cattle, dumping by road users	Dumping by road users	Car washing activities, agricultural practices	Car washing activities, agricultural practices	Dumping by road users	Dumping by road users	Car and utensils washing	Agricultural cultivation lands	Laundry, bathing, cattle watering	Laundry, bathing, cattle watering	Main Road	The adjacent ranch and the road	Cattle watering, dumping by road users	Dumping by road users	Fluorspar industry dust, dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users

Note: n/a: data not available

Table 6-21 Surface Water Sampling Characterization (cont'd)

Watercourse Sampling Site ID	7		7		8		8		9		9		10		10		11	
	Mbaruk River				Mereronai River				Rongai River				Molo River				Non-designated watercourse	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Date	2021-05-01	2021-05-01	2021-02-24	2021-02-24	2021-05-01	2021-05-01	2021-02-24	2021-02-24	2021-04-30	2021-04-30	2021-02-23	2021-02-23	2020-12-12	2020-12-12	2021-02-23	2021-02-23	2021-02-22	2021-02-23
Season	Wet		Dry		Wet		Dry		Wet		Dry		Wet		Dry		Dry	
Time	13:56	14:04	12:58	12:50	11:26	10:45	12:18	11:55	15:10	14:47	15:12	14:50	12:22	12:30	13:27	13:11	09:36	12:14
Latitude	-0,367917	-0,367417	-0,367917	-0,367417	-0,357694	-0,358250	-0,357750	-0,358083	-0,213361	-0,212750	-0,213389	-0,212806	-0,201464	-0,198453	-0,199694	-0,199139	-0,204917	-0,204583
Longitude	36,214194	36,213972	36,214194	36,213972	36,201889	36,201833	36,202694	36,201750	35,863583	35,864028	35,863556	35,864111	35,829300	35,832147	35,830250	35,830500	35,805583	35,805806
Water Presence	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no
Watercourse Depth (m)	15	10	15	10	1	2	1	1	2	1.5	0.4	0.6	n/a	n/a	1	0.1	3	2
Sampling Depth (m)	n/a	n/a	n/a	n/a	0.3	0.3	0.2	0.2	0.1	0.3	0.3	0.3	0.05	0.05	0.3	0.1	n/a	n/a
Width of Floodplain (m)	100	150	100	500	5	10	4	7	5	5	4.5	15	n/a	n/a	15	8	1.5	1.5
Substrate	Boulders, clay	Clay	Boulder, clay, cobble	Clay	Hardrock, boulders, pebble, silt	Boulder, cobble, pebbles, silt	Boulder, clay, cobble	Clay, hard rock, cobble, pebble	Boulder, pebble, silt	Hardrock	Hardrock, boulder, pebble, cobble, silt	Hardrock	Rocks	Rocks	Hardrock, pebble, silt	Hardrock, boulder, pebble, silt	Hardrock, boulder, cobble, pebble, silt	Hardrock, boulder, cobble, pebble, silt
Site Description	Fenced forested ranch with shrubs and grassland	Fenced ranch, wild animals and cattle grazing	Fenced ranch, planted forest	Fenced ranch, planted forest, cattle grazing	Wetland, picnic site	Fenced ranch and residential area	Residentials, fenced ranch, picnic site	Residentials, fenced ranches	Flower farm, cultivated land, planted trees	Residentials cultivated land	Cultivated land, flower farm	Residentials, cultivated land	Maze plantation, forested area, cattle rearing	Maze plantation, forested area, cattle rearing	Trees and bushes	Fenced ranches and homestead	Natural forest	Planted forest, quarry, bare land
Possible Contamination Sources	Cattle grazing and dumping by road users	Dumping by road users	Cattle grazing field, road user's dumpling	Dumping by road users	Dumping by road users	Water abstraction and dumping by road users	Dumping by road users	Dumping by road users	Flower farm dumping and dumping by road user	Laundry, cleaning of vegetables, washing of motorbikes	Waste farm, flower farm, laundry	Laundry, cleaning of vegetables from farms adjacent, flower farm	Maize plantation and cattle farm	Maize plantation and cattle farm	Swimmers	Laundry, animal watering	Dumping by road users	Dumping by road users

Note: n/a: data not available

Table 6-21 Surface Water Sampling Characterization (cont'd)

Watercourse Sampling Site ID	12		12		13		13		14		14		15		15		B3		B3	
	Molo River tributary				Molo River Tributary				Non-designated watercourse				Molo River Tributary				River draining to Rift Valley			
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Date	2021-04-30	2021-04-30	2021-02-23	2021-02-23	2021-04-30	2021-04-30	2021-02-20	2021-02-20	2021-04-30	2021-04-30	2021-02-20	2021-02-20	2020-12-12	2020-12-12	2021-02-20	2021-02-20	2020-12-14	2020-12-14	2021-02-25	2021-02-25
Season	Wet		Dry		Wet		Dry		Wet		Dry		Wet		Dry		Wet		Dry	
Time	13:31	12:45	10:54	10:34	11:19	11:35	15:50	15:28	10:46	10:24	14:09	13:50	10:40	11:20	12:23	12:10	14:50	14:25	9:41	10:26
Latitude	-0,205167	-0,205806	-0,205222	-0,205778	-0,195472	-0,195889	-0,195472	-0,195833	-0,178000	-0,178306	-0,178083	-0,178250	-0,160219	-0,161453	-0,160722	-0,161167	-0,967706	-0,984775	-0,975056	-0,976000
Longitude	35,784639	35,785056	35,784667	35,785000	35,720167	35,720056	35,720139	35,720056	35,710472	35,710250	35,710472	35,710278	35,696056	35,695156	35,695806	35,695306	36,575672	36,578103	36,578861	36,578667
Water Presence	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Watercourse Depth (m)	0.3	1	0.3	0.2	0.6	1	0.2	0.05	1	0.6	0.2	0.3	n/a	n/a	0.3	0.2	n/a	n/a	3	4
Sampling Depth (m)	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.05	0.1	0.05	0.2	0.2	0.09	0.15	0.2	0.2	0.3	0.3	0.2	0.1
Width of Floodplain (m)	3	5	3	2	3	3	3	1	3	1	2	1	n/a	n/a	3	0.605	n/a	n/a	5	10
Substrate	Boulder, pebble, sand, silt	Cobble, pebble, silt	Boulder, cobble, silt	Boulder, cobble, silt	Hardrock, boulder, cobble, pebble, silt, clay	Cobble, pebble, silt, clay	Boulder, cobble, pebble, clay	Hardrock, boulders, pebble, cobble, clay	Silt, clay, pebbles	Silt, clay, pebble	Pebble, clay	Pebble, sand, silt	Rocks and sediments	Rocks and sediments	Boulder, pebble, cobble, silt	Silt, boulder, hard rock	Soil and rocks	Soil and rocks	Silt, pebble, cobble, boulder	Hardrock, boulder, cobble, pebble, silt
Site Description	Planted forest, cultivated land	Homestead, banana plantation	Cultivated land, planted forest	Homestead, cultivated land, banana plantation	Wetland, cultivated land, planted forest	Planted forest	Planted forest, cattle rearing	Planted forest, cultivated land, cattle rearing	Residential, wetland	Fishpond, cultivated land	Wetland at the edge, farms (cultivated)	Fishponds, cattle, grazing, field cultivated land	Car wash, washing of utensils, laundry and cattle drinking point	Car wash, washing of utensils, laundry and cattle drinking point	Farming	Farming	Car wash and water abstraction loading point	Car wash and water abstraction loading point	Truck cleaning (car wash), water abstraction, shopping center	Residentials
Possible Contamination Sources	Laundry place, dumping by road users	Cultivated land	Laundry and cultivated land, dumpling by road users	homestead, dumping by road users	Laundry upstream, watering of animals	Watering of animals, dumping by road users	Washing of motorcycles, laundry, cattle rearing	Cattle grazing field, road user's dumpling	Laundry, animals watering, dumping by road users, washing of vegetables	Animals drinking place	Vegetable cleaning	Litter from the road site, cattle, grazing	Car wash, washing of utensils and laundry	Car wash, washing of utensils and laundry	Farming (maize plantation, laundry, car wash, bathing)	Vegetable cleaning, laundry, car wash, bathing, farming	Car wash and water abstraction activities	Car wash and water abstraction activities	Cleaning of trucks, water abstraction	Residence and road users dumping

Note: n/a: data not available

Table 6-21 Surface Water Sampling Characterization (cont'd)

Watercourse Sampling Site ID	B4		B5		B6		B7		B7		B10	
	Non-designated watercourse		Non-designated watercourse		Non-designated watercourse		Non-designated watercourse				Non-designated watercourse	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Date	2021-02-25	2021-02-25	2021-02-25	2021-02-25	2021-02-25	2021-02-25	2021-05-02	2021-05-02	2021-02-25	2021-02-25	2021-02-25	2021-02-25
Season	Dry		Dry		Dry		Wet		Dry		Dry	
Time	19:13	9:19	12:26	12:16	12:41	12:36	08:14	08:30	8:53	9:01	13:25	13:30
Latitude	-0,945833	-0,946194	-0,925639	-0,926222	-0,919917	-0,920111	-0,906778	-0,907333	-0,907139	-0,907111	-0,782111	-0,782167
Longitude	36,546389	36,546167	36,529611	36,529472	36,524889	36,524528	36,515056	36,514806	36,515056	36,514778	36,454750	36,454000
Water Presence	no	no	no	no	no	no	no	no	no	no	no	no
Watercourse Depth (m)	2	15	1	20	3	3	2	10	2	10	1.5	8
Sampling Depth (m)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Width of Floodplain (m)	5	20	2	10	15	10	30	15	300	0	4	10
Substrate	Silt, cobble, pebble	Silt, cobble, pebble, boulder	Silt, boulder, pebble	Silt, boulder, pebble	Hardrock, boulder, silt, pebble	Silt, cobble, pebble	Cobble, pebble, sand, silt	Cobble, pebble, sand, silt	Silt, cobble, pebble	Silt, cobble, pebble, hard rock	Silt, boulder, pebble	Cemented for more than 100m, silt
Site Description	Homesteads, acacia tree plantation	Heygrass plantation, construction of railway	Grazing land, hills, hey grass plantation, homestead	Hey grass plantation, constructed railway line, homestead, planted acacia trees	Hills, cultivated land, grazing field	Hey grass plantation, constructed railway line	Thicket and bush surrounded by lines	Railway constructed, planted forest	Arable land and bush, surrounded by hills	Construction of railways, planted forest	Planted forest, residentials	Fenced homesteads, planted acacia trees
Possible Contamination Sources	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users	Dumping by road users

Note: n/a: data not available

ANALYTICAL WATER QUALITY

Analytical water quality results obtained are summarised in Table 6-22 and 6-23 for samples collected during rain and dry season, respectively. As required, values exceeding the criteria values considered (ANZECC, CCME and KEBS) are outlined in yellow, red or blue.

No concentration values recorded from water samples analyses exceed the criteria considered for petroleum hydrocarbons, oxygen, polycyclic aromatic hydrocarbons and volatile organic compounds. However, it should be noted some of these parameters don’t have any water quality criterion associated with it. In other cases, laboratory detection limits where no precise value is obtained, led to the impossibility of determining whether criteria below the detection limits are exceeded or not.

Overall, the water quality results obtained demonstrate:

- Some instances of low dissolved oxygen concentrations (2.0-5.2 mg/l).
- Cases of high pH (9.5-10) recorded only in dry season. Dissolving effect of increased water levels during the rainy season may contribute to pH discrepancy observed between survey seasons.
- Parameters only defined by KEBS criteria, namely for color, turbidity, phosphate, E. coli and coliforms also present exceeding values for many samples. Nonetheless, this illustrates the limit of comparing freshwater results with potable water criteria where turbidity and total/fecal coliforms are at stake for human health reasons, while being considered normal in natural water systems impacted by human activities.
- Nitrate was found in exceeding values in many samples, and this may reflect the influence of farming and cattle which were documented at many watercourse survey stations. Nitrate was also found in field blanks, but in rather low concentrations as compared with other results above criteria.
- Phenols were recorded above water quality criteria in all samples collected during the dry season while exhibiting values under detection limits for all samples from the rainy season. A possible explanation for this discrepancy between seasons may again be the dissolving effect of increased water levels during the rainy season. Nevertheless, the ubiquity of phenols at watercourse sampling sites may reflect their widespread use in industrial processes (automotive parts, construction, appliances) and manufacturing of many products such as plastics, paints, synthetic textiles and pesticides (Government of Canada, 2021).
- Metals and derivatives are consistently found in all water samples collected during both survey seasons, namely in the form of fluoride, aluminum, iron, nickel, zinc and in one sample, copper. All three field blanks, however, exhibit concentration values similar or even higher as compared to results of samples above quality criteria for either fluoride, aluminum, iron and nickel. This observation may cast some doubt on the values obtained for metal analyses and their reliability. However, beyond the rigorous application of field blank procedures that could be questioned, the metal concentration values obtained mostly demonstrate the widespread presence of metals in the Project’s environment. Nickel and zinc were also recorded in certain proportions during the soil quality study (see Section 6.1.7.3) whereas zinc was also found in exceeding value in the sediment quality study (see Section 6.1.7.4).

Table 6-22 Summary of Surface Water Analytical Results from Rainy Season

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]	Sample ID / Sampling Site and Date / Analytical Results							
								1		3		4+		5	
								Non-designated watercourse		Karate River		Malewa River		Gilgil River	
	99%		95%		Long-term		mg/l	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l		2020-12-15	2020-12-15	2020-12-14	2020-12-14	2020-12-13	2020-12-13	2020-12-13	2020-12-13
Field data															
Temperature (°C)	-	-	-	-	-	-	-	13.9	13.7	18	18	19.4	19.4	15.7	7.31
Conductivity (µS/cm)	-	-	-	-	-	-	2500	174.1	170.4	1168,0	1167,0	110,0	110.7	83.1	82.9
Dissolved oxygen (min value - mg/L)	-	-	-	-	-	5.5	-	4.1	4.0	6.2	7.1	10.1	10,0	9.8	10.1
pH	5.0-9.0				6.5-9.0		5.5-9.5	7.84	7.62	7.19	7.2	7.57	7.4	7.42	7.31
Salinity (ppt)	-	-	-	-	-	-	-	0.1	0.1	0.1	0.7	0.1	0.1	0.1	0.1
Total dissolved solids (mg/L)	-	-	-	-	-	-	1500	0.2337	0.2222	0.1349	0.1348	0.1243	0.124	0.1008	0.101
Turbidity (NTU)							25	-	-	-	-	-	-	-	-
Others															
Color (u. Hazen)	-	-	-	-	-	-	50	>70	>70	30	35	>70	>70	>70	>70
Turbidity (NTU)	-	-	-	-	-	-	25	121	126	3.89	3.14	32.2	30.7	11.93	19.49
Total suspended solids (mg/l)	-		-	-	-	-	-	5	5	8	6	9	11	16	14
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	-	-	-	-	-	-	-	-
Hardness (mg/l)	-	-	-	-	-	-	600	52.23	50.53	258.59	258.91	36.83	36.54	18.51	19.15
Phenols (mg/l)	-	0,085	-	0,32	-	0,004	2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate (NO3) (mg/l)	-	0.017	-	-	-	13	45	-	-	-	-	-	-	-	-
Phosphate (PO4) (mg/l)	-	-	-	-	-	-	2,2	-	-	-	-	-	-	-	-
Petroleum hydrocarbons (mg/l)															
Oil and Greases	-	0.3	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
GRO Petroleum hydrocarbons C_6-C_{10}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DRO Petroleum hydrocarbons C_{10}-C_{28}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum hydrocarbons C6-C44	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Oxygen (mg/l)															
Chemical Oxygen Demand	-	-	-	-	-	-	-	108	108	108	108	108	108	92	108
BOD 5 at 20°C	-	-	-	-	-	-	-	6	6	6	6	6	6	5.1	6,00
Other organic compounds															
Total coliforms (MPN*/100 ml)	-	-	-	-	-	-	0	1100	1100	1100	1100	1100	1100	1100	1100
Fecal coliforms (MPN/100 ml)	-	-	-	-	-	-	0	1100	1100	1100	1100	1100	1100	1100	1100
E.coli (MPN/100 ml)	-	-	-	-	-	-	0	1100	1100	1100	1100	1100	1100	0	1100
Polycyclic aromatic hydrocarbons (mg/l)															
Acenaphtene	-	-	-	-	-	0,0058	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphtylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	-	-	-	-	-	0,000012	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) pyrene	-	-	-	-	-	0,000015	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (b) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (g,h,i) perylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (k) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo (a,h) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	-	-	-	-	-	0,00004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	-	-	-	-	-	0,003	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Naphtalene	-	0,0025	-	0,016	-	0,001	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PAH (sum)							0,70	<0.10	<0.10	<0.10	<0.10	-	-	<0.10	<0.10
Phenanthrene	-	-	-	-	-	0,0004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	-	-	-	-	-	0,000025	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Organic Compounds (ug/l)															
Benzene	600		950		370	-	*10 ug/l*	<1	<1	<1	<1	<1	<1	<10	<1
Toluene	-	-	-	-	2	-	*700 ug/l*	<1	<1	<1	<1	<1	<1	<10	<1
Ethybenzene	-	-	-	-	90	-	-	<1	<1	<1	<1	<1	<1	<10	<1
1,2- Dimethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3+1,4- Dimenthylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (sum)	-	-	-	-	-	-	*500 ug/l*	<2	<2	<2	<2	<2	<2	<20	<2
Metals and derivatives (mg/l)															
Fluoride	-	-	-	-	-	0.12	1.5	0.36	0.35	1.24	1.28	0.1	0.11	0.11	0.11
S-Chloride	-	-	-	-	-	120	250	17.5	17.4	36.1	34.7	5.7	5.4	5	9.6
Aluminum	-	0.027	-	0.055	-	0.1	0.2	2.46	2.21	1.02	0.98	0.9	1.11	0.48	0.39
Calcium	-	-	-	-	-	-	150	13.94	14.15	91.9	76.51	9.95	9.73	5.52	5.63
Cadmium	-	0.00006	-	0.0002	-	-	0.003	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Copper	-	0.001	-	0.0014	-	0.002	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	-	-	-	-	-	0.3	0.3	1.26	1.08	0.32	0.28	0.96	1.15	0.94	0.76
Chromium	-	0.00001	-	0.001	-	-	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	-	0.008	-	0.011	-	0.025	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cobalt	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead	-	0.001	-	0.0034	-	0.001	0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Sodium	-	-	-	-	-	-	200	29.81	30.08	156.68	149.48	13.02	12.68	13.2	13.09
Zinc	-	0.0024	-	0.008	-	-	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes: n/d: not detected
Absence of value is identified with -
Values above those of guidelines and criteria are highlighted according to color patterns associated with the greatest value criterion applicable.
[1] Australian and New Zealand Environment and Conservation Council – Trigger values for freshwater -Level of protection (% species) indicating percentage of species expected to be protected
[2] Canadian Council of Ministers of the Environment – Freshwater criteria, long-term exposure
[3] Kenya Bureau of Standards (KEBS) - Natural potable water limit

Table 6-22 Summary of Surface Water Analytical Results from Rainy Season (cont'd)

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]	Sample ID / Sampling Site and Date / Analytical Results							
								6		8		Dup of 8		9	
								L. Elmentaita tributary		Mereronai River		Mereronai River		Rongai River	
	99%		95%		Long-term		mg/l	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l		2021-05-01	2021-05-01	2021-05-01	2021-05-01	2021-05-01	2021-05-01	2021-04-30	2021-04-30
Field data															
Temperature (°C)	-	-	-	-	-	-	-	22.8	22.2	16.4	15.9	-	-	19.5	18.9
Conductivity (µS/cm)	-	-	-	-	-	-	2500	567	544	147.5	140.1	-	-	223.8	234.9
Dissolved oxygen (min value - mg/L)	-	-	-	-	-	5.5	-	2	2.2	10.3	6.2	-	-	11	10.3
pH	5.0-9.0				6.5-9.0		5.5-9.5	7.74	8.05	7.27	7.35	-	-	7.6	7.62
Salinity (ppt)	-	-	-	-	-	-	-	0.2	0.2	0.1	0.1	-	-	0.1	0.1
Total dissolved solids (mg/L)	-	-	-	-	-	-	1500	584	575	176.6	170	-	-	255.1	265.9
Turbidity (NTU)							25	27	86.2	171	89.5	-	-	424	750
Others															
Color (u. Hazen)	-	-	-	-	-	-	50	>70	>70	>70	>70	>70	>70	>70	>70
Turbidity (NTU)	-	-	-	-	-	-	25	41.8	53	53	57	80.6	61.7	77.2	77.6
Total suspended solids (mg/l)	-		-	-	-	-	-	373	282	216	238	157	146	284	301
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	395	392	101	100	101	100	159	167
Hardness (mg/l)	-	-	-	-	-	-	600	48.03	49.36	22.19	25.86	21.92	22.88	19.43	21.76
Phenols (mg/l)	-	0,085	-	0,32	-	0,004	2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate (NO_3) (mg/l)	-	0.017	-	-	-	13	45	<0.1	6.16	4.25	9.26	5.93	4.92	16.12	20.37
Phosphate (PO4) (mg/l)	-	-	-	-	-	-	2,2	0.06	<0.02	1.87	0.21	0.31	0.09	0.28	0.7
Petroleum hydrocarbons (mg/l)															
Oil and Greases	-	0.3	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
GRO Petroleum hydrocarbons C_6-C_{10}	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
DRO Petroleum hydrocarbons C_{10}-C_{28}	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Petroleum hydrocarbons C6-C44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Oxygen (mg/l)															
Chemical Oxygen Demand	-	-	-	-	-	-	-	<7.00	<7.00	<7.00	<7.00	7.97	31.87	23.9	47.81
BOD 5 at 20°C	-	-	-	-	-	-	-	0.1	0.1	3.1	1.1	3,00	0.9	4.2	3.6
Other organic compounds															
Total coliforms (MPN*/100 ml)	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
Fecal coliforms (MPN/100 ml)	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-
E.coli (MPN/100 ml)	-	-	-	-	-	-	0	540	11	22	<2	22	<2	11	<2
Polycyclic aromatic hydrocarbons (mg/l)															
Acenaphtene	-	-	-	-	-	0,0058	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphtylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	-	-	-	-	-	0,000012	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) pyrene	-	-	-	-	-	0,000015	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (b) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (g,h,i) perylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (k) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo (a,h) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	-	-	-	-	-	0,00004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	-	-	-	-	-	0,003	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Naphtalene	-	0,0025	-	0,016	-	0,001	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PAH (sum)							0,70	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	-	-	-	-	-	0,0004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	-	-	-	-	-	0,000025	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Organic Compounds (ug/l)															
Benzene	600		950		370	-	10 *ug/l*	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	-	-	-	-	2	-	700 *ug/l*	<1	<1	<1	<1	<1	<1	<1	<1
Ethybenzene	-	-	-	-	90	-	-	<1	<1	<1	<1	<1	<1	<1	<1
1,2- Dimethylbenzene	-	-	-	-	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1
1,3+1,4- Dimenthylbenzene	-	-	-	-	-	-	-	<2	<2	<2	<2	<2	<2	<2	<2
Xylenes (sum)	-	-	-	-	-	-	500 *ug/l*	<2	<2	<2	<2	<2	<2	<2	<2
Metals and derivatives (mg/l)															
Fluoride	-	-	-	-	-	0.12	1.5	8.03	8.12	0.64	0.56	0.49	0.58	0.95	0.97
S-Chloride	-	-	-	-	-	120	250	11.8	11.4	8.7	8.5	8.8	8.7	14.2	14.6
Aluminum	-	0.027	-	0.055	-	0.1	0.2	1.62	1.46	0.9	1.07	0.87	0.79	2.01	2.02
Calcium	-	-	-	-	-	-	150	16.17	16.28	6.93	6.48	7.28	7.05	7.03	7.34
Cadmium	-	0.00006	-	0.0002	-	-	0.003	n/d	n/d	n/d	n/d	n/d	n/d	n/d	n/d
Copper	-	0.001	-	0.0014	-	0.002	1	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Iron	-	-	-	-	-	0.3	0.3	1.2	1.13	1.48	1.39	1.36	1,00	1.39	0.95
Chromium	-	0.00001	-	0.001	-	-	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	-	0.008	-	0.011	-	0.025	0.02	0.06	0.06	0.04	0.04	0.04	0.03	0.04	0.05
Cobalt	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead	-	0.001	-	0.0034	-	0.001	0.01	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Sodium	-	-	-	-	-	-	200	90.95	91.23	19.3	18.93	19.47	19.45	32.78	33.6
Zinc	-	0.0024	-	0.008	-	-	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes: n/d: not detected

Absence of value is identified with -

Values above those of guidelines and criteria are highlighted according to color patterns associated with the greatest value criterion applicable.

[1] Australian and New Zealand Environment and Conservation Council – Trigger values for freshwater -Level of protection (% species) indicating percentage of species expected to be protected

[2] Canadian Council of Ministers of the Environment – Freshwater criteria, long-term exposure

[3] Kenya Bureau of Standards (KEBS) - Natural potable water limit

Table 6-22 Summary of Surface Water Analytical Results from Rainy Season (cont'd)

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]	Sample ID / Sampling Site and Date / Analytical Results										
								10		12		15		B3		Field blank 1	Field blank 3	Field blank 4
								Molo River		Molo River tributary		Molo River tributary		River draining to Rift Valley		-	-	-
	99%		95%		Long-term		mg/l	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	-	at #14	at #6
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l		2020-12-12	2020-12-12	2021-04-30	2021-04-30	2020-12-12	2020-12-12	2020-12-14	2020-12-14	2020-12-15	2021-04-29	2021-04-29
Field data																		
Temperature (°C)	-	-	-	-	-	-	-	18.3	18.3	19.9	18.5	18	18.5	23.1	23	-	-	-
Conductivity (µS/cm)	-	-	-	-	-	-	2500	169.3	176.9	154.4	149.2	87.1	89.3	818,0	8.23	-	-	-
Dissolved oxygen (min value - mg/L)	-	-	-	-	-	5.5	-	10,0	10.1	9.6	10	8.8	8.7	8.2	7.8	-	-	-
pH	5.0-9.0				6.5-9.0		5.5-9.5	7.6	7.61	7.7	7.44	6.54	6.86	7.87	7.85	-	-	-
Salinity (ppt)	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.4	-	-	-
Total dissolved solids (mg/L)	-	-	-	-	-	-	1500	0.1941	0.2024	171	170.7	0.1053	0.1103	0.857	0.858	-	-	-
Turbidity (NTU)							25	-	-	74.6	68.4	-	-	-	-	-	-	-
Others																		
Color (u. Hazen)	-	-	-	-	-	-	50	>70	>70	>70	>70	45	20	>70	30	-	2.5	2.5
Turbidity (NTU)	-	-	-	-	-	-	25	32.6	30.1	22.6	20.4	5.23	6.57	6.11	4.99	-	2.05	2.23
Total suspended solids (mg/l)	-		-	-	-	-	-	12	9	204	203	<5	7	23	10	-	146	169
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	-	-	98	97	-	-	-	-	-	50	50
Hardness (mg/l)	-	-	-	-	-	-	600	27.84	28.25	21.26	22.61	19.87	19.84	64.07	63.04	-	1.63	0.84
Phenols (mg/l)	-	0,085	-	0,32	-	0,004	2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.001	<0.001
Nitrate (NO3) (mg/l)	-	0.017	-	-	-	13	45	-	-	14.39	9.39	-	-	-	-	-	1.46	0.18
Phosphate (PO4) (mg/l)	-	-	-	-	-	-	2,2	-	-	0.18	0.09	-	-	-	-	-	0.15	0.09
Petroleum hydrocarbons (mg/l)																		
Oil and Greases	-	0.3	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
GRO Petroleum hydrocarbons C_6-C_{10}	-	-	-	-	-	-	-	-	-	<1.0	<1.0	-	-	-	-	-	<1.0	<1.0
DRO Petroleum hydrocarbons C_{10}-C_{28}	-	-	-	-	-	-	-	-	-	<1.0	<1.0	-	-	-	-	-	<1.0	<1.0
Petroleum hydrocarbons C6-C44	-	-	-	-	-	-	-	<1.0	<1.0			<1.0	<1.0	<1.0	<1.0	<1.0		
Oxygen (mg/l)																		
Chemical Oxygen Demand	-	-	-	-	-	-	-	84,00	88	23.9	<7.00	64	76	108	108	88	<7.00	<7.00
BOD 5 at 20°C	-	-	-	-	-	-	-	4.3	2.6	2.6	3.8	2.9	1.6	6	6	2.6	0.1	0.1
Other organic compounds																		
Total coliforms (MPN*/100 ml)	-	-	-	-	-	-	0	1100	1100	-	-	1100	1100	1100	1100	1100	-	-
Fecal coliforms (MPN/100 ml)	-	-	-	-	-	-	0	1100	1100	-	-	1100	1100	1100	1100	1100	-	-
E.coli (MPN/100 ml)	-	-	-	-	-	-	0	0	43	8	<2	0	1100	1100	1100	43	<2	<2
Polycyclic aromatic hydrocarbons (mg/l)																		
Acenaphtene	-	-	-	-	-	0,0058	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphtylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	-	-	-	-	-	0,000012	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) pyrene	-	-	-	-	-	0,000015	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (b) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (g,h,i) perylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (k) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo (a,h) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	-	-	-	-	-	0,00004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	-	-	-	-	-	0,003	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Naphtalene	-	0,0025	-	0,016	-	0,001	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
PAH (sum)							0,70	-	-	<0.10	<0.10	-	-	-	-	-	<0.10	<0.10
Phenanthrene	-	-	-	-	-	0,0004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	-	-	-	-	-	0,000025	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile Organic Compounds (ug/l)																		
Benzene	600		950		370	-	10 *ug/l*	<10	<10	<1	<1	<10	<10	<1	<1	<1	<1	<1
Toluene	-	-	-	-	2	-	700 *ug/l*	<10	<10	<1	<1	<10	<10	<1	<1	<1	<1	<1
Ethybenzene	-	-	-	-	90	-	-	<10	<10	<1	<1	<10	<10	<1	<1	<1	<1	<1
1,2- Dimethylbenzene	-	-	-	-	-	-	-	-	-	<1	<1	-	-	-	-	-	<1	<1
1,3+1,4- Dimenthylbenzene	-	-	-	-	-	-	-	-	-	<2	<2	-	-	-	-	-	<2	<2
Xylenes (sum)	-	-	-	-	-	-	500 *ug/l*	<20	<20	<2	<2	<20	<20	<2	<2	<2	<2	<2
Metals and derivatives (mg/l)																		
Fluoride	-	-	-	-	-	0.12	1.5	0.14	0.14	0.42	0.38	0.05	0.05	0.93	0.97	0.33	0.63	0.65
S-Chloride	-	-	-	-	-	120	250	15.7	15.4	13.2	13	7.2	5.6	110	111	19.1	1.9	1.8
Aluminum	-	0.027	-	0.055	-	0.1	0.2	0.79	0.89	1.27	0.23	0.24	0.29	0.69	0.74	2.65	<0.05	<0.05
Calcium	-	-	-	-	-	-	150	8.2	8.26	8.25	5.77	6.22	6.24	17.88	17.9	14.64	0.57	0.68
Cadmium	-	0.00006	-	0.0002	-	-	0.003	<0.007	<0.007	n/d	n/d	<0.007	<0.007	<0.007	<0.007	<0.007	n/d	n/d
Copper	-	0.001	-	0.0014	-	0.002	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	-	-	-	-	-	0.3	0.3	0.7	0.89	0.44	0.49	0.49	0.96	0.48	0.55	1.42	<0.02	<0.02
Chromium	-	0.00001	-	0.001	-	-	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	-	0.008	-	0.011	-	0.025	0.02	<0.02	<0.02	0.04	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.03
Cobalt	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead	-	0.001	-	0.0034	-	0.001	0.01	<0.02	<0.02	<0.004	<0.004	<0.02	<0.02	<0.02	<0.02	<0.02	<0.004	<0.004
Sodium	-	-	-	-	-	-	200	29.54	29.12	19.25	17.83	11.14	11.26	109.84	123.44	30.48	18.37	18.56
Zinc	-	0.0024	-	0.008	-	-	5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes: n/d: not detected
Absence of value is identified with -
Values above those of guidelines and criteria are highlighted according to color pattern associated with the greatest value criterion applicable.
[1] Australian and New Zealand Environment and Conservation Council – Trigger values for freshwater -Level of protection (% species) indicating percentage of species expected to be protected
[2] Canadian Council of Ministers of the Environment – Freshwater criteria, long-term exposure
[3] Kenya Bureau of Standards (KEBS) - Natural potable water limit

Table 6-23 Summary of Surface Water Analytical Results from Dry Season

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]	Sample ID / Sampling Site and Date / Analytical Results								
								1		Duplicate of 1	3		4+		5	
								Non-designated watercourse			Karate River		Malewa River		Gilgil River	
	99%		95%		Long-term		mg/l	Upstream	Downstream	Upstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l		2021-02-19	2021-02-19	2021-02-19	2021-02-24	2021-02-24	2021-02-24	2021-02-24	2021-02-24	2021-02-24
Field data																
Temperature (°C)	-	-	-	-	-	-	-	22.2	20.4	-	19.4	19.1	20.9	21.2	19.6	19.5
Conductivity (µS-cm)	-	-	-	-	-	-	2500	145.8	146,0	-	307.5	314.2	146.9	152.6	100.7	147,0
Dissolved oxygen (min value - mg/l)	-	-	-	-	-	5.5	-	2.8	4.2	-	10.2	10,0	10.4	9.3	4.2	7.1
pH	5.0-9.0				6.5-9.0		5.5-9.5	9.54	10,00	-	7.43	8.20	7.90	7.92	7.73	9.92
Salinity (ppt)	-	-	-	-	-	-	-	0.1	0.1	-	0.1	0.1	0.1	0.1	0.1	0.1
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	109.2	108.5	-	222.3	230	102.8	105.6	73.7	106.8
Others																
Color (u. Hazen)	-	-	-	-	-	-	50,0	>70	>70	>70	>70	>70	>70	>70	>70	>70
Turbidity (NTU)	-	-	-	-	-	-	25,0	78.3	2.95	137	247	256	34.1	34.7	188	176
Total suspended solids (mg/l)	-		-	-	-	-	-	367	336	8	129	142	17	13	24	12
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	117	83	115	277	275	118	118	124	125
Phenols (mg/l)	-	0,085	-	0,32	-	0,004	2	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.01
Nitrate (NO3) (mg/l)	-	0.017	-	-	-	13,0	45,0	0.04	0.53	<0.01	40.07	39.36	0.58	0.8	2.6	2.91
Phosphate (PO4) (mg/l)	-	-	-	-	-	-	2,2	0.24	0.15	0.21	5.7	6.81	0.24	0.12	0.36	0.39
Petroleum hydrocarbons (mg/l)																
Oil and Greases	-	0.3	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GRO Petroleum hydrocarbons C6-C10	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
DRO Petroleum hydrocarbons C10-C28	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Oxygen (mg/l)																
Chemical Oxygen Demand	-	-	-	-	-	-	-	112.45	16.06	80.35	72.32	48.21	16.07	56.25	40.18	32.14
BOD 5 at 20°C	-	-	-	-	-	-	-	0.9	1.2	0.7	3,00	3.4	6.5	4.5	1.5	0.8
Other organic compounds																
E.coli (MPN-100ml)	-	-	-	-	-	-	0	<2	<2	<2	<2	<2	11,00	<2	5,00	<2
Polycyclic aromatic hydrocarbons (mg/l)																
Acenaphtene	-	-	-	-	-	0,0058	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphtylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	-	-	-	-	-	0,000012	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) pyrene	-	-	-	-	-	0,000015	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (b) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (g,h,i) perylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (k) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo (a,h) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	-	-	-	-	-	0,00004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	-	-	-	-	-	0,003	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Naphtalene	-	0,0025	-	0,016	-	0,001	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	-	-	-	-	-	0,0004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	-	-	-	-	-	0,000025	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile organic compounds (ug/l)																
Benzene	600	-	950	-	370	-	10 *ug/l*	<10	<10	<10	<10	<10	<10	<10	<10	<10
Toluene	-	-	-	-	2	-	700 *ug/l*	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ethybenzene	-	-	-	-	90	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10
Xylenes (sum)	-	-	-	-	-	-	500 *ug/l*	<20	<20	<20	<20	<20	<20	<20	<20	<20
Metals and derivatives (mg/l)																
Fluoride	-	-	-	-	-	0.12	1.5	1.03	0.47	1.16	1.50	1.9	0.58	0.53	0.94	0.92
S-Chloride	-	-	-	-	-	120	250	7.5	8.2	8.9	14.7	14.50	7.2	7.90	6	6
Aluminium	-	0.027	-	0.055	-	0.1	0.2	4.49	1.66	3.87	3.32	3.71	1.05	1.00	1.79	2.08
Calcium	-	-	-	-	-	-	150	10.56	5.96	9.93	20.14	19.09	13.02	11.27	10.96	11.16
Cadmium	-	0.00006	-	0.0002	-	-	0.003	n-d	n-d	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Copper	-	0.001	-	0.0014	-	0.002	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	-	-	-	-	-	0.3	0.3	2.26	0.76	2.1	1.27	1.61	1.10	0.99	1.02	1.38
Chromium	-	0.00001	-	0.001	-	-	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	-	0.008	-	0.011	-	0.025	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cobalt	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead	-	0.001	-	0.0034	-	0.001	0.01	<0.02	<0.02	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Sodium	-	-	-	-	-	-	200	23.07	11.01	21.44	44.73	44.49	16.67	17.21	18.75	19.54
Zinc	-	0.0024	-	0.008	-	-	5	0.04	0.03	0.03	<0.01	<0.01	0.03	<0.01	<0.01	<0.01

Notes: n/d: not detected
Absence of value is identified with -
Values above those of guidelines and criteria are highlighted according to color patterns associated with the greatest value criterion applicable.
[1] Australian and New Zealand Environment and Conservation Council – Trigger values for freshwater -Level of protection (% species) indicating percentage of species expected to be protected
[2] Canadian Council of Ministers of the Environment – Freshwater criteria, long-term exposure
[3] Kenya Bureau of Standards (KEBS) - Natural potable water limit

Table 6-23 Summary of Surface Water Analytical Results from Dry Season (cont'd)

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]	Sample ID / Sampling Site and Date / Analytical Results								
								8		9		Duplicate of 9	10		12	
								Mereronai River		Rongai River			Molo River		Molo River tributary	
	99%		95%		Long-term		mg/l	Upstream	Downstream	Upstream	Downstream	Downstream	Upstream	Downstream	Upstream	Downstream
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l		2021-02-24	2021-02-24	2021-02-23	2021-02-23	2021-02-23	2021-02-23	2021-02-23	2021-02-23	2021-02-23
Field data																
Temperature (°C)	-	-	-	-	-	-	-	17.3	17.1	18.2	18.3	-	18.9	18.8	14.5	14.3
Conductivity (µS-cm)	-	-	-	-	-	-	2500	160,0	162.2	233.2	233.7	-	192.4	193.7	140.8	139,0
Dissolved oxygen (min value - mg/l)	-	-	-	-	-	5.5	-	5.2	6.2	12.1	11.6	-	12.2	12.8	12,0	10.2
pH	5.0-9.0				6.5-9.0		5.5-9.5	8.81	7.48	8.48	8.32	-	8.17	8.46	8.95	8.29
Salinity (ppt)	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	-	0.1	0.1	0.1	0.1
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	121.4	124.2	174.2	174	-	140.2	142.1	113.6	113.4
Others																
Color (u. Hazen)	-	-	-	-	-	-	50,0	>70	>70	>70	>70	>70	20	>70	50	>70
Turbidity (NTU)	-	-	-	-	-	-	25,0	41.2	41	18.36	22.5	21.2	21	8.37	10.54	14.48
Total suspended solids (mg/l)	-		-	-	-	-	-	10	14	154	124	179	145	172	121	175
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	141	140	199	188	194	161	151	126	127
Phenols (mg/l)	-	0,085	-	0,32	-	0,004	2	0.02	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01
Nitrate (NO3) (mg/l)	-	0.017	-	-	-	13,0	45,0	3.5	3.6	21.16	19.92	12.57	10.14	12.07	16.11	17.7
Phosphate (PO4) (mg/l)	-	-	-	-	-	-	2,2	0.45	0.15	0.42	0.45	0.39	0.27	0.12	0.21	0.03
Petroleum hydrocarbons (mg/l)																
Oil and Greases	-	0.3	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GRO Petroleum hydrocarbons C6-C10	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
DRO Petroleum hydrocarbons C10-C28	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Oxygen (mg/l)																
Chemical Oxygen Demand	-	-	-	-	-	-	-	56.25	40.18	8.03	32.14	48.19	64.26	32.13	56.22	40.16
BOD 5 at 20°C	-	-	-	-	-	-	-	2,00	0.8	2.6	2.2	1.9	6.9	6.5	3.8	2.6
Other organic compounds																
E.coli (MPN-100ml)	-	-	-	-	-	-	0	<2	<2	11,00	<2	<2	5,00	<2	<2	5,00
Polycyclic aromatic hydrocarbons (mg/l)																
Acenaphtene	-	-	-	-	-	0,0058	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphtylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	-	-	-	-	-	0,000012	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) pyrene	-	-	-	-	-	0,000015	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (b) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (g,h,i) perylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (k) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo (a,h) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	-	-	-	-	-	0,00004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	-	-	-	-	-	0,003	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Naphtalene	-	0,0025	-	0,016	-	0,001	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	-	-	-	-	-	0,0004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	-	-	-	-	-	0,000025	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile organic compounds (ug/l)																
Benzene	600	-	950	-	370	-	10 *ug/l*	<10	<10	<10	<10	<10	<10	<10	<10	<10
Toluene	-	-	-	-	2	-	700 *ug/l*	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ethybenzene	-	-	-	-	90	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10
Xylenes (sum)	-	-	-	-	-	-	500 *ug/l*	<20	<20	<20	<20	<20	<20	<20	<20	<20
Metals and derivatives (mg/l)																
Fluoride	-	-	-	-	-	0.12	1.5	0.78	0.73	0.88	0.85	0.53	0.27	0.22	0.22	0.26
S-Chloride	-	-	-	-	-	120	250	9.60	9.2	18	9.6	10.7	13.7	9.4	9.2	13
Aluminium	-	0.027	-	0.055	-	0.1	0.2	0.88	0.96	0.65	0.49	0.49	0.21	0.18	0.32	0.32
Calcium	-	-	-	-	-	-	150	9.89	9.86	8.46	6.82	5.66	6.89	7.09	7.54	7.67
Cadmium	-	0.00006	-	0.0002	-	-	0.003	<0.007	<0.007	n-d	<0.007	n-d	n-d	n-d	n-d	n-d
Copper	-	0.001	-	0.0014	-	0.002	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	-	-	-	-	-	0.3	0.3	1.26	1.35	0.45	0.26	0.46	0.36	0.34	0.55	0.49
Chromium	-	0.00001	-	0.001	-	-	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	-	0.008	-	0.011	-	0.025	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cobalt	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead	-	0.001	-	0.0034	-	0.001	0.01	<0.004	<0.004	<0.02	<0.004	<0.02	<0.02	<0.02	<0.02	<0.02
Sodium	-	-	-	-	-	-	200	25.07	24.09	38.84	26.45	23.96	17.02	13.47	12.21	16.76
Zinc	-	0.0024	-	0.008	-	-	5	<0.01	0.03	0.02	0.03	<0.01	<0.01	0.05	0.07	0.07

Notes: n/d: not detected
Absence of value is identified with -
Values above those of guidelines and criteria are highlighted according to color patterns associated with the greatest value criterion applicable.
[1] Australian and New Zealand Environment and Conservation Council – Trigger values for freshwater -Level of protection (% species) indicating percentage of species expected to be protected
[2] Canadian Council of Ministers of the Environment – Freshwater criteria, long-term exposure
[3] Kenya Bureau of Standards (KEBS) - Natural potable water limit

Table 6-23 Summary of Surface Water Analytical Results from Dry Season (cont'd)

Parameter	ANZECC Trigger values for freshwater[1]				CCME Freshwater criteria[2]		KEBS Natural potable water limit[3]	Sample ID / Sampling Site and Date / Analytical Results									
								13		14		15		Duplicate of 15	B3		Field blank 2
								Molo River Tributary		Non-designated watercourse		Molo River Tributary			River draining to Rift Valley		-
	99%		95%		Long-term		mg/l	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Downstream	Upstream	Downstream	at 9 and 12
	µg/l	mg/l	µg/l	mg/l	µg/l	mg/l		2021-02-20	2021-02-20	2021-02-20	2021-02-20	2021-02-20	2021-02-20	2021-02-20	2021-02-25	2021-02-25	2021-02-18
Field data																	
Temperature (°C)	-	-	-	-	-	-	-	22.6	22.5	17.8	19.6	18.5	18.5	-	17.0	16.6	-
Conductivity (µS-cm)	-	-	-	-	-	-	2500	194.8	193.3	120.9	72.8	84.7	42.5	-	576.0	563.0	-
Dissolved oxygen (min value - mg/l)	-	-	-	-	-	5.5	-	10.3	11.2	6,0	5,0	12,0	10,0	-	10.0	12.2	-
pH	5.0-9.0				6.5-9.0		5.5-9.5	7.33	7.46	7.73	7.69	8.35	8.81	-	7.60	7.20	-
Salinity (ppt)	-	-	-	-	-	-	-	0.1	0.1	0.1	0.1	0.1	0	-	0.1	0.1	-
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	132.3	131.7	91.2	54.2	62.7	67	-	440.5	435.1	-
Others																	
Color (u. Hazen)	-	-	-	-	-	-	50,0	35	25	30	40	25	60	35	>70	>70	20
Turbidity (NTU)	-	-	-	-	-	-	25,0	3.95	2.48	2.6	11.36	20.5	2.83	14.69	9.85	8.09	2.27
Total suspended solids (mg/l)	-		-	-	-	-	-	234	141	120	184	78	130	92	15	6	5
Total dissolved solids (mg/l)	-	-	-	-	-	-	1500	144	121	81	58	61	74	62	555	554	13
Phenols (mg/l)	-	0,085	-	0,32	-	0,004	2	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02
Nitrate (NO3) (mg/l)	-	0.017	-	-	-	13,0	45,0	<0.1	<0.1	0.88	3.45	7.79	8.49	11.95	1.9	1.59	<0.1
Phosphate (PO4) (mg/l)	-	-	-	-	-	-	2,2	0.09	0.06	0.03	0.03	<0.02	0.06	0.03	<0.02	0.12	<0.02
Petroleum hydrocarbons (mg/l)																	
Oil and Greases	-	0.3	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
GRO Petroleum hydrocarbons C6-C10	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
DRO Petroleum hydrocarbons C10-C28	-	-	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Oxygen (mg/l)																	
Chemical Oxygen Demand	-	-	-	-	-	-	-	24.1	48.19	24.11	16.06	8.03	56.22	32.13	24.11	16.07	24.11
BOD 5 at 20°C	-	-	-	-	-	-	-	3.8	1.5	2.6	2.1	4.3	2.4	4.7	4.2	5.2	0.1
Other organic compounds																	
E.coli (MPN-100ml)	-	-	-	-	-	-	0	2,00	<2	<2	<2	<2	<2	<2	<2	7,00	<2
Polycyclic aromatic hydrocarbons (mg/l)																	
Acenaphtene	-	-	-	-	-	0,0058	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Acenaphtylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anthracene	-	-	-	-	-	0,000012	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (a) pyrene	-	-	-	-	-	0,000015	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (b) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (g,h,i) perylene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Benzo (k) fluoranthene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chrysene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Dibenzo (a,h) anthracene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluoranthene	-	-	-	-	-	0,00004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Fluorene	-	-	-	-	-	0,003	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Indeno (1,2,3-cd) pyrene	-	-	-	-	-	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Naphtalene	-	0,0025	-	0,016	-	0,001	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Phenanthrene	-	-	-	-	-	0,0004	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Pyrene	-	-	-	-	-	0,000025	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Volatile organic compounds (ug/l)																	
Benzene	600	-	950	-	370	-	10 *ug/l*	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Toluene	-	-	-	-	2	-	700 *ug/l*	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ethybenzene	-	-	-	-	90	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Xylenes (sum)	-	-	-	-	-	-	500 *ug/l*	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Metals and derivatives (mg/l)																	
Fluoride	-	-	-	-	-	0.12	1.5	0.2	0.19	0.14	0.14	0.13	0.23	0.11	2.45	2.34	0.05
S-Chloride	-	-	-	-	-	120	250	8.9	11.60	4.5	7.00	1.7	4.4	2.5	84.20	85.2	4.7
Aluminium	-	0.027	-	0.055	-	0.1	0.2	0.09	0.12	0.06	0.20	0.12	10.50	0.13	1.54	0.83	<0.05
Calcium	-	-	-	-	-	-	150	6.55	103.46	4.55	4.29	3.36	10.25	3.22	14.99	14.66	1.67
Cadmium	-	0.00006	-	0.0002	-	-	0.003	n-d	n-d	n-d	n-d	n-d	<0.007	n-d	<0.007	<0.007	<0.007
Copper	-	0.001	-	0.0014	-	0.002	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	-	-	-	-	-	0.3	0.3	0.29	0.34	0.53	1.25	0.39	7.31	0.41	1.02	0.59	0.07
Chromium	-	0.00001	-	0.001	-	-	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nickel	-	0.008	-	0.011	-	0.025	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cobalt	-	-	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead	-	0.001	-	0.0034	-	0.001	0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.004	<0.02	<0.004	<0.004	<0.004
Sodium	-	-	-	-	-	-	200	8.99	12.53	11.95	11.50	4.76	16.90	4.37	84.76	85.74	3.5
Zinc	-	0.0024	-	0.008	-	-	5	<0.01	0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	0.03

Notes: n/d: not detected
Absence of value is identified with -
Values above those of guidelines and criteria are highlighted according to color patterns associated with the greatest value criterion applicable.
[1] Australian and New Zealand Environment and Conservation Council – Trigger values for freshwater -Level of protection (% species) indicating percentage of species expected to be protected
[2] Canadian Council of Ministers of the Environment – Freshwater criteria, long-term exposure
[3] Kenya Bureau of Standards (KEBS) - Natural potable water limit

FRESHWATER ECOLOGY BASELINE STUDY RESULTS

Water quality results obtained for the freshwater ecology baseline study are presented in detail in Section 6.3.7 of this ESIA report.

The analysis results for samples where concentrations recorded exceed criteria values are the following:

- Turbidity, conductivity;
- Aluminum, iron, fluoride, copper, chromium, sodium.

Some sampling sites for the freshwater ecology study were at the same location as some of the surface water quality study presented in section 6.1.5.3 and for those sites, the water samples collected tend to exhibit similar results. Various parameters were found in excessive concentrations with regard to their respective criteria for the following samples with comparable survey location between studies:

- Sample 1 / N4_S ; Sample 3 / N3_S (turbidity);
- Sample 4+ / N2_R ; Sample 5 / N1_S ; Sample 8 / E1_S (iron and aluminum);
- Sample 6 / E4_S (fluoride and aluminum);
- Sample 9 / M9_S (fluoride, iron and aluminum);
- Sample 10/ M6_R (aluminum).

Among the parameters with results identified as exceeding the criteria in the freshwater ecology study but not in the water quality study is sodium, for which no criterion was in fact available in the water quality study. By using the same criterion of 50 mg/l for sodium (Kotze, 2002), we obtained a similar result for the same location samples. For instance, sample 6 (sodium: 91,23 mg/l) in comparison with its counterpart E4_S (sodium: 110 mg/l). As for chromium, lab results were below detection limits which did not allow any comparison with the surface water quality study.

Overall, water quality data considered in this study demonstrate a few instances of watercourses with low dissolved oxygen and high pH, certain levels of turbidity, nitrate, phosphate, total/fecal coliforms and E. coli, ubiquitous high level of phenols, and metals and derivatives concentrations consistently higher than quality guidelines and criteria in all water samples collected.

6.2.5.4 GROUND WATER RESOURCES

METHODOLOGICAL CONSIDERATIONS

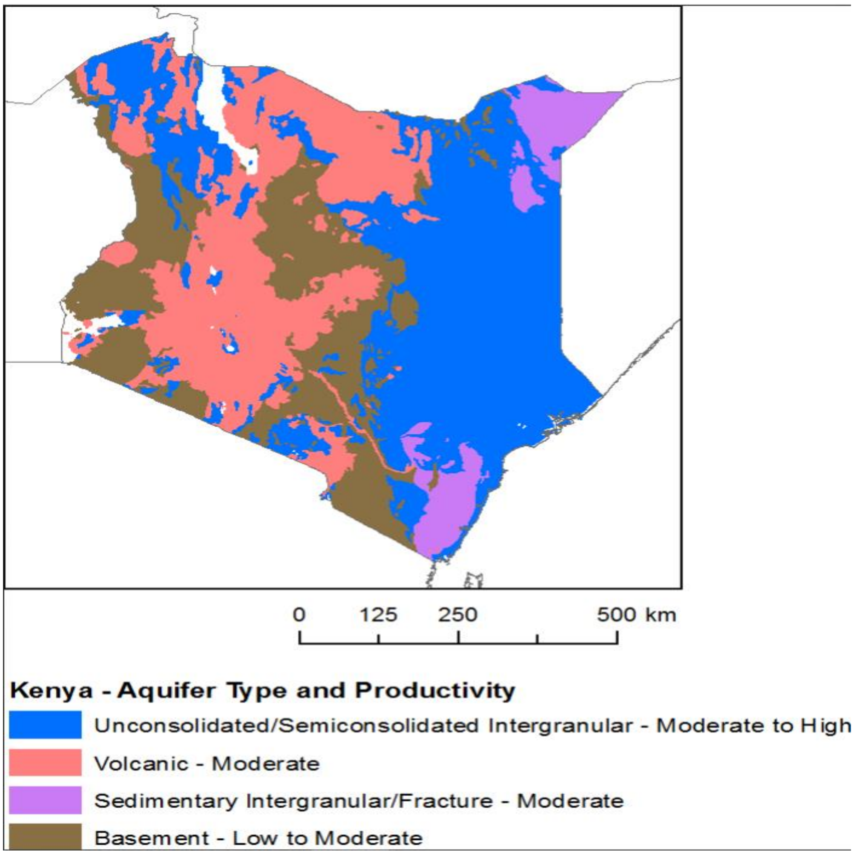
This section is based on existing desktop data and information acquired primarily from the WRA of Kenya. Given the nature of the Project, no sampling was performed as part of the ESIA to assess groundwater quality.

HYDROGEOLOGICAL CONTEXT

Ground water occurrence and distribution in Kenya are predominantly influenced by the underlying geological formations in different areas and the characteristics of aquifers found in those areas. The characteristics of aquifers in these hydrogeological zones are influenced by the physical parameters of the rocks in those areas, those being porosity, permeability, transmissivity, specific storage, specific yield and hydraulic conductivity. Aquifer occurrence and geological formations give rise to the various hydrogeological zones in the country.

The major hydrogeological zones of Kenya, characterized according to geology and basic aquifer characteristics, are represented in Figure 6-27 and include:

- Intrusive and volcanic rocks, covering approximately 26 % of the country and are prevalent in Western and Central Kenya, and the rift valley system where the NNM Highway Project is located. The types of volcanic rocks found here vary from Phonolites, Trachytes, Tuffs and Basalts. This rocks store groundwater in the old, weathered surfaces between lava flows and the older formations, and between subsequent flows.
- Sedimentary rocks that cover about 55 % of Kenya, predominantly in the eastern, north-western parts, L. Victoria regions and the coastal areas. These rocks are mainly composed of sands, clays, sandstones, shales and limestone. Aquifers are mainly found within the coarse - grained sediments and solution cavities.
- Pre-Cambrian Metamorphic Basement rocks, and sedimentary rocks, covering about 17% of the country, with a wide distribution in the Central, Western and North-Western parts of the country. The dominant types of rocks are granite, gneiss, schists and sediments. The aquifers in these geological formations are found within fractures and weathered surfaces of the formation.



Source: http://earthwise.bgs.ac.uk/index.php/Hydrogeology_of_Kenya

Figure 6-27 Map of hydrogeology of Kenya adopted from Africa Groundwater Atlas

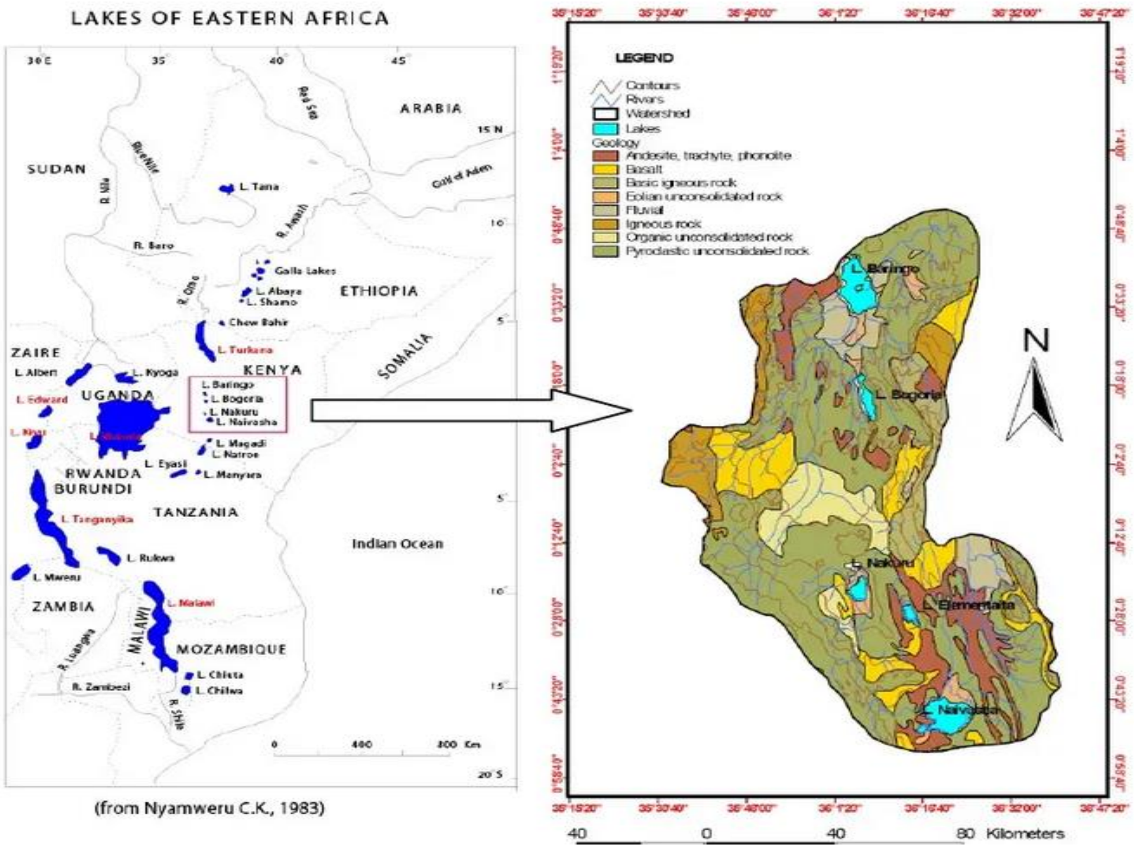
Based on productivity of aquifers in these hydrogeological zones, the Water Resources Authority (WRA) distinguish five main classes of aquifer as presented in Table 6-24.

Table 6-24 WRA Aquifer Classification

Class	Description	Aquifer name
Strategic aquifer	Aquifer used to supply significant amounts/ proportions of water in a given area and for which there are no available alternative resources, or where such resources would take time and money to develop; significant transboundary aquifers	Tiwi, Nairobi, central Merti, Sabaki, Nakuru, Kabatini, Lake Naivasha, Lamu Island
Major aquifer	High-yield aquifer systems with good quality water	Daua and Elgon volcanic rock aquifers
Minor aquifer	Moderate-yield aquifer systems with variable water quality.	Mandera - Jurassic (Mesozoic-Paleozoic)
Poor aquifer	Low- to negligible-yield aquifer systems with moderate to poor water quality.	Basement System
Special aquifer	Aquifer systems designated as such by WRMA	Isinya

REGIONAL HYDROGEOLOGY

The Project is located predominantly in the Kenyan Rift Valley region whose hydrogeology is dominated by intrusive and volcanic rocks, like Phonolites, Trachytes, Tuffs and Basalts. The aquifers are intricately associated with the lakes of this region and the lakes' drainage systems as illustrated in the Figure 6-28, and from the WRA classification criterion, they fall under strategic aquifers.



Source: https://www.tandfonline.com/doi/pdf/10.1623/hysj.54.4.765

Figure 6-28 Hydrogeology of the Kenyan Central Rift Valley adapted from Olago et al. 2009: Ground water and climate in Africa

The current groundwater use estimates according to the WRA in the Rift Valley Basin is at 198 Mm^3/a, which is about half of the estimated sustainable groundwater yield (398 Mm^3/a), with the annual groundwater recharge also estimated at approximately 3,168 Mm^3/a, and a sustainable annual yield of 398 Mm^3/a. As a result, this makes the ground water a reliable source of water for both industrial and domestic use, more especially during dry years and seasons.

The Project alignment is specifically located in the lake Naivasha, lake Elmentaita and lake Nakuru drainage areas. The ground water in this area, according to Allen et al.,1992, is mainly derived from rainfall from the highlands in the west and east of the rift valley. The aquifer properties in these drainage areas are influenced by tectonic movements of the rift, which create fault lines/cracks and weathered volcanic sediment deposits that impact the depth and permeability of the aquifers.

The hydrogeology of the drainage basins within the project location is discussed in the sections that follow:

THE NAKURU DRAINAGE BASIN

The hydrogeology of the basin is composed of fractured and weathered volcanic rocks and lacustrine sedimentary deposits. There are three aquifers in the Nakuru drainage basin namely Bahati, Olobanita and Baharini. These aquifers are recharged from the Mau and Bahati highlands which are characterized by high rainfall values. The ground water in this aquifer is confined with an average depth of boreholes of between 180 m and 225 m below ground level (mbgl), reaching ground water at depth ranging between 88 mbgl and 159 mbgl. The yield of the aquifer ranges between 10 m^3/h and 15 m^3/h. There are no known subsurface nor ground outlets from this basin except for the high-rate evapotranspiration. This is highly attributed to the thick pile of clay sediments in the basin that prevent underground seepage from the floor of the basin (Duhnforth et al., 2006). Groundwater flow in this basin flows in linear fissure zones found on the porous, fractured volcanic rocks and along weathered rock sediments.

The Nakuru basin is characterised by perched water tables and due to varying depth of the aquifers, several of them are likely to overlay each other. The average transmissivity of the drainage basin ranges approximately from 50 m^2 /day to 100 m^2 /day (Duhnforth et al., 2006). Generally, the high-confining pressures and confined conditions result in high yields for the boreholes in the section of the basin that the Highway Project crosses. With the water demand for Nakuru municipality exceeding current supply, according to the Nakuru Water and Sanitation Company, the easily accessible groundwater is the alternative source of water for domestic and industrial use since Lake Nakuru water is saline. From the WASREB, 2018 report, the Nairobi road well field which directly intersects with the Highway Project, has three boreholes used by the Nakuru Water and Sanitation Services Company to supply water in and around Nakuru City. In addition to this, are 8 boreholes in the Kabatini well field and 5 from the Baharini well field. Greater Nakuru area is being supplied with ground water from the Olobanita and Kabatini well fields (ADB,2004), which have averagely low yields of approximately 6.3 m^3/h (151.2 m^3/d) (Sosi. B 2020).

The important population density in the Nakuru Municipality affects surface water quality which in turn also affects groundwater quality as it is recharged by the polluted surface water from the Nakuru City and the Nakuru Industrial zone. Because the Highway Project goes through Nakuru Municipality, any effluent discharges from the road during construction and operation phases will drain easily into the shallow permeable aquifers of this region through storm waters and surface runoff. Thus, this could contribute to the contamination of local ground water.

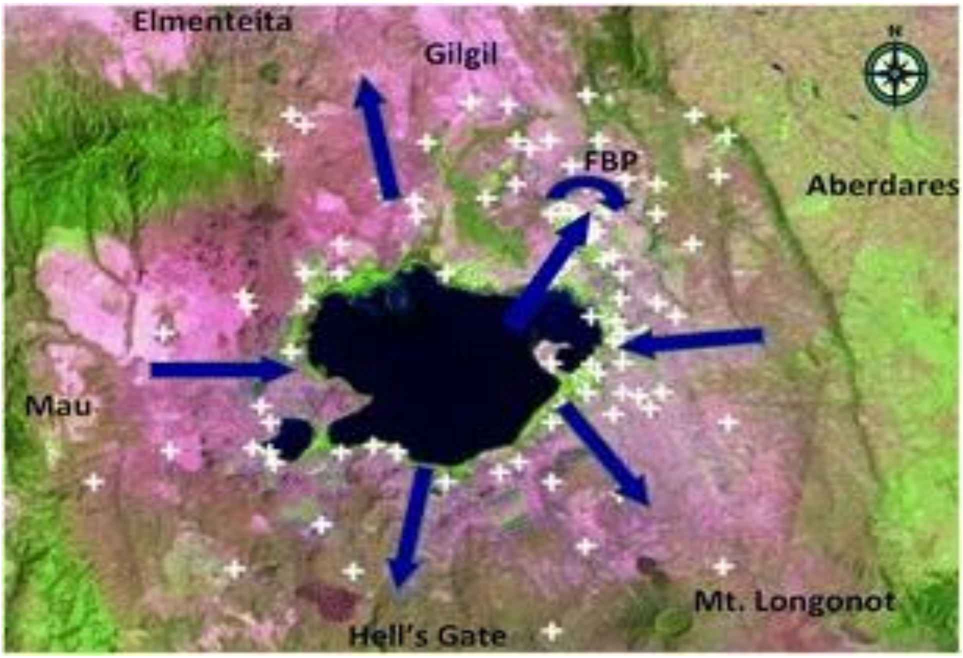
THE LAKE NAIVASHA - ELMENTAITA DRAINAGE BASIN

The Lake Naivasha-Elmentaita Basin is a protected area under section 22 of the Water Act. The hydrogeology of the basin is composed of weathered volcanic rocks and lacustrine deposits derived from erosion and redeposition of the sediments. The aquifers in the basin are shallow, occurring between 20-60 mbgl. They are characterised by relatively high discharge yields and transmissivity (Bwire-Ojiambo et al., 2003). The average depth of the boreholes ranges approximately from 167 mbgl to 297 mbgl. The basin is recharged by the Malewa and Gilgil rivers flowing from the Aberdares highlands in Nyandarua and the Mau escarpment respectively feeding Lake Naivasha and percolating into perched groundwater tables within the basin (Everald et al., 2002). There is no surface outflow from the aquifers. However, from groundwater levels and the isotopic composition of the groundwater, it is evident that there is groundwater outflow from Lake Naivasha both to the north and south as shown in Figure 6-29 (Becht et al., 2005). Some groundwater in Lake Naivasha basin evaporates and escapes in the form of steam in the geothermal areas, while the remainder flows to Lake Magadi and Lake Elmentaita. It takes thousands of years to reach these lakes (Becht et al., 2005).

Shallow aquifers occur between 20-60 mbgl around Lake Naivasha within lake sediments while deeper aquifers penetrated by the current boreholes range from 167 mbgl to 297 mbgl. Electrical resistivity measurements identified deeper aquifers around Lake Naivasha between 180 mbgl and 240 mbgl which are not penetrated by the current boreholes.

According to Van Oel et al. (2013), the Lake Naivasha-Elmentaita basin water balance is mainly influenced by the amount of precipitation received, inflow from rivers, evaporation rate, abstraction rate and the amount of outflow from the lake. However, the quantity of abstractions can only be estimated using data of the abstraction permits from water users. This data indicates that ground water abstraction exceeds the considered safe yield of the lake (Becht &Harper, 2002), with WRMA abstraction surveys showing that the approximate groundwater abstraction in the basin is 40M m^3/yr. beyond the safe yield, which was evaluated at 23,04M m^3/yr (Reta, 2011; DeJong, 2011).

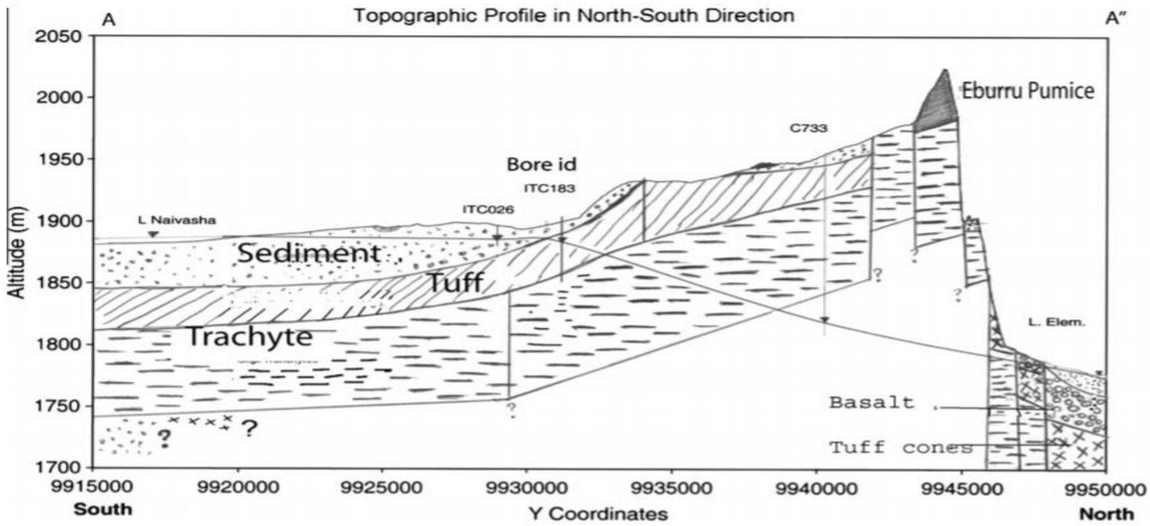
According to WASREB 2018, Naivasha town and its environs is supplied by ground water from 13 boreholes and several private water supply boreholes that support commercial irrigation. Further away, there is intense groundwater abstraction for irrigation purposes for the ongoing horticulture and floriculture activities, and the heavily chemical effluents from these farms percolate into the shallow groundwater tables in the area, contaminating it.



Source: Becht and Nyaoro, 2006. The white crosses indicate borehole locations

Figure 6-29 Ground water flow directions around Lake Naivasha

Lake Elmentaita is a shallow lake composed of coarse, salt impregnated, sedimentary rocks. It has a subsurface hydraulic connection to Lake Naivasha, where it recharges from (Figure 6-30). The groundwater potential around this area appears to be low and doesn't support boreholes drilling in the region.



Source: Yihdego and Becht, 2013.

Figure 6-30 Topographic and Geologic Profile along Lake Naivasha-Elmentaita Basin

REGISTERED GROUNDWATER WELLS

The WRA has provided the locations of registered groundwater wells within a distance 250 meters from the Project's right-of-way. A total of 54 groundwater well sites were identified by the WRA at 31 locations (Table 6-25). Some wells are listed as having multiple uses by the WRA. They range in depth from a minimum of 34 meters to a maximum of 248 meters and the average depth for all wells is 126 meters.

Table 6-25 WRMA Groundwater Well Information

Designation	Number of Wells	Well Locations
Public	14	Bibirioni, Cdn-Plot-Lanet, Limuru Township, Lodiani, Naivasha, Nakuru, Nakuru.Lr.6521, Rongai
Domestic	17	Dundori.Lr.10446, Mau Summit, Muguga, Nakuru, Nakuru Lr 8906, Naivasha, Naivasha 1554, Ndeiya, Parish Camp Nvsha.
Subsistence Irrigation	10	Lanet/6574, Mau Narok.426/4/1, Mau Summit.Lr.3913, Menengai, Naivasha, Naivasha.Lr.427, Naivasha.Lr.428, Nakuru, Longonot.
Commercial Irrigation	2	Naivasha
Industrial/Commercial	3	Lanet, Naivasha.Lr.13209, Nivasha
Others	8	Kinangop, Limuru, Molo R. Camp, Naivasha, Naivasha Lr.427, Nakuru

In addition to the wells above, the Marula farm to the north of Lake Naivasha shared positions of 10 wells located within 400m of the road alignment, and Soysambu conservancy (Nakuru County) shared positions of 2 wells in the same corridor. It is important to note that there are likely existing wells that were not officially registered with the WRA and for which a location is not available.

6.2.6 *SOILS AND SEDIMENTS*

6.2.6.1 PEDOLOGICAL CONTEXT

Within the Rift Valley the numerous generations of extensional faulting are known to have resulted in horst and graben structures. The smaller graben structures within the valley are described being often covered with superficial gravel or soils from volcanic ashes (Saggerson, 1991). This will conceal shallow variations in bedrock and consequent soil types. It is noted that much of the lava and tuff materials weather to pale brown or red ferruginous soils and often ferric rete is developed (Saggerson, 1991). This will result in generally favourable soil conditions along the road alignment and also, likely, the availability of suitable road construction gravels. There is mention of black swamp soils that have formed in some areas (e.g., Limuru at the southern edge of the alignments (Saggerson, 1991)) where drainage is impeded. These will be local deposits but will have an important effect on the road drainage and support.

6.2.6.2 SOIL PROPERTIES AND QUALITY

METHODOLOGICAL CONSIDERATIONS

The detailed methodology followed to assess soil properties and quality is presented in Chapter 5 - Section 5.3.2.5. Furthermore Appendix 5-1 described the specific soil sampling protocol. The specific location of the sampling stations is illustrated on Map 5-3.

As part of the ESIA development, a soil sampling campaign was carried out from March 1-3, 2021 and comprised the excavation of ten holes; seven along Highway A8, and three along Highway A8 South. The ten holes were each manually excavated using a shovel to depths of 0.5 m below ground level (mbgl). Soil samples were retrieved from the base of each hole for chemical analysis, and throughout the profile for determination of physical parameters. Copies of the original field data sheets are provided in Appendix 6-6, and photographs from each position are included in Appendix 6-7.

STANDARDS CONSIDERED

The IFC EHS Guidelines do not recommend specific soil contamination standards other than the locally applicable regulations and standards or, in their absence, other sources of soil quality criteria. There are no known soil quality guidelines/standards published in Kenya and, therefore, reference is made to Soil Screening Values (SSVs) published under Part 8 of the National Environmental Management: Waste Act (Act No. 59 of 2008) of the Republic of South Africa (RSA). These were presented in Government Notice GN R.331: National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (02 May 2014). They provide a tiered system of priority soil contaminants to facilitate the determination of sensitivity of the relevant receptor which may be subject to exposure, and are defined as follows:

- SSV1 represents the lowest value calculated for each parameter from both the human health and water resource protection pathways. SSV1 values are not land-use specific
- SSV2 represents the land-use specific soil concentration and are appropriate for screening level site assessment in cases where protection of water resources is not an applicable pathway for consideration

The Soil Screening Values (SSVs) are available on-line at this address:

- https://cer.org.za/wp-content/uploads/2010/03/national-environmental-management-waste-act-59-2008-national-norms-and-standards-for-the-remediation-of-contaminated-land-and-soil-quality_20140502-GGN-37603-00331.pdf

SOIL BASELINE CONDITIONS

PHYSICAL PROPERTIES

A summary of the physical properties is provided in Table 6-26 and the official laboratory results are presented in Appendix 6-8.

The bulk density of the soils varies substantially but in all cases is very low. The values are well below what would be expected from fine-grained soils (~1 100 kg/m^3) and, in the case of A8s-2 being a sandy soil (1 600 kg/m^3). This is almost certainly due to the high organic matter content (organic content of typical mineral soils would be expected to be 3–6 %) and porosity values (generally indicative of organic clays and silts) which indicate that these are likely topsoil.

The soil properties also do not appear to follow what would have been predicted from the geological and geomorphological setting in which the samples were obtained. Samples A8-3 and A8-4 (and potentially A8-5) would have been expected to be fine-grained due to their sedimentary origin and lowland settings, while the remaining samples would be expected to be sandier based on the trachytic origins. Elsewise, there is some variability, seemingly particularly within southern regions of the alignments.

Based on the available soils data, it is unlikely that the shallow soils would be suitable for use in earthworks as the variability and high organic contents would make their engineering properties unpredictable and unstable respectively. They are likely to have a very low permeability when compacted and as observed in the data, retain relatively large moisture contents. However, they could be stored aside and be used for landscaping purposes.

ANALYTIC CHEMICAL QUALITY

Analytical soil quality results obtained are summarised in Table 6-27 and the results are described in the following sections. Official Laboratory results are presented in Appendix 6-9.

Table 6-26 Summary of Physical Properties

Sample	Grain Size (%)			Organic Matter (%)	Bulk Density (kg/m^3)	Porosity (%)	Permeability (m/sec)	Erodibility (K-Value)	Moisture Content (%)	Soil Water Retention (kPa)
	Gravel	Sand	Mud							
A8-1	0	0.1	99.9	34.3	182	77.50	4.14E-04	0.047	17.4	233.3
A8-2	0	0	100	27.2	118	86.99	1.48E-04	0.0474	11.5	194.1
A8-3	0	3.7	96.3	30	194	76.02	2.07E-04	0.0445	18.6	19.6
A8-4	0	0	100	20.9	98	89.24	1.88E-04	0.0463	9.7	158.4
A8-5	0	0	100	32.3	211	73.85	6.90E-04	0.0405	20.1	26.3
A8-6	0	0	100	30.4	215	73.20	2.30E-04	0.0421	20.4	57.1
A8-7	0	0	100	44.6	405	57.76	7.60E-07	0.0381	35.9	88.2
A8s-1	0	0	100	27.7	195	75.44	1.04E-03	0.0454	18.6	19.2
A8s-2	0	72.3	27.7	30.3	156	80.16	1.04E-04	0.007	15	98.5
A8s-3	0	0	100	41.6	421	57.00	7.76E-06	0.0458	37.3	21.1
Minimum	**0**	**0**	**27.7**	**20.9**	**98**	**57**	**7.60E-07**	**0.007**	**9.7**	**19.2**
Maximum	**0**	**72.3**	**100**	**44.6**	**421**	**89.24**	**1.04E-03**	**0.0474**	**37.3**	**233.3**
Mean	**0**	**7.6**	**92.4**	**31.9**	**219.5**	**74.72**	**3.03E-04**	**0.04**	**20.5**	**91.58**
Std. Dev.	**0**	**21.6**	**21.6**	**6.56**	**103.4**	**10.0**	**3.11E-04**	**0.011**	**8.74**	**74.80**
Lower Bound	**0**	**0.000**	**70.8**	**25.37**	**116.13**	**64.69**	**0**	**0.029**	**11.71**	**16.78**
Upper Bound	**0**	**29.2**	**100**	**38.49**	**322.87**	**84.74**	**6.14E-04**	**0.052**	**29.19**	**166.38**

Table 6-27 Summary of Chemical Analytical Results

Sample Date		01/03/2021	01/03/2021	01/03/2021	02/03/2021	02/03/2021	02/03/2021	03/03/2021	03/03/2021	03/03/2021	03/03/2021	SUMMARY STATISTICS					
Sample Time		12:30	13:15	16:00	13:10	14:25	15:20	07:50	12:35	10:20	09:10	Minimum	Maximum	Calculated Mean	Standard Deviation	Lower Bound	Upper Bound
Sample Location ID		A8-1	A8-2	A8-3	A8-4	A8-5	A8-6	A8-7	A8s-1	A8s-2	A8s-3						
Sample Depth (m)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5						
Analytical Laboratory		SGS Kenya Limited Laboratory Services															
Laboratory Analysis Report No.		MA21-00916.001	MA21-00916.002	MA21-00916.003	MA21-00934.001	MA21-00934.002	MA21-00934.003	MA21-00947.001	MA21-00946.001	MA21-00946.002	MA21-00946.003						
	Units	SAMPLE LOCATIONS															
Metals																	
Cadmium	mg/kg	0.56	0.51	0.3	0.33	0.4	0.28	0.4	0.37	0.33	0.49	0.28	0.56	0.40	0.09	0.13	0.67
Chromium	mg/kg	6.06	3.12	6.95	21.38	8.34	25.24	12.11	3.15	3.31	17.7	3.12	25.24	10.74	7.66	0.00	33.71
Copper	mg/kg	4.33	3.92	9.91	5.52	9.08	8.87	4.74	3.68	5.01	10.89	3.68	10.89	6.60	2.62	0.00	14.46
Lead	mg/kg	22.03	16.71	12.56	10.76	15.35	14.41	28.07	12.53	12.58	27.65	10.76	28.07	17.27	6.07	0.00	35.47
Nickel	mg/kg	7.83	2.67	4.28	7.33	7.21	15.85	6.72	2.43	2.96	8.53	2.43	15.85	6.58	3.78	0.00	17.93
Zinc	mg/kg	86.8	95.37	77.13	43.72	59.03	70.15	49.38	91.1	71.71	134.45	43.72	134.45	77.88	24.89	3.23	152.54
Petroleum Hydrocarbons																	
GRO (C_6-C_{10})	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-
DRO (C_{10}-C_{28})	mg/kg	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	-	-
BTEX Compounds																	
Benzene	µg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-
Toluene	µg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-
Ethylbenzene	µg/kg	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	-	-	-
Xylenes (sum)	µg/kg	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	-	-
Polycyclic Aromatic Hydrocarbons																	
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Benzo(a)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Benzo(b)fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Benzo(k)fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-

Notes: Lower and upper bounds based on 3x standard deviation from mean
0 adopted for lower bound where calculated bound <0

METALS

Expectedly given the geological origins of the soils together with the high organic carbon content, the analysed metals were all recorded above their respective laboratory detection limits within each of the ten samples analysed. Adopting three standard deviations from the mean as being a measure of potentially significant deviation (i.e., statistical outlier), statistical evaluation of the dataset indicates all samples to be of broadly similar quality.

Some lesser variation is, however, apparent, particularly as follows and illustrated on Figure 6-31:

- The concentrations of nickel at A8-6 (15.85 mg/kg), and zinc at A8s-3 (134.45 mg/kg) are markedly higher than elsewhere;
- Chromium is higher within samples A8-4 and A8-6;
- Lead is higher within samples A8-1, A8-7 and A8s-3.

Whilst unconfirmed, it is likely that these seemingly localised difference is a function of the relatively small dataset and representative of local variances in the topsoil.

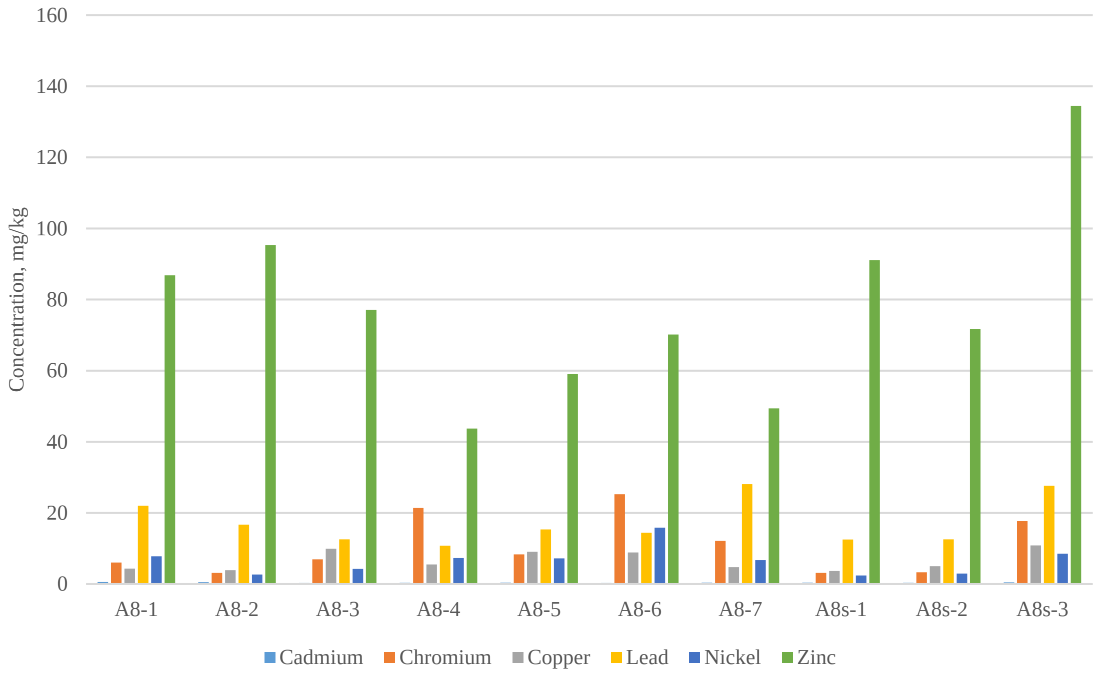


Figure 6-31 Metal Concentrations in Collected Soil Samples

The RSA SSVs for the metals considered as part of the sampling exercises are provided in Table 6-28 and are presented alongside the maximum concentrations recorded as part of the recent sampling; exceedances of any SSV are highlighted in blue.

Table 6-28 Recorded Concentrations (mg/kg) versus South African SSVs for Analysed Metals

Metal	SSV1	SSV2 (Land-Use Dependent)			Recorded Maximum
		Informal Residential	Standard Residential	Commercial/ Industrial	
Cadmium	7.5	15	32	260	0.56
Chromium	46 000	46 000	96 000	790 000	25.24
Copper	16	1 100	2 300	19 000	10.89
Lead	20	110	230	1 900	**28.07**
Nickel	91	620	1 200	10 000	15.85
Zinc	240	9 200	19 000	150 000	134.45

The concentrations of all metals were well below their respective RSA SSV1 values with the exception of lead and thus are not considered to represent a potentially significant source of risk. Lead was above its RSA SSV1 within the following three samples:

- A8-1 (22.03 mg/kg);
- A8-7 (28.07 mg/kg);
- A8s-3 (27.65 mg/kg).

With reference to the RSA Framework for the Management of Contaminated Land, which outlines the methodology for the derivation of the SSVs, the SSV1 for lead is based on the protection of drinking water resources and, therefore, may be overly conservative in the current context. When considering freshwater aquatic ecosystems and human health under an informal residential scenario (excluding consideration of subsistence agriculture), equivalent SSVs of 100 mg/kg and 110 mg/kg would be respectively applicable, which are far greater than the maximum value recorded. Further, an average lead concentration of 17.27 mg/kg is calculable across all samples. On the basis of the above, and providing that appropriate institutional controls are adopted during earthworks activities alongside suitable material management practices, the chemical quality of soils is unlikely to represent a significant constraint to the development.

ORGANICS

All organic determinants were recorded below their compound specific laboratory limits of detection within each of the ten soil samples obtained. Whilst hydrocarbon staining and odours were noted at certain positions, the results indicate that these impacts are highly localised and are thus not considered to be significant.

6.2.6.3 SEDIMENT QUALITY

METHODOLOGICAL CONSIDERATIONS

The detailed methodology followed to assess sediment properties and quality is presented in Chapter 5 - Section 5.3.2.5. Furthermore Appendix 5-1 described the specific sediment sampling protocol. The specific location of the sampling stations is illustrated on Map 5-5.

As part of the ESIA development, sediment sampling was carried out during two complementary campaigns on December 12-14, 2020 and April 30-May 2, 2021, both during rainy seasons. A total of eight sites were sampled out of the ten watercourses targeted. Two sites could not be sampled due to the substrate type (hard rock) and because of the dry waterbed leaving the impression watercourse non-existent. Whenever possible, sampling was conducted at both upstream and downstream positions from the crossing site. Each sample was composed of three homogenized subsamples and sampling sites were described using sediment sampling data sheets.

Copies of the original field data sheets are provided in Appendix 6-10, and photographs from each sampling site are included in Appendix 6-4 (same as for surface water). Laboratory certificates of analysis are provided in Appendix 6-11. Laboratory certificates of analysis are provided in Appendix 6-12.

STANDARD CONSIDERED

Since there are no sediment quality criteria known in Kenya, results are compared with the ANZECC – Sediments quality guidelines (2013) and the CCME - Criteria for the assessment of freshwater sediment quality (2021). The latter Canadian criteria include a Threshold effect level (lower values) and a probable effect level (higher values). The guidelines and criteria are complementary and intend to cover most parameters analysed.

BASELINE SEDIMENT CONDITIONS

Table 6-29 summarize sampling sites position and qualitative observations recorded at the time of sediment collection.

Table 6-29 Sediment Sampling Locations and Observations

Sampling Site ID	1		3	4+	5	8		10	12		15	B3	B7	
	Upstream	Downstream	Upstream	Upstream	Upstream	Upstream	Downstream	Downstream	Upstream	Downstream	Downstream	Upstream	Upstream	Downstream
Date	2021-05-02	2021-05-02	2020-12-14	2020-12-13	2020-12-13	2021-05-01	2021-05-01	2020-12-12	2021-04-30	2021-04-30	2020-12-12	2020-12-14	2021-05-02	2021-05-02
Time	10:39	10:49	10:16	12:56	10:09	11:26	10:45	12:22	13:31	12:45	10:40	14:50	08:14	08:30
Latitude	-0,798639	-0,798833	-0,694964	-0,667931	-0,571453	-0,357694	-0,358250	-0,199111	-0,205167	-0,205806	-0,160942	-0,975383	-0,906778	-0,907333
Longitude	36,527361	36,525722	36,422661	36,387936	36,360656	36,202139	36,201833	35,830092	35,784639	35,785056	35,695558	36,578656	36,515056	36,514806
Weather Conditions	clear/sunny	clear/sunny	n/a	n/a	n/a	clear/sunny	clear/sunny	n/a	clear/sunny	clear/sunny	n/a	n/a	clear/sunny	clear/sunny
Water Presence	yes	yes	n/a	n/a	n/a	yes	yes	n/a	yes	yes	n/a	n/a	no	no
Sampling Success	no	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no
Sampling Depth (m)	n/a	n/a	n/a	n/a	n/a	0.3	0.3	n/a	0.2	0.2	n/a	n/a	n/a	n/a
Watercourse Depth (m)	1	3	0.1	4	0.5	1	2	0.05	0.3	1	0.09	0.3	2	10
Substrate*	Hard rock	Hard rock	n/a	n/a	n/a	Hard rock, boulder, pebble, sand	Boulder, pebble, silt	n/a	Boulder, cobble, pebble, sand, silt	Cobble, pebble, sand, silt	n/a	n/a	Sand	Sand
Sediment Odor	Decomposition of dead animal	None	n/a	n/a	n/a	Sulfur	Sulfur	n/a	n/a	Fertilizer	Sulphur	n/a	Animal dung	n/a
Sediment Color	Grey	Grey	Grey black	Black brown	Black brown	Grey-white	Grey-white	Grey black	Black, grey	Grey, black	Brown black	Black grey	Brown white	Brown white
Debris Present	Food wrappers, plastics	Plastics	Electronic wastes, clothing, plastics	Plastics and other litter	Plastics	Food wrappers, plastics	Food wrappers, plastics	Plastics	Plastics and soap wrappers	None	Thrown plastics, papers, soap wrappers	Tire pieces, plastics	Plastics	Plastics & burned metals
Organic Material	Grass, leaves	Grass, leaves	Plant materials	Plant materials	Plant materials	Throut roses, grass, leaves	Grass, leaves	Plant material	Roots	Leaves, roots	Plant material	Plant materials	Shrubs, grass	Shrubs, grass
Living Organisms	Tadpoles	Tadpoles	Red worms	None	None	Earth worms	Earth worms	None	Worms, flies	Worms	Red worms	Red worms	None	None
Site Observations	Homestead, planted forest	Planted forest, cattle grazing land, homestead	Agricultural farms in the surrounding, cattle watering point, car wash, bathing	Irrigation of small farms adjacent to the river, car washing, bathing and washing of utensils	Surrounded by ranch on both sides	Wetland, picnic site	Faced ranch and residential area	Maze plantation, forested area, cattle rearing and fast flowing river	Planted forest, cultivated place	Homestead and cultivated land	Car wash, washing of utensils, laundry and cattle drinking point	Car wash and water abstraction loading point	Thicket and bushes surrounded by hills	Railway construction, planted forest

Notes: n/a : data not available
Certain sampling sites were described only at upstream or downstream position
* See Table 6-30 for complementary fine sediment composition from laboratory analysis

PHYSICAL PROPERTIES

A summary of the physical properties is provided in Table 6-30. Grain size distribution for the watercourse sediment samples varies greatly between sites and within a single watercourse (upstream vs. downstream). Overall, sand is the most common sediment found at sampling sites. Organic matter is present in all samples, although typically in weak proportions (< 12 %) with a few exceptions (samples 8 and 12) where values are within 22 % to 35 %. Moisture content of sediment samples ranges from 16 % to 64 %. Some of the moisture levels recorded were to be expected since sampling was strictly conducted during rain seasons. Nonetheless, samples collected in April-May tend to have a greater moisture content than those from December.

CHEMICAL QUALITY

The reported analytical results are summarised in Table 6-30.

OIL AND GREASE

No guidelines or criteria are available for this parameter. All results obtained for the oil and grease analysis are below the laboratory's detection limits.

POLYCYCLIC AROMATIC HYDROCARBONS

All results obtained for the Polycyclic Aromatic Hydrocarbons (PAH) analyses are below the laboratory's detection limits. The criteria of the probable effect level, except for Acenaphtene, have values above the 0.1 mg/kg detection limit. Thus, it can be concluded that PAH results for sediment samples are rather low and most likely all within acceptable levels, being underneath the applicable criteria.

METALS

All analysed sediment samples resulted in recorded metals value above their respective laboratory detection limits. Metal concentrations above the considered guidelines and criteria were obtained for:

- Cadmium within sample 12 downstream (Threshold effect level);
- Chromium within sample 3 downstream (ANZECC guidelines, Threshold effect level and Probable effect level);
- Zinc within samples 3 upstream, 5 downstream, 10 upstream and 4+ upstream and downstream (Threshold effect level).

Most metal concentrations obtained for the eight samples analysed were within the guidelines and criteria or just slightly above.

It is worth mentioning the chromium concentration recorded for sample 3 downstream exceeds the probable effect level more than fivefold. This result is unique as no such value was obtained for any other sediment chemical analysis. In comparison, the highest chromium result recorded in soil samples was around 25 mg/kg (see Table 6-30). The sediment sample of a 491 mg/kg concentration is thus much greater than possible natural concentrations and likely from anthropogenic sources as this metal is largely related to several industrial applications. Chromium, depending on its form, can potentially have toxic effects on humans and living organisms exposed to it or when consumed (Tumolo et al., 2020; Government of Canada, 2015).

Zinc is widely used for industrial (eg. for galvanising purposes) and domestic applications (electronics and electrical appliances) but is also found naturally in rocks and soils that get eroded and account for a large input of zinc into watercourses (Government of Canada, 2019). Similarly, cadmium also occurs naturally in rocks and enters the environment through anthropogenic sources including metal production, stationary fuel combustion, transportation and solid water disposal (Government of Canada, 1994). Although both metals can have harmful effects on the environment, biological diversity and to a certain extent, human health, the concentrations recorded above the sediment quality guidelines only exceeded slightly the Threshold effect level (the most sensitive one) and therefore should not constitute any serious risk to living organisms shortly exposed to them.

Table 6-30 Summary of Sediment Analytical Results

Parameter	ANZECC Sediment Quality Guidelines (mg/kg) [1]	CCME Criteria for the assessment of freshwater sediment quality (mg/kg) [2]		Sample Location ID / Sampling Date / Analytical Results																	
				3		5		8		Duplicate of 8		10		15		12		B3		4+	
				Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
	Guideline value	TEL	PEL	2020-12-14	2020-12-14	2020-12-13	2020-12-13	2021-05-01	2021-05-01	2021-05-01	2021-05-01	2020-12-12	2020-12-13	2020-12-12	2020-12-12	2021-04-30	2021-04-30	2020-12-14	2020-12-14	2020-12-13	2020-12-13
Grain Size Distribution																					
Gravel	-	-	-	67.2	0	0	20.8	0	0	-	-	94.6	81.4	0	7.2	0	0	0	86	69	38.2
Sand	-	-	-	32.8	0	0	79.2	100	5.2	-	-	5.4	18.6	100	92.9	25.1	91.6	0	14	31	61.8
Mud	-	-	-	0	100	100	0	0	94.8	-	-	0	0	0	0	74.9	8.4	100	0	0	0
Other Organic Compound																					
Organic matter (%) (Loss on Ignition)	-	-	-	4.5	7.9	9.8	5,00	34.5	25.7	33.6	27.8	3.6	4.6	11.9	11.4	25.2	22.4	1.8	1.4	3.5	3.7
Other Analysis																					
Moisture content (%)	-	-	-	30.4	32.3	36.4	23.6	62.9	49.9	64.2	51.5	25.4	24.9	45.8	46.4	53.6	42.1	19.2	19.3	16.2	18.9
Oil And Greases																					
Oil and Greases (mg/kg)	-	-	-	<0.1	<0.1	<0.1	<0.1	-	-	-	-	<0.1	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	<0.1
Polycyclic Aromatic Hydrocarbons (Mg/Kg)																					
Acenaphtene	-	0.0067	0.0089	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphtylene	-	0.0059	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	-	0.047	0.24	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (a) anthracene	-	0.032	0.39	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (a) pyrene	-	0.032	0.78	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (b) fluoranthene	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (g,h,i) perylene	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (k) fluoranthene	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	-	0.057	0.86	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo (a,h) anthracene	-	0.0062	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	-	0.11	2.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	-	0.021	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Indeno (1,2,3-cd) pyrene	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Naphtalene	-	0.035	0.39	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	-	0.042	0.52	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	-	0.053	0.88	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Parameter	ANZECC Sediment Quality Guidelines (mg/kg) [1]	CCME Criteria for the assessment of freshwater sediment quality (mg/kg) [2]		Sample Location ID / Sampling Date / Analytical Results																	
				3		5		8		Duplicate of 8		10		15		12		B3		4+	
				Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
	Guideline value	TEL	PEL	2020-12-14	2020-12-14	2020-12-13	2020-12-13	2021-05-01	2021-05-01	2021-05-01	2021-05-01	2020-12-12	2020-12-13	2020-12-12	2020-12-12	2021-04-30	2021-04-30	2020-12-14	2020-12-14	2020-12-13	2020-12-13
Metals (mg/kg or % if indicated																					
Cadmium	1.5	0,60	3,5	0.35	0.36	0.25	0.29	0.22	0.29	0.31	0.23	0.53	0.29	0.14	0.15	0.5	0.76	0.3	0.24	0.3	0.21
Copper	65	36,0	200	7.91	5.67	3.66	4.46	11.88	7.74	11.67	8.46	14.37	3.21	3.38	4.94	16.28	26.78	4.75	0.39	9.18	11.3
Nickel	21	-	-	8.01	6.92	5.09	7.16	3.14	7.54	2.69	1.66	5.16	2.65	3.44	5.55	2.87	2.53	1.44	0.59	12.89	17.82
Chromium	80	37,0	90	7.09	491	5.65	7.06	2.24	0.74	2.01	0.48	5.79	4.57	4.39	5.57	2.48	4.84	1.93	3.06	16.54	24.04
Iron (%)	-	-	-	3.15	0.62	0.14	4.04	-	-	-	-	0.03	0.15	0.16	0.02	-	-	0.63	0.65	5.24	7.51
Cobalt	-	-	-	6.58	4.52	3.46	5.36	-	-	-	-	6.23	3.67	2.77	3.68	-	-	2.3	2.13	12.35	20.06
Lead	50	35,0	91	10.76	10.04	10.44	18.08	8.12	3.59	7.33	3.68	21.05	12.38	8.19	10.36	10.03	14.29	11.33	10.86	13.88	18.36
Zinc	200	120	310	133.11	117.54	87.79	136.14	48.11	38.86	52.64	42.6	133.9	100.93	67.21	90.17	59.06	67.25	116.76	111.44	123.62	166.74
Aluminium (%)	-	-	-	2.44	0.86	0.22	2.58	-	-	-	-	0.05	0.22	0.24	0.05	-	-	0.89	0.91	3.2	4.03

Notes: Values above those of guidelines and criteria are highlighted according to color patterns associated with the greatest value criterion applicable.
Certain samples were not analysed for all parameters and an absence of value is identified with -.
[1] Australian and New Zealand Environment and Conservation Council – Sediments quality guidelines.
[2] Canadian Council of Ministers of the Environment - Criteria for the assessment of freshwater sediment quality. TEL: Threshold effect level; PEL: Probable effect level.

6.3 BIOLOGICAL ENVIRONMENT

This section describes the baseline conditions for the valued environmental components (VEC) of the biological environment selected for the Project (See Chapter 5 – Section 5.2 for details about VECs selection). For each biological component, a description of species diversity within the LAA is provided, and species of conservation interest are identified. These include threatened species according to the IUCN, nationally protected species, and endemic and/or restricted-range species. According to IFC's PS6 Guidance Note (IFC, 2019), the term endemic is defined as restricted-range and restricted range refers to a limited extent of occurrence (EOO) (<50,000 km^2 for terrestrial species and <500 km linear geographic span for aquatic species). Important habitats for each taxonomic group are also described, for which particular attention will be given in the impact analysis (chapter 8).

Species of conservation interest are then further analysed in the Critical Habitat Assessment (section 6-3-9 and Appendix 6-23) and Ecosystem Services are described (section 6-3-10).

6.3.1 METHODOLOGICAL CONSIDERATIONS

A thorough review of literature combined with field surveys were undertaken to describe the biological baseline conditions. A first biodiversity reconnaissance survey was carried out (November 2020), followed by two rounds of biological surveys during the dry season (February 2021) and the wet season (April 2021) to gather field data on terrestrial habitats and flora, birds, amphibians and reptiles, small and large mammals, as well as freshwater ecology. In parallel to these field surveys, camera-traps were deployed in two key areas for fauna to better understand wildlife movement and connectivity. These cameras were active from the end of February 2021 to the beginning of June 2021. The general methodology for the biological surveys is presented in Chapter 5 - Section 5.4.2.6. Furthermore, the detailed methodology for each biological component is described within the sectorial reports found in Appendices 6-14 to 6-19, and 6-21.

Additional specific analyses and modelling to better characterize biodiversity in the RAA were completed. These include:

- Land use and land use change analysis (Appendix 6-13);
- Habitat suitability and ecological connectivity modelling (Appendix 6-20);
- Standardised biodiversity sensitivity analysis (Appendix 6-22);
- IFC Performance Standard 6 Habitat Analysis, including Critical Habitat Assessment (Appendix 6-23).

Furthermore, a characterization of ecosystem services in the RAA was also completed to better understand these services and the level of dependency of local communities on them (Appendix 6-24).

Finally, the biological baseline also relies on information gathered through stakeholder consultations. Notably, two workshops relative to wildlife movement and connectivity were held, assembling wildlife experts, environmental NGOs and private land conservancy representatives (see Chapter 7 for more detail). Furthermore, focus groups on ecosystem services with local community representatives were done in each sub-county crossed by the Project (see Chapter 7 for more detail).

6.3.2 BIODIVERSITY CONTEXT

NATIONAL CONSIDERATIONS

Kenya is recognized for its biodiversity due to the abundance and variety of species present in the country's diverse ecosystems. This rich biodiversity can be attributed to a number of factors, including a long evolutionary history, variable climatic conditions, and diverse habitat types and ecosystems (NEMA, 2011). In fact, the country has a large diversity of ecological zones and habitats, including lowland and mountain forests, wooded and open grasslands, semi-arid scrubland, dry woodlands, inland aquatic, as well as coastal and marine ecosystems. They also support livelihoods through the provision of food, medicine, wood for construction and fuel, and services such as water catchment areas. They perform important watershed functions, in addition to providing sites for high plant and animal biodiversity. Wetlands also contribute greatly to Kenya's economy in terms of agriculture, livestock production, energy production (through hydroelectric developments), fisheries and tourism. Forests are the backbone of Kenya's economy through agriculture and tourism. (CBD, 2021).

Kenya's known biodiversity assets include 7 000 plants, 315 mammals, 191 reptiles, 180 freshwater fish, and 88 amphibians (NEMA, 2009). The country also has one of the richest avifauna in Africa with approximately 1,162 bird species recorded to date (Lepage, 2021). Approximately 170 bird species are Palearctic migrants, with another 60 species being Afrotropical migrants (Bennun and Njoroge, 1999). The Rift Valley is considered as a major flyway for waterbirds and Palearctic migrants, notably birds of prey during the spring and autumn passage. The project is also located in close proximity to large endorheic lakes, which are all important congregatory habitat for waterbird species and seasonal feeding stations for large numbers of Lesser Flamingo (*Phoeniconaias minor*).

The major biodiversity concentration sites fall within the existing protected areas network (national parks, reserves and sanctuaries) which are mostly managed by the Kenya Wildlife Service (KWS). However, over 70 % of the national biodiversity occurs outside the protected areas (NEMA,2011).

REGIONAL CONSIDERATIONS

The Regional Assessment Area is composed of a complex landscape with diverse habitat types and topography, home to a variety of large, wide-ranging species. It is set for the most part in the Southern Kenya Rangeland ecosystems, and more precisely within the Eburru Forest and Naivasha-Elmentaita-Nakuru lakes sub-ecosystem. This ecosystem includes several protected areas and a number of public and private sanctuaries and ranches with substantial wildlife populations. The rest of the area is occupied by a mixture of small-scale holdings and private lands under various uses. (Government of the Republic of Kenya, 2017). Within the landscape, six areas can be distinguished along the different road sections, which are illustrated on Map 6-1 Regional Biodiversity Context:

1 The south of the study area, along road sections 1 and 5, has an Afromontane character with a large proportion of the land covered by natural landscapes. While agricultural land and pasture are present, areas of natural or sub-natural forests are better represented. This trend is particularly evident at the eastern limit of the study area, bordering the Kinale Forest. On the A8, an escarpment marks the transition from the Naivasha Plateau to the mountain, this area is occupied by dense mountainside woodlands and a few well-structured acacia forests. Overall, on the west side of this area, there is a continuum of relatively well-preserved environments.

2 South of Naivasha, by road section 6 (A8 South), is a plateau comprising pastures with relatively little cultivated area. It is bordered to the west by the Longonot Volcano National Park and dense woodlands. To the east and south this area is bordered by a transitional zone comprising the mountainous southern part of the study area. To the East, the landscape is heavily transformed. To the south, on the other hand, more natural vegetation is found on the escarpment of the Rift valley.

3 Between Naivasha and Nakuru, along road section 2, there is a vast plain also characterised by agriculture and the presence of several urban areas. However, major natural elements are found with Lake Elmentaita and large areas of thicket and degraded woodland on the slopes of the steepest hills. Well-formed woodlands are often found along the banks of major streams and open to wooded savannahs. Two conservation areas are located in this area, Soysambu Conservancy, located north of Elmentaita Lake and

Marula Estates located just north of the city of Naivasha. Agriculture and grazing are practised in these private conservation areas, but very large natural or semi-natural environments are also present.

4 Section 3 of A8 is located in the urban area of Nakuru. It consists of an essentially human transformed landscape, with the fenced off Lake Nakuru national Park to the south of the City. No natural environments are found along the road.

5 To the west of Nakuru, along road section 4 up to Rongai, is a vast and highly agricultural plain, where natural or semi-natural environments are almost excluded. This area has a rather heterogeneous composition and contains a mosaic of crops, pastures and forest plantations interspersed with small farms and larger estates.

6 The north of road section 4, past Rongai, is an area of altitude largely dominated by an agricultural matrix and by plantations of exotic species (Eucalyptus, resinous, etc.). Natural forest elements, most often subject to high exploitation pressure (domestic uses), are present, however, they are located almost exclusively in valleys. There are also large areas of highly grazed grasslands. On the eastern flank (towards Nakuru) of this mountainous area, there is a transitional zone where landscapes comprised of forests and forested meadows with Acacias are found.

PROTECTED AREAS

There are several Protected Areas and Internationally Recognised Areas (IRA) within the RAA. According to IFC (2019), a protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. Whereas, Internationally Recognised Areas are defined as UNESCO Natural World Heritage Sites, UNESCO Man and the Biosphere Reserves, Key Biodiversity Areas, including Important Bird Areas (IBA), and wetlands designated under the Convention on Wetlands of International Importance (the Ramsar Convention) (IFC, 2019). Table 6-31 lists the legally protected areas and IRAs, encountered in the RAA.

The RAA also contains many private conservancies, which do not meet IFC's definition of legally protected areas. Private conservancies are listed in Table 6-32. Although not legally protected, these areas play an important role in the protection of wildlife within the study area. Map 6-1 illustrates the regional biodiversity context, including protected areas, IRAs, forest reserves and private conservancies.

Zoomed in maps for sites found in close proximity (<1km), overlapping, or adjacent to the road are available in Appendix 6-25, showing current land use, site boundary, and ROW.

Table 6-31 Protected Areas and Internationally Recognized Areas within the RAA

Road Section	Site	Status and designation	Area (ha)	Overview	Distance from RoW
3	Lake Nakuru National Park	National Park IBA World Heritage Site Ramsar site	18,800	This area comprises a very shallow, strongly alkaline lake (3,300 ha), with surrounding woodland and grassland. The lake is internationally famous for its populations of Lesser Flamingos (numbers can reach 1.5 million at times) being a very important feeding site for this species. At times, it is a major feeding ground for the Great White Pelicans. Globally threatened species such as the Madagascar Squacco Heron can also be found in the park. It is also a sanctuary for the Black Rhinoceros, the Nubian Giraffe and carnivores such as Leopard and Cheetah.	350 m
2	Lake Elmentaita	National Sanctuary IBA World Heritage Site Ramsar site	7,200	Elmentaita is a shallow alkaline lake (1,800 ha), 20 km south-east of Nakuru City. The surrounding landscape is characterized by rocky faults, volcanic outcrops and cones. The lake consistently holds internationally important populations of Lesser Flamingos and Pied Avocets and is a key breeding site for the Great White Pelicans. The Nubian Giraffe is also found in the area.	860 m the road is adjacent to the World Heritage Site's buffer zone along 11.5 km.
4	Mau Forest Complex	Complex of five Forest Reserves[1] and one Natural Reserve IBA	270,000	The Mau Forest Complex is the largest indigenous montane forest in East Africa and encompasses five main Forest Reserves: Eastern, Western and South-western Mau, Trans-Mara and Ol Pusimoru. A sixth large block, the Maasai Mau is as yet ungazetted. It serves as a critical water catchment area for Kenya and is the source from which numerous rivers flow, many of them draining into bodies of water like Lake Victoria, which receives 60% of its water from Mau. The Mau generally has a rich highland bird community, characteristic of the Central Kenya highlands, including a number of regional endemic, restricted-range and regionally threatened species. Notable mammals such as the African Elephant inhabit these forests.	2.9 km
4	Mount Londiani Forest Reserve[2]	Forest Reserve[1]	30,152	According to the delimitation available on Protected Planet (UNEP-WCMC (2022) this forest reserve encompasses the Koibatek and the Sabatia Forest Block, Koibatek forest block being the one crossed by the A8 Highway. The larger part of the forest is dominated by plantations and agriculture, with small patches of natural vegetation remaining. .	the road crossed the site along 5.6 km
2 and 6	Lake Naivaisha	IBA Ramsar Site	23,600	The site consists of a shallow freshwater lake (15,600 ha) and its fringing Acacia woodland (c. 7,000 ha). Depending on water levels, it can be a significant site for the African Spoonbill and the Red-knobbed Coot. The lake also supports a large population of Hippopotamus.	90 m – Ramsar Site the road is adjacent to the IBA along 11.2 km
6	Hells Gate National Park	National Park IBA	68	The Hells Gate National Park lies within the Eco-Climatic zone IV that is described as environmentally fragile and prone to land degradation. It is situated on the Rift Valley floor. The general topography of the area is characterized by a wide range of features associated with volcanic activity. There are over 100 bird species recorded inside the park, including the only nationally protected nesting colony of the Critically Endangered Rüppell's Vultures (19 nests per year). African White-backed Vulture also occurs in the Park alongside a range of large mammals including Cheetah, Leopard, Spotted Hyena, Mountain Reedbuck, Plains Zebra and Thompson's Gazelle.	1.3 km
1 and 2	Aberdare National Park	National Park IBA 3	190,000	The Aberdare or Nyandarua mountains are an isolated volcanic range that forms the easternmost wall of the Gregory Rift Valley, to the east of the high Kinangop/Laikipia plateau. They are about 100 km long from north to south, with two main peaks above 3,900 m separated by a land above 3,000 m. Sharpe's Longclaw occurs on the southern slope grasslands (apparently at low densities) and the Aberdare Cisticola occurs locally in the tussock moorland. Black Rhinoceros, African Elephant and the endemic shrew Surdisorex norae also inhabit the Park.	16.5 km
1	Kinangop Grasslands	IBA	72,000	These montane grasslands lie on the Kinangop Plateau, a wide stretch of land bounded by the forests of the Aberdare mountains and Kikuyu Escarpment to the east and south, and by a steep scarp dropping to the Rift Valley floor on the west. Originally, the entire plateau was covered with almost treeless, tussocky grassland, including many tussock bogs in the swampy valleys. Since the 1960s the area has been settled by small-scale farmers and much of the plateau is now under farmland or pasture. This is probably the world stronghold of the Sharpe's Longclaw. The Aberdare Cisticola is thought to occur in the higher parts of the plateau, close to the Aberdare mountains, but its status is uncertain. The fauna and flora of these grasslands have been little studied. Very few large wild mammals survive on the Kinangop, but many smaller species that are confined to highland grassland can be expected. The frogs *Hyperolius montanus* and *Phrynobatrachus kinangopensis* are recorded only in Kinangop and a few other sites in the Kenyan highlands.	the road crosses the site along 4.5 km
1 and 5	Kikuyu Escarpment Forest	IBA Forest Reserve[1]	37,000	The Kikuyu Escarpment Forest lies 30 km north-north-west of Nairobi and covers the eastern slopes of the escarpment from about 2,700 m in the north-west (bordering grassland at the edge of the Kinangop Plateau) to around 2,050 m in the east, where it borders agricultural land. This forest has a rich avifauna, characteristic of the central Kenyan highlands but with a composition different to that of the nearby Aberdare mountains. The African Elephant is present in good numbers at times. This forest is ecologically linked to the Aberdares, but now cut off (for larger mammals) by a fence that separates it from the main plantation Kinale Forest, through which the road passes.	the road crosses the site along 9.2 km – Section 1 and 13.8 km along Section 5
1 and 6	Naivasha Wildlife Training Institute Local Sanctuary (Kenya Wildlife Service Training Institute)	National Sanctuary	800	The institute is located 90 km northwest of the city of Nairobi. It offers training in wildlife management, tourism and hospitality management, and fisheries. The institute land has a lake Naivasha frontage where a fishery teaching annex is located. The KWSTI Sanctuary, a gazetted Protected Area, lies astride the A8 highway at the edge of Naivasha town. The main block of around 200 ha (500 acres) surrounds the institute buildings south-west of the A8. The 'game farm', covering a further c. 600 ha (1500 acres) lies on the other side of the road. A third section, the 'annex', lies across the A8 South from the main sanctuary, abutting Lake Naivasha. An abundance of wildlife roams the institute grounds that include giraffe, impala, wildebeest, waterbuck, zebra, eland, buffalo, warthog and hippopotamus.	the road is adjacent to the site along 3.0 km- section 1, and 1.3 km - section 6

Adapted from : Bennun *et al.*, 2018

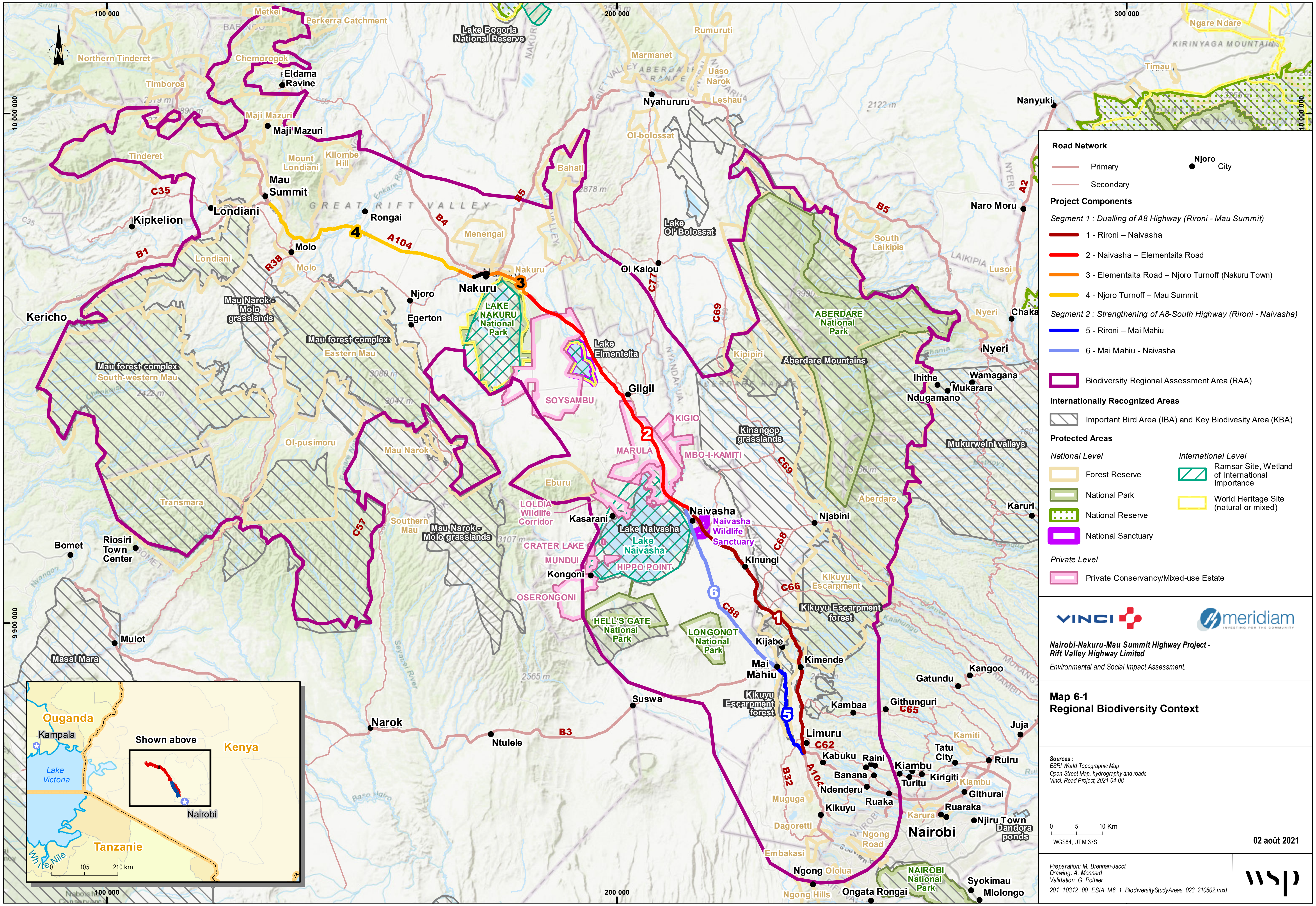
1 The Forest Management and Conservation Act 2016 (the Act) has replaced the Forest Act 2005 and as per Article 76 of the Act. And Article 77 (a) of the Act stated that a "Forest Reserve" is now deemed to be a "Public Forest".

2 Mount Londiani Forest Reserve is sometimes included in the Mau Forest Complex. However, The Mau Forest Complex defined by Birdlife International (2022) and designated as an Important Bird Area does not include Mount Londiani Forest Reserve. The Mount Londiani Forest Reserve is thus described separately.

Table 6-32 Private Conservancies within the RAA

Road Section	Site	Status and designation	Area (ha)	Overview	Distance from RoW
2	Soysambu Conservancy	Private conservation area	19,425	The Soysambu Conservancy is an open land area bordering the Elmentaita Badlands in the south and sharing a boundary with Lake Nakuru National Park that has been created to preserve the land from human development. The Nubian (Rothschild's) Giraffe occurs here, together with a range of other wildlife including Lion and Cape Buffalo. Cattle are ranched on the conservancy alongside wildlife. Part of the Conservancy, to the north-western side of the road, has been sold for a new residential development and a cemetery (see zoomed in Map in Appendix 6-25)	the road crosses the site along 7.7 km
2	Kigio Wildlife Conservancy	Private conservation area	1,400	The Conservancy is located between Lake Nakuru and Lake Naivasha. Originally a cattle ranch, the area is now dedicated to eco-tourism. The conservancy is enclosed by an electric fence. Nubian (Rothschild's) Giraffe, Thompson's Gazelle, Grant's Zebra, Spotted Hyena, Leopard and Caracal are among the mammals occurring here.	1.4 km
6	Oserengoni Wildlife Sanctuary (formerly Oserian)	Private conservation area	7,284	The Sanctuary is located close to Hell's Gate National Park. It is enclosed by an electric fence, except for the boundary with the park. Mammals including Spotted Hyena, Leopard and Plains Zebra occur in the area.	20.6 km
6	Kedong Ranch	Private conservation area	60,000	The ranch straddles Mount Longonot, Hell's Gate and Lake Naivasha. A part of the ranch is leases for agriculture production. Plains Zebra and other wildlife species occur here.	2.2 km
2	Loldia Conservancy	Private conservation area	2,300	The Loldia Estates are situated north of Lake Naivasha, stretching from the lake edge up to the craters of Eburu Forest. Loldia is an important wildlife corridor, connecting Eburu Forest with the lake and its riparian habitat. The North Lake Road divides the farm in two Loldia Estates, is zoned as agricultural land and is owned by four family groups that have a collective vision for Loldia Corridor and the conservation of the land. The section along the lake front (2,500 acres) is home to a spectacular diversity of water birds as well as an important population of hippopotamus. Loldia House, a lodge managed by Wilderness and Governors Group, is on the lake edge. It has become a very popular destination for overseas visitors wishing to explore Naivasha and surroundings as well as Lake Nakuru to the north. The majority of the farm (3,502 acres) is on the north side of the road and reaches up the slopes of Eburu Forest. This section of the farm includes tree species such as cedar, podocarpus, and olive. Higher up the slopes of the mountain, there are steam jets within the farm and in the Eburu forest. Mount Eburu is an extinct volcano and continues to exhibit substantial geothermal activity.	6.7 km
2	Marula Estate	Private conservation area	13,400	Marula Estate is a privately owned ranch and farm, which protect some natural habitat and holds substantial wildlife populations	the road crosses the site along 21.7 km
6	Kongoni Conservancy	Private conservation area	181	Kongoni conservancy is managed since 2010 by the Animal Rights Reserved Foundation in an effort to stop development of the area. It has a number of resident leopards, elands, giraffes, buffaloes, warthogs, hyenas and antelopes.	22.7 km
6	Mundui Estate	Private conservation area	668	The Mundui Estate, located on the shores of Lake Naivasha, consists of 1,200 acres of acacia woodland and grass plains. It is managed since 2010 by the Animal Rights Reserved Foundation. Mammals including giraffe, zebra, eland, cheetah and hippopotamus all roam the grounds.	19.2 km
6	Lentolia Farms	Private conservation area	60	Lentolia Farm was established by Private Individuals in 2004. Because of its natural habitat, resources and positioning as part of a game 'corridor' alongside Naivasha Lake in the Great Rift Valley it attracts wildlife, including giraffe, buffalo, eland, zebra, Thompson Gazelle, impala, Water Buck, Warthog, hippos, Colobus Monkey, baboons, sykes and python.	19.9 km
6	Hippo Point Naivasha Conservancy	Private conservation area	395	This private wildlife conservancy is sitting on an isthmus between Lake Naivasha and Lake Oloidien at an altitude of 6,200 feet or 2,000 meters with a near perfect microclimate, over 350 species of birds and an average of 1,200 resident animals.	14.8 km
6	Crater Lake Conservancy	Private conservation area	335	Crater Lake Game Sanctuary Naivasha is a small private sanctuary centered around a green soda lake at the bottom of an extinct volcano on the western side of Lake Naivasha and north of the village of Kongoni. The lake attracts birds, including Greater and Lesser Flamingos, Little Grebes, Cape Teal and Ruff's, Great White Pelican, Whiskered Tern, Maribou, Grey and Black-headed Heron, African Fish Eagle, Yellow-billed Storks, Pied Avocets, Egyptian Geese, and the surrounding forests and plains attract wildlife, including gazelle, giraffe, zebra, eland, baboon and black and white Colobus Monkeys	19.1 km

Note: Adapted from Bennun *et al.*, 2018 and according to Rift Lakes Conservancies Association (RLCA, 2016)



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

MAIN THREAT AND ISSUES AFFECTING BIODIVERSITY

Main threats to biodiversity in Kenya are linked to human-induced environmental degradation, such as destruction of natural landscapes, soil erosion, water pollution and invasive alien species. Kenya's rapidly rising population is causing changes in land use patterns which in turn drive biodiversity loss. Uncontrolled domestic and industrial discharges, pollution and contamination are also major threats to the country's biodiversity. In particular, the Great Rift Valley lakes have experienced in the recent years heavy pollution loads emanating from increased agricultural, industrial and municipal waste discharge. Invasive alien species are important agents of biodiversity loss and represent a threat to habitats and biodiversity in Kenya, especially in freshwater habitats where they suffocate, replace and often result in the extinction of indigenous species.

More specifically in the RAA, the increasing human population is having a visible impact on wildlife populations, who depend on ecological connectivity within the landscape, as well as on the forests and the lake system itself. Improved infrastructure and establishment of new industries have resulted in the rapid growth of towns and settlements, specifically along the existing Nairobi- Nakuru highway. In addition, rampant land sub-division and the fencing of properties have continued to fragment wildlife habitats and to block movement corridors. Insecurity of land tenure has led the owners of some large tracts to subdivide and sell small parcels of land to individual title holders. Sub-division of land in some places, and the expansion of agriculture (the horticulture industry especially) and soda ash mining in others, has led to the fragmentation of habitats and to increased fencing.

Only about 10 % of wildlife in the Eburru Forest and Naivasha-Elmentaita-Nakuru lakes sub-ecosystem is found inside protected areas. The rest of the wildlife, if its populations are to be sustained, depends on community protection Fences and other barriers to wildlife movement are another major constraint, along with increases in poaching activity, illegal offtake for the bush-meat trade, and human-wildlife conflict. (Government of the Republic of Kenya, 2017).

The lake system in the RAA is a major source of water. Yet escalating human activity, including expansion of agriculture, horticulture farming and industries, is threatening biodiversity in and around the lakes. Agricultural pesticides and industrial effluents have been blamed for the biodiversity losses.

LAND USE ANALYSIS

In order to identify the landscape of concern in the RAA, a land use and land use change analysis (LULUCA) spanning three reference years (the years 2000, 2010 and 2020) was undertaken (FFMES, 2021a). This analysis provides an overview of the current land use and land cover for the study area as well as the grounding of the current situation within the context of the land use and land cover since the year 2000. Images were analyzed in 10-year increments to provide a broad outline of the evolution of the landscape over the past 20 years. Figure 6-32 highlights the changes in land use considered to have occurred between 2000 and 2020. The complete LULUCA Report is available in Appendix 6-13.

This analysis confirms the trends and threats on biodiversity described above. A large extent of the RAA is comprised of areas of cultivation and severe deforestation/degradation (with old lands and minor settlements included), which link villages and towns. These areas, including road verges, are often utilized as grazing areas for domestic livestock such as cattle, sheep, donkeys and goats, as well as for subsistence cultivation, particularly between community settlements. These areas are further interspersed with exotic forestry plantations particularly at higher-altitude areas (i.e., the south-eastern extent near Nairobi and the north-western extent near Molo), with the common forestry species being *Cupressus lusitanica*, *Eucalyptus sp*p. and *Pinus spp*.

The areas of lower degradation/utilization contain remnants of indigenous vegetation, which provide corridors to facilitate the flow of important ecological patterns and processes that support greater biodiversity.

The main apparent change is one of a landscape in flux from a semi-agricultural one in 2000 to one where agriculture is dominant and interspersed with pockets of more natural ground that are typically under retreat and progressively confined to sections of land under some form of conservation status.

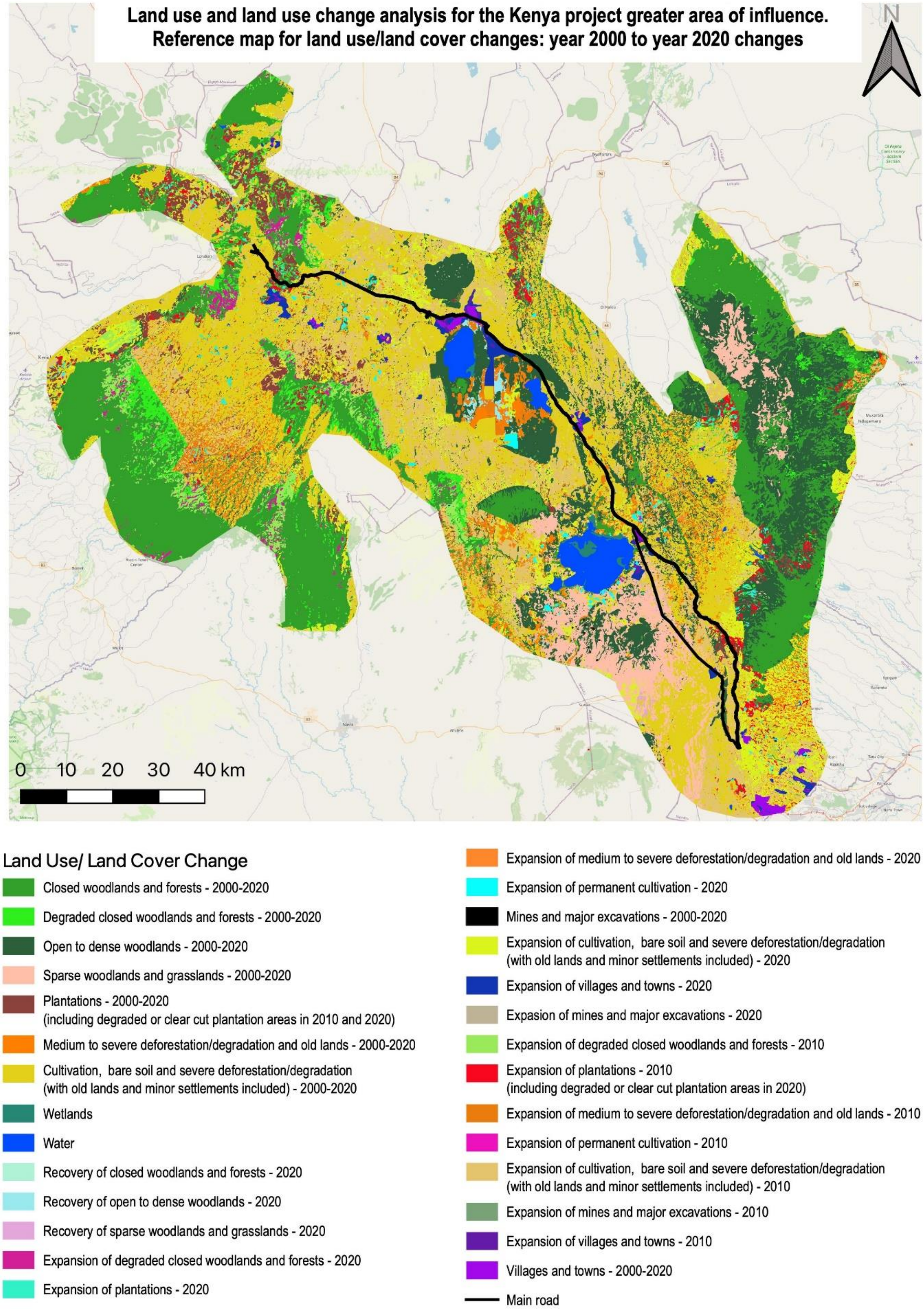


Figure 6-32 **Land Use and Land Use Change Analysis in the Biodiversity RAA. Reference map for the land use/landcover changes between year 2000 and 2020**

The land use change trend in the study area highlights agricultural activities "eating" away of 0.71% of the land per annum between 2000 and 2020, and a retreat of natural land at near equivalent rhythm of -0.33% per annum in the study area between 2000 and 2020. In parallel to this agricultural expansion and natural land retreat, there is a clear degradation of land under woodland or forest cover, most likely associated with the agricultural expansion but also the need for wood resources by local people in expanding cities and rural communities.

Based on Global Forest Watch (2020), Nakuru county was the county with the second highest level of deforestation between 2001 and 2020, with shifting agriculture being the main culprit (responsible for 93.6% of the changes noted in the Global Forest Watch summary of 2020). It is believed that this is reflected here through the very high rate of loss of natural land, and the fact that conversion to agriculture represents +/- 90% of the surface area lost by natural lands. This situation sets the context for the Nairobi-Nakuru-Mau Summit Highway Project and highlights the particularly essential nature of keeping isolated fragments of natural habitat connected across the landscape.

6.3.3 TERRESTRIAL HABITATS AND FLORA

HABITAT TYPES

The Nairobi-Nakuru-Mau Summit Highway Project traverses nine Vegetation and Climate change in East Africa (VECEA) habitat types, as illustrated in Figure 6-33. Table 6-33 shows the total area (km^2) that each VECEA habitat type encompasses within the Biodiversity RAA; and the percentage of this area explicitly designated for biodiversity, species or landscape protection (A) and areas designated for both protection (nationally protected) and sustainable use objectives (B) (Kindt et al. 2015, van Breugel et al. 2015a, van Breugel et al. 2015b). Wetlands are characterized by two habitat types: the freshwater swamps and the halophytic vegetation found on the shorelines of endorheic lakes, such as Lakes Nakuru, Elmentaita and Naivasha. Wetlands are also further described in terms of freshwater habitats in section 6.3.7.

A description of each VECEA habitat type, including a summary of field observations in each habitat is presented in the following sections. The Vegetation, Plants and Habitat Report (FFMES, 2021b) in Appendix 6-14 provides detailed results for the characterization of habitats and associated flora diversity.

Table 6-33 VECEA habitat types occurring throughout the Biodiversity RAA

Habitat type	Area (km^2)	A (%)	B (%)
Afromontane bamboo (B)	4,084	13.50	66.10
Afromontane rain forest (Fa)	74,291	4.30	32.40
Afromontane undifferentiated forest (Fb)	33,883	4.60	28.50
Edaphic grassland on drainage-impeded or seasonally flooded soils (g)[1]	48,865	10.60	6.70
Evergreen and semi-evergreen bushland and thicket (Be)	71,708	8.90	7.30
Halophytic vegetation (Z)	6,087	16.70	9.10
Riverine wooded vegetation (R)	7,955	10.00	12.40
Upland Acacia wooded grassland (We)	19,259	15.60	5.20
Freshwater swamp (X) [Water bodies (w)]	29,189	20.80	7.50

Note: 1 Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (wd) is a subtype of Edaphic grassland on drainage-impeded or seasonally flooded soils (g)

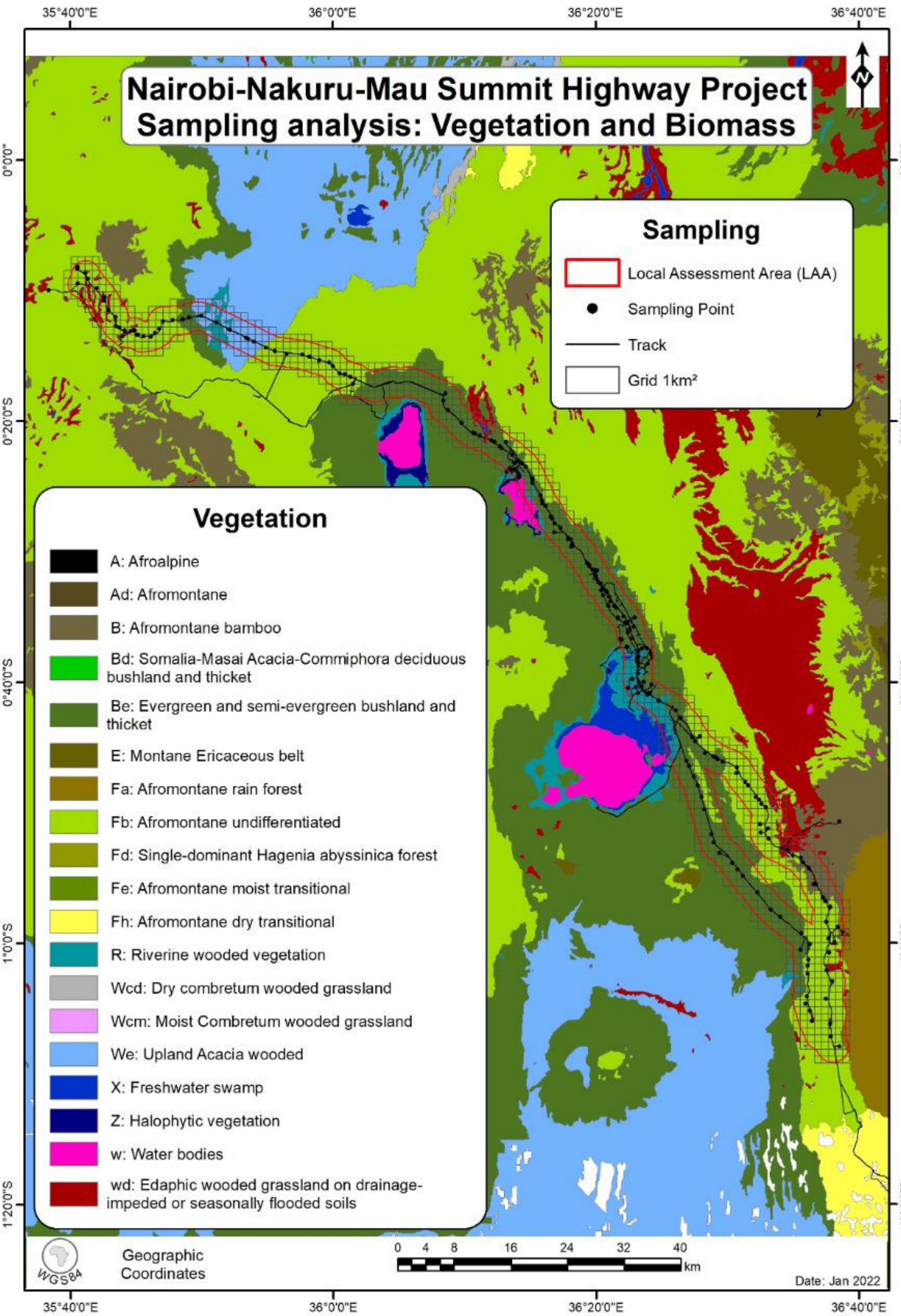


Figure 6-33 VECEA habitat types that occur throughout the Biodiversity Local Assessment Area

AFROMONTANE BAMBOO (B)

Figure 6-34 **Picture of Afromontane Bamboo in the LAA**

The dominant species of the Afromontane bamboo habitat type is ***Sinarundinaria alpina*** (synonyms: *Arundinaria alpina* and *Yushania alpina*), which is a species of bamboo that occurs on most high mountains throughout East Africa (Kindt *et al.* 2015, van Breugel *et al.* 2015a, van Breugel *et al.* 2015b). It is mostly found between 2,400 and 3,000 m asl in East Africa, although it ascends on Mt. Kenya to 3,500 m asl and descends to 1,630 m asl in the Uluguru mountains in Tanzania. It often forms dense, impenetrable patches on deep volcanic soils and gentle slopes in areas that receive an annual rainfall exceeding 1,250 mm.

As cited in Kindt *et al.* (2015), van Breugel *et al.* (2015a) and van Breugel *et al.* (2015b); White (1983) described the largest areas to exist in Kenya on the Aberdare Range (65,000 ha), the Mau Range (51,000 ha) and Mt. Kenya (39,000 ha).

Expected characteristic plant species are *Cornus volkensii*, *Dombeya torrida*, *Faurea saligna*, ***Hagenia abyssinica***, *Ilex mitis*, ***Juniperus procera***, ***Lepidotrichilia volkensii***, ***Nuxia congesta***, ***Podocarpus latifolius***, ***Prunus africana***, ***Rapanea melanophloeos*** and *Tabernaemontana stapfiana*. Generalist and marginal species expected to be present include ***Hypericum revolutum***, *Schefflera volkensii*, *Agauria salicifolia*, *Peddiea fischeri*, ***Rhamnus prinoides***, *Rubus apetalus* and *Sambucus ebulus* (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Afromontane bamboo (B) habitat type: *Oxalis corniculata*, *Centella asiatica*, *Urtica massaica*, *Achyrospermum schimperi*, *Juniperus procera*, *Kalanchoe densiflora*, *Pilea* cf. *johnstonii* and *Selaginella kraussiana*.

The dominant class for trees were the canopy trees, which had a mean height of 17.0 m and a mean percentage cover of 90.3%. The dominant class for shrubs were the high shrubs class, which had a mean height of 4.0 m and a mean percentage cover of 60.0%. The dominant class of grasses were the very high grasses, which had a mean height of 1.6 m (mean cover percentage = 60.0%) and the sub-dominant class were low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 57.0%).

Plant diversity in the Afromontane bamboo (B) was moderate-high. The mean number of species per sample plot for the eight plots surveyed was 23 species with a range from 7 to 52 species.

AFROMONTANE RAIN FOREST (FA)

Figure 6-35 Picture of Afromontane Rain Forest in the LAA

On most mountains the lowermost vegetation is forest, with a transitional zone connecting the forest to the lowland vegetation zone. However, almost everywhere in Kenya this transitional zone has been destroyed by fire and cultivation, with forest being dominant on the lower slopes. Nearly everywhere the vegetation on mountains diminishes in stature from the lower slopes to the summit, dominated by secondary, fire-maintained grasslands (White, 1983). Good examples of this forest habitat type are represented in the Kinale and Gatamaiyo Forest east of Kimende town.

Afromontane rain forest is remarkably similar in structure and physiognomy to Guineo-Congolian lowland rain forest with an upper stratum of 25 to 45 tall trees that are heavy- branched and wide-spreading; a middle tree stratum of 14 to 30 m tall, with narrow crowns but do not form a dense canopy; a lower tree stratum of 6 to 15 m tall and forming a dense canopy, followed by a shrub layer of 3 to 6 m tall but poorly differentiated from the lower tree layer. The Afromontane rain forest differs from the Guineo-Congolian rain forest in the occurrence of tree ferns *Cyathea spp*. and *Podocarpus/Afrocarpus spp*. These forests mainly occur from 1,200 – 2,500 m asl in areas where the mean annual rainfall lies between 1,250 – 2,500 mm. Afromontane rainforest is less deciduous than lowland semi-evergreen forests that receive similar rainfall, which is likely due to mist frequently occurring during the dry season.

Characteristic plant species expected are *Chrysophyllum gorungosanum, Cola greenwayi, Cyathea dregei, Cyathea humilis,* ***Cyathea manniana****, Cylicomorpha parviflora, Diospyros abyssinica, Fleroya rubrostipulata, Macaranga capensis, Myrianthus holstii, Ochna holstii, Ocotea usambarensis, Olea capensis,* ***Podocarpus latifolius****, Pouteria adolfi-friedericii,* ***Prunus africana****, Strombosia scheffleri,* ***Syzygium guineense****, Tabernaemontana stapfiana and* ***Xymalos monospora*** (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Afromontane rain forest (Fa) habitat type: *Cestrum aurantiacum, Galinsoga parviflora, Gnaphalium unionis, Pennisetum clandestinum, Acanthus cf. pubescens, Achyrospermum schimperi, Acmella caulirhiza, Amaranthus hybridus, Bidens pilosa, Buddleja polystachya, Centella asiatica, Cirsium vulgare, Colocasia esculenta, Commelina benghalensis, Conyza bonariensis, Conyza subscaposa, Cupressus lusitanica, Cyathula cylindrica, Cynodon nlemfuensis, Dichondra repens, Dichrocephala integrifolia, Digitaria diagonalis, Emex australis, Ensete ventricosum, Eragrostis nindensis, Helichrysum foetidum, Helichyrusum forskahlii, Kalanchoe densiflora, Kyllinga alba, Lagenaria abyssinica, Leucas grandis, Micromeria imbricata, Oenothera parviflora, Oldenlandia scopulorum, Oxalis corniculata, Physalis peruviana, Pilea johnstonii, Poa leptoclada, Pycnostachys meyeri, Ricinus communis, Rubia cordifolia, Rubus scheffleri, Salvia nilotica, Sida tenuicarpa, Solanum anguivi, Solanum giganteum, Solanum mauritianum, Solanum campylacanthum, Sporobolus agrostoides, Stellaria media, Tagetes minuta, Trifolium semipilosum, Urena lobata* and *Zea mays.*

The dominant class for trees were the canopy trees, which had a mean height of 16.0 m and a mean percentage cover of 90.0%. The dominant class for shrubs were the medium shrubs class, which had a mean height of 3.0 m and a mean percentage cover of 40.0%. The dominant class of grasses were the low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 71.5%) and the sub-dominant class were very high grasses, which had a mean height of 1.6 m (mean cover percentage = 35.0%).

Plant diversity in the Afromontane rain forest (Fa) was moderate. The mean number of species per sample plot for the two plots surveyed was 29 species with a range from 27 to 31 species.

AFROMONTANE UNDIFFERENTIATED FOREST (FB)

Figure 6-36 Picture of Afromontane Undifferentiated Forest in the LAA

Afromontane undifferentiated forest is usually shorter than Afromontane rain forest and despite some floristic overlap of characteristic species (e.g., *Podocarpus latifolius*, *Prunus africana* and *Xymalos monospora*), a distinctive difference in composition exists. Afromontane undifferentiated forest usually replaces Afromontane rain forest at altitudes between 1,250 and 2,500 m asl on the drier slopes of mountains, and at higher altitudes on the wetter slopes (and sometimes at lower altitudes) (Kindt *et al*,. 2015, van Breugel *et al*,. 2015a, van Breugel *et al*,. 2015b, White, 1983).

Mostly degraded and of secondary succession where it occurs as remnant patches along perennial streams and rivers. Large tracts of this forest habitat have been converted to plantations with some areas cleared under the 'shamba' system.

The two sub-types of Afromontane undifferentiated forest relevant to the study area are:

- **Afromontane single-dominant *Juniperus procera* forest (Fbj)** generally occurs on drier mountain slopes between 1,800 and 2,900 m asl and although they often form dense forests, it is a strong light-demander and does not regenerate in its own shade. Its presence is largely dependent on fire. Scattered individuals were observed in forest systems close to Nakuru and Naivasha.
- **Afromontane single-dominant *Hagenia abyssinica* forest (Fd)** generally occurs as almost pure stands of 9 to 15 m tall individuals between montane forest, thickets and shrubland at altitudes of 1,800 to 3,400 m asl.

Characteristic plant species expected are ***Afrocarpus falcatus***, ***Apodytes dimidiata***, *Cassipourea malosana*, ***Ekebergia capensis***, ***Halleria lucida***, *Ilex mitis*, ***Juniperus procera***, ***Nuxia congesta***, *Nuxia floribunda*, ***Ocotea kenyensis***, ***Olea europaea***, *Olinia rochetiana*, ***Podocarpus latifolius***, ***Prunus africana***, ***Rapanea melanophloeos***, *Vepris nobilis* and ***Xymalos monospora*** (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Afromontane undifferentiated forest (Fb) habitat type: *Oxalis corniculata, Bidens pilosa, Conyza bonariensis, Sida tenuicarpa and Pennisetum clandestinum*.

The dominant class for trees were the canopy trees, which had a mean height of 12.7 m (mean cover percentage = 42.3%) and the sub-dominant class were mid-canopy trees, which had a mean height of 9.1 m (mean cover percentage = 33.1%). The dominant class for shrubs were the very high shrubs, which had a mean height of 6.0 m (mean cover percentage = 41.7%) and the sub-dominant class were high shrubs, which had a mean height of 4.6 m (mean cover percentage = 40.6%). The dominant class of grasses were the low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 53.1%) and the sub-dominant class were very high grasses, which had a mean height of 1.7 m (mean cover percentage = 47.3%).

Plant diversity in the Afromontane undifferentiated forest (Fb) was moderate-high. The mean number of species per sample plot for the 67 plots surveyed was 35 species with a range from 6 to 82 species.

EDAPHIC WOODED GRASSLAND ON DRAINAGE-IMPEDED OR SEASONALLY FLOODED SOILS (WD)

Figure 6-37 Picture of Edaphic Wooded Grassland on Drainage-Impeded or Seasonally Flooded Soils in the LAA

This vegetation type is drainage-impeded or found on seasonally flooded soils. Where estimated tree cover is > 10%, the vegetation is classified as edaphic woody grasslands while the remainder is classified as edaphic grasslands. It is often associated with hillslope seeps or unchanneled valley-bottom seeps, which attract waterbirds and grassland-associated bird species.

Characteristic species are ***Vachellia drepanolobium*** and ***Vachellia seyal***. Other species frequently encountered include *Balanites aegyptiaca, Borassus aethiopum, Combretum adenogonium, Commiphora schimperi, Dalbergia melanoxylon,* ***Faidherbia albida***, *Hyphaene compressa, Lannea humilis, Microchloa indica, Oryza longistaminata, Piliostigma thonningii, Sclerocarya birrea, Senegalia mellifera,* ***Senegalia polyacantha***, ***Senegalia senegal***, *Senegalia tanganyikensis, Setaria incrassata, Terminalia spinosa, Terminalia stuhlmannii, Thespesia danis,* ***Vachellia gerrardii***, *Vachellia malacocephala,* ***Vachellia nilotica***, *Vachellia paolii, Vachellia pseudofistula,* ***Vachellia sieberiana***, *Vachellia tortilis,* ***Vachellia xanthophloea*** and *Vachellia zanzibarica*, (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (wd) habitat type: *Achyranthes aspera, Pennisetum clandestinum, Alchemilla kiwuensis, Bidens pilosa, Centella asiatica, Conyza bonariensis, Crassocephalum montuosum, Cynodon dactylon, Cyperus rigidifolius, Digitaria diagonalis, Eucalyptus ovata, Galinsoga parviflora, Oxalis corniculata* and *Senecio moorei.*

The dominant class for trees were the canopy trees, which had a mean height of 20.0 m and a mean percentage cover of 40.0%. The dominant class of grasses were the low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 65.0%) and the sub-dominant class were medium grasses, which had a mean height of 0.9 m (mean cover percentage = 35.0%).

Plant diversity in the Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (wd) was moderate. The mean number of species per sample plot for the five plots surveyed was 24 species with a range from 12 to 35 species.

EVERGREEN AND SEMI-EVERGREEN BUSHLAND AND THICKET (BE)

Figure 6-38 Picture of Evergreen and semi-evergreen bushland and thicket in the LAA

This vegetation type is prominent on the LAA and occurs on drier slopes of mountains, often forming an ecotone between Afromontane forest and deciduous bushland, in areas where the mean annual rainfall is between 500 – 850 mm. Good examples of this unit are conserved within the Soysambu and Kigio conservancies and the Marula Estates. Large parts have been converted to pastures and cultivation which resulted in open short shrubland dominated by secondary grasses and *Solanum spp*.

Characteristic plant species expected are ***Acokanthera oppositifolia***, ***Acokanthera schimperi***, *Allophylus africanus*, ***Aloe kedongensis***, ***Aspilia mossambicensis***, *Azima tetracantha*, ***Calodendrum capense***, *Canthium keniense*, *Capparis fascicularis*, ***Capparis tomentosa***, ***Carissa spinarum***, *Cassine buchananii*, *Cissus quadrangularis*, *Cissus rotundifolia*, ***Croton dichogamus***, ***Cussonia holstii***, ***Dodonaea viscosa* var. *angustifolia***, ***Dombeya burgessiae***, *Dracaena ellenbeckiana*, *Drypetes gerrardii*, ***Erythrococca bongensis***, ***Euclea divinorum***, *Euclea racemosa*, ***Euphorbia candelabrum***, ***Gnidia subcordata***, ***Grewia bicolor***, ***Grewia similis***, *Grewia tembensis*, ***Gymnosporia heterophylla***, ***Juniperus procera***, ***Maerua triphylla***, ***Olea europaea***, ***Psiadia punctulata***, ***Psydrax schimperiana***, ***Pterolobium stellatum***, ***Sarcostemma viminale***, ***Schrebera alata***, ***Scutia myrtina***, ***Searsia natalensis***, ***Senegalia brevispica***, ***Senegalia senegal***, ***Tarchonanthus camphoratus***, *Tarenna graveolens*, ***Tinnea aethiopica***, *Turraea mombassana*, *Turraea nilotica*, ***Vachellia drepanolobium***, ***Vachellia gerrardii***, ***Vachellia hockii***, *Vachellia kirkii*, ***Vachellia seyal***, *Vepris nobilis*, ***Vepris simplicifolia***, *Vepris trichocarpa* and ***Vernonia brachycalyx*** (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Evergreen and semi-evergreen bushland and thicket (Be) habitat type: *Sida tenuicarpa*, *Hypoestes forskaolii*, *Psiadia punctulata*, *Solanum campylacanthum*, *Conyza bonariensis*, *Cynodon dactylon*, *Ocimum gratissimum*, *Vachellia xanthophloea*, *Cynodon nlemfuensis*, *Tarchonanthus camphoratus*, *Fuerstia africana*, *Gymnosporia heterophylla* and *Themeda triandra*.

The dominant class for trees were the regeneration level trees, which had a mean height of 2.0 m (mean cover percentage = 65.0%) and the sub-dominant class were canopy trees, which had a mean height of 9.5 m (mean cover percentage = 42.4%). The dominant class for shrubs were the high shrubs, which had a mean height of 4.1 m (mean cover percentage = 50.7%) and the sub-dominant class were very high shrubs, which had a mean height of 6.0 m (mean cover percentage = 30.0%). The dominant class of grasses were the low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 58.2%) and the sub-dominant class were medium grasses, which had a mean height of 1.0 m (mean cover percentage = 47.1%).

Plant diversity in the Evergreen and semi-evergreen bushland and thicket (Be) was moderate-high. The mean number of species per sample plot for the 102 plots surveyed was 32 species with a range from 8 to 62 species.

HALOPHYTIC VEGETATION (Z)

Figure 6-39 Picture of Halophytic Vegetation in the LAA

This unit is restricted to the shoreline of endorheic lake systems, notably Lakes Nakuru, Elmentaita and Naivasha. It represents a small group of plants that can grow on saline soils typically found along the Rift Valley lake systems. Characteristic species found around these lakes are ***Cyperus laevigatus***, ***Sporobolus spicatus*** and *Sueda monoica*. Other species expected are *Drake-brockmania somalensis, Leptochloa fusca, Salsola africana, Salvadora persica*, **Sesbania sesban**, *Sporobolus robustus* and *Triplocephalum holstii* (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Halophytic vegetation (Z) habitat type: *Chloris gayana, Craterostigma pumilum, Cycnium tubulosum, Sida tenuicarpa, Vachellia xanthophloea, Cynodon nlemfuensis, Hypoestes forskaolii, Kalanchoe densiflora, Scutia myrtina, Senecio hadiensis, Senecio moorei, Sporobolus agrostoides, Achyranthes aspera, Capparis tomentosa, Chenopodium album, Chenopodium cf. opulifolium, Commelina benghalensis, Cordia monoica, Cynodon dactylon, Gymnosporia heterophylla, Harpachne schimperi, Oldenlandia corymbosa, Oldenlandia monanthos, Opuntia ficus-indica, Pavetta sp*. and *Tagetes minuta*.

The dominant class for trees were the canopy trees, which had a mean height of 16.0 m and a mean percentage cover of 72.5%. The dominant class for shrubs were the medium shrubs class, which had a mean height of 3.0 m and a mean percentage cover of 10.0%. The dominant class of grasses were the low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 75.8%) and the sub-dominant class were high grasses, which had a mean height of 1.4 m (mean cover percentage = 60.0%).

Plant diversity in the Halophytic vegetation (Z) was moderate. The mean number of species per sample plot for the five plots surveyed was 21 species with a range from 15 to 25 species.

RIVERINE WOODED VEGETATION (R)

Figure 6-40 Picture of a Riverine Wooded Vegetation in the LAA

This habitat type occurs as a narrow band of tall woodland along major drainage systems, especially along the Malewa, Gilgil and Molo Rivers and some of their tributaries. Typical species expected in larger drainage systems include *Diospyros mespiliformis*, ***Ficus sycomorus***, ***Syzygium guineense*** and *Trichilia emetica*. However, many species from adjacent vegetation types that river systems run through can also be expected within the riparian zone and along the fringes (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Riverine wooded vegetation (R) habitat type: *Vachellia xanthophloea*, *Achyranthes aspera*, *Hypoestes forskaolii*, *Cynodon nlemfuensis*, *Sida tenuicarpa*, *Gymnosporia heterophylla*, *Phytolacca dodecandra*, *Conyza bonariensis*, *Senecio hadiensis*, *Commelina benghalensis*, *Cynanchum altiscandens*, *Setaria verticillata*, *Solanum campylacanthum* and *Tagetes*

The dominant class for trees were the canopy trees, which had a mean height of 14.1 m (mean cover percentage = 48.6%) and the sub-dominant class were mid-canopy trees, which had a mean height of 7.6 m (mean cover percentage = 33.8%). The dominant class for shrubs were the high shrubs, which had a mean height of 4.3 m (mean cover percentage = 25.0%) and the sub-dominant class were medium shrubs, which had a mean height of 2.5 m (mean cover percentage = 12.8%). The dominant class of grasses were the low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 63.1%) and the sub-dominant class were high grasses, which had a mean height of 1.3 m (mean cover percentage = 46.4%).

Plant diversity in the Riverine wooded vegetation (R) was moderate-high. The mean number of species per sample plot for the 24 plots surveyed was 28 species with a range from 16 to 53 species.

UPLAND *ACACIA* WOODED GRASSLAND (WE)

Figure 6-41 Picture of an Upland Acacia wooded grassland in the LAA

Upland acacia wooded grassland is dominated by *Vachellia/Senegalia spp.*, which commonly occur together with Evergreen species such as ***Carissa edulis***, ***Dodonaea viscosa* var. *angustifolia***, ***Euclea divinorum***, *Euclea racemosa* and ***Tarchonanthus camphoratus*** often because of habitat transformation (Kindt *et al.*, 2015, van Breugel *et al*,. 2015a, van Breugel *et al*,. 2015b, White, 1983). It is often the case that *Vachellia/Senegalia* (*Acacia*) *spp.* exhibit invader characteristics as a result of over-stocking and utilization by domestic (or wild) herbivores, which transform other vegetation types e.g., Evergreen and semi-evergreen bushland and thicket (Be).

Characteristic plant species expected are ***Acokanthera schimperi***, ***Capparis tomentosa***, ***Carissa spinarum***, ***Cussonia holstii***, ***Dodonaea viscosa* var. *angustifolia***, *Cassine buchananii*, ***Euclea divinorum***, *Euclea racemosa*, ***Euphorbia candelabrum***, ***Grewia bicolor***, ***Grewia similis***, ***Pterolobium stellatum***, ***Schrebera alata***, ***Scutia myrtina, Searsia natalensis***, ***Senegalia senegal***, *Tarenna graveolens*, ***Vachellia drepanolobium***, ***Vachellia gerrardii***, ***Vachellia hockii***, *Vachellia kirkii* and ***Vachellia seyal*** (Species in bold were recorded during one/more of the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Upland *Acacia* wooded grassland (We) habitat type: *Chloris gayana, Conyza bonariensis, Cynodon dactylon, Laggera alata, Sporobolus pyramidalis, Ageratum conyzoides, Bidens pilosa, Chloris pycnothrix, Indigofera hochstetteri, Lantana camara, Schkuhria pinnata, Solanum campylacanthum, Tagetes minuta, Aristida congesta* subsp. *barbicollis, Asparagus racemosus, Crotalaria incana, Cycnium tubulosum, Indigofera bogdanii, Lantana trifolia, Leucas grandis, Ocimum gratissimum, Oxalis corniculata, Richardia brasiliensis, Sida tenuicarpa, Themeda triandra, Trifolium rueppelianum, Vachellia xanthophloea, Verbena bonariensis* and *Vernonia glabra.*

The dominant class for trees were the canopy trees, which had a mean height of 12.0 m and a mean percentage cover of 20.0%. The dominant class for shrubs were the medium shrubs class, which had a mean height of 2.7 m and a mean percentage cover of 8.3%. The dominant class of grasses were the low-level grasses, which had a mean height of 0.4 m (mean cover percentage = 78.0%) and the sub-dominant class were medium grasses, which had a mean height of 0.8 m (mean cover percentage = 51.7%).

Plant diversity in the Upland *Acacia* wooded grassland (We) was moderate. The mean number of species per sample plot for the five plots surveyed was 27 species with a range from 20 to 38 species.

FRESHWATER SWAMP (X)

Figure 6-42 Picture of a Freshwater Swamp in the LAA

This vegetation type occurs in depressions where water permanently floods the surface to a shallow depth, while seasonal swamps are usually covered with edaphic grassland (White, 1983). They consist of a wide belt of reed-swamp, where the dominant species are usually rooted in the soil with stems that rise above the water (Figure 6-42). An expected characteristic plant species *is Cyperus papyrus*, (recorded during the surveys).

The following species had an occurrence of ≥ 40% across all sample plots in the Freshwater swamp (X) habitat type (Note: there was only one sampling plot in this habitat type, therefore the species recorded have a 100% occurrence): *Achyranthes aspera*, *Chenopodium opulifolium, Chloris virgata, Conyza bonariensis, Cordia monoica, Cynanchum altiscandens, Cynodon dactylon, Grewia similus, Gymnosporia heterophylla, Justicia anagalloides, Kalanchoe densiflora, Opuntia ficus-indica, Pappea capensis, Pavonia patens, Searsia natalensis, Senecio hadiensis, Senecio moorei, Vachellia xanthophloea* and *Warburgia ugandensis.*

The dominant class for trees were the canopy trees, which had a mean height of 14.0 m and a mean percentage cover of 40.0%. The dominant class for shrubs were the medium shrubs class, which had a mean height of 3.0 m and a mean percentage cover of 10.0%. The dominant class of grasses were the low-level grasses, which had a mean height of 0.2 m (mean cover percentage = 92.0%).

Plant diversity in the Freshwater swamp (X) was moderate. The total number of species per sample plot for the one plot surveyed was 19 species.

CARBON CONTENT OF HABITATS

Carbon stocks in the aboveground, belowground and dead wood pools of the vegetation in the proposed Nairobi to Mau Summit Study LAA was quantified for all of the different habitat types, using the Intergovernmental Panel on Climate Change (IPCC) guidelines. The full results of this study are described in the report Vegetation: Woody biomass, carbon and woody populations condition (FFMES, 2021c) in Appendix 6-15.

Aboveground carbon in live trees ranged from 2 tonnes in the upland acacia wooded grassland habitat to 170.2 tonnes in the Afromontane rainforest habitat. Belowground carbon in live trees followed a similar pattern, with the lowest total found in upland acacia wooded grassland habitats (1 tonne) and the highest, 56.7 tonnes, found in Afromontane rainforest habitats. In the upland acacia wooded grassland habitats and the edaphic wooded grassland habitats, there was zero carbon mass in dead wood, however, in the Afromontane rainforest sites 33.4 tonnes were recorded (Figure 6-43).

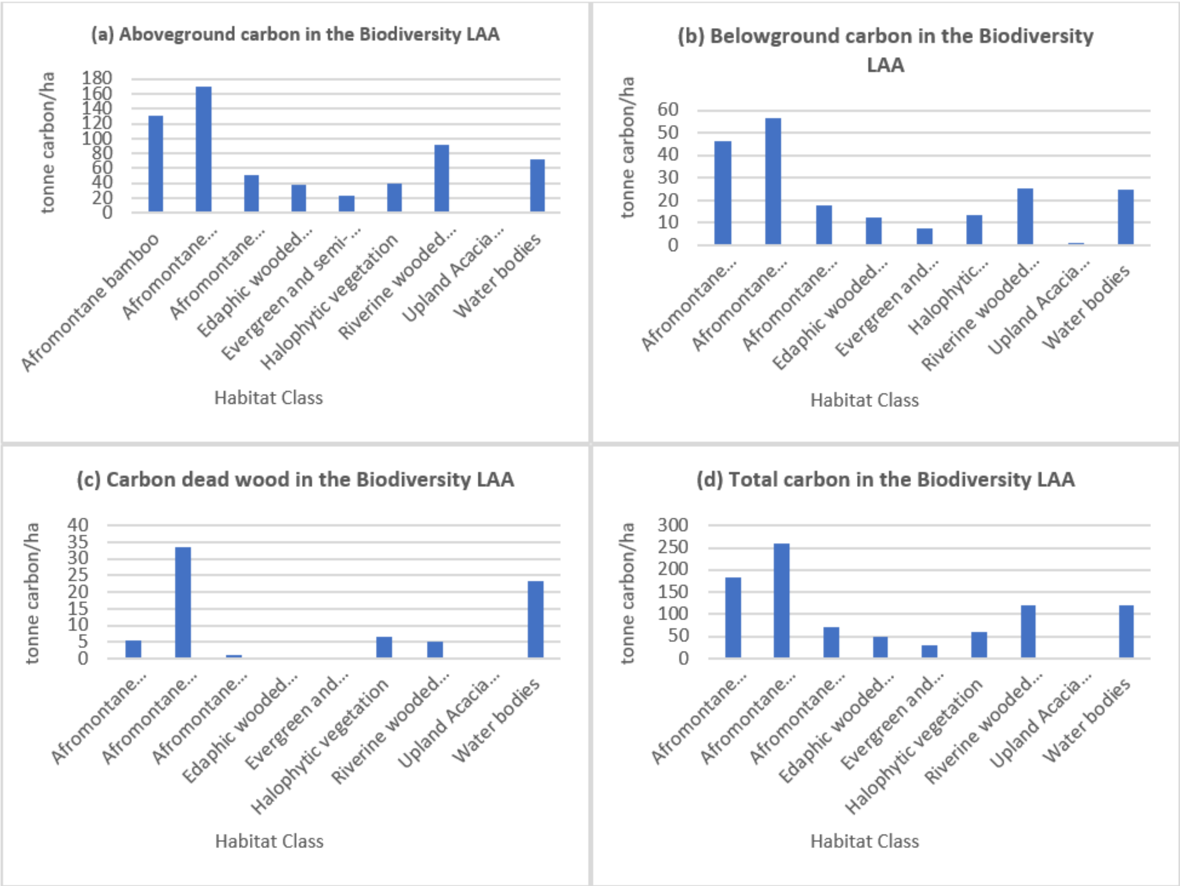


Figure 6-43 **Comparison of (a) aboveground carbon per ha; (b) belowground carbon per ha; (c) carbon in dead wood per ha; and (d) total carbon in aboveground, belowground and dead wood per ha per habitat class in the Biodiversity LAA**

Results show the carbon contained in the LAA's vegetation compares well with the carbon content of similar savanna and woodland types in East Africa. The highest carbon values were found in the Afromontane rainforests which are covered by both indigenous forest and plantations. The lowest values were found in the relatively unforested upland acacia wooded grassland. The area of high carbon content is covered by Afromontane rainforest and is limited to the very eastern fringes of the LAA. The majority of the land in the Nairobi to Mau Summit LAA has a carbon content of between >3.04 – 38.57 t C/ha. This low level of storage is likely explained by the high level of land transformation in the LAA and the conversion of natural landscapes to urbanised areas or agricultural sites.

ASSESSMENT OF HABITAT DEGRADATION, FRAGMENTATION AND QUALITY

The Habitat degradation assessment highlighted that despite obvious degradation evidence, the LAA retains the potential to rapidly bounce back naturally should it be left unperturbed for a short period of time. However, on a habitat level, the Afromontane rain forest (Fa) has lost this potential and may not be able to regenerate naturally. The Afromontane bamboo (B) habitat and the Upland *Acacia* wooded grassland (We) are the next two most degraded habitat types, with the Freshwater swamp (X) and the Halophytic vegetation (Z) habitat types noted as least degraded over the study area.

The habitat fragmentation assessment made it clear that the study area has reached an advanced stage of fragmentation with 41% of sites visited falling within that class, highlighting that a transition to the next stage in the sequence has already started. Overall, in at least two thirds of the sites visited, fragmentation had occurred and was a prevalent matter.

The habitat quality assessment showed that at least one third of the Biodiversity LAA is already within the realm of modified conditions and no longer retains the basic structure necessary for natural conditions. For the remainder of the study area, whilst it technically falls within the natural condition realm, most of it has already suffered light to medium modification influences and this is noted as most likely evolving towards a heavily modified stage. The most natural habitat type encountered in terms of botanical investigations was the Freshwater swamp (X), followed by Halophytic vegetation (Z) usually surrounding the water bodies. Riverine wooded vegetation (R) was generally noted as having suffered degradation and light to medium modification. Evergreen and semi-evergreen bushland and thicket (Be) were generally under the meso modification stage, while the Afromontane undifferentiated forest (Fb) habitat was generally heavily modified, although not as profoundly as the remainder of habitat types. The Afromontane bamboo (B), Afromontane rain forest (Fa), Edaphic wooded grassland on drainage-impeded or seasonally flooded soils (Wd) and Upland *Acacia* wooded grasslands (We) were deemed to be heavily modified with >50% of sampled sites within these habitat types falling within that stage.

The determination and mapping of modified versus natural habitat, as per IFC PS6 definition, is discussed in section 6.3.9.1.

DIVERSITY

A total of 889 taxa from 123 families were recorded in the LAA during the reconnaissance, dry and wet season surveys (219 sampling plots). The families Asteraceae (114 species), Poaceae (95 species) and Fabaceae (61 species) dominated the flora. The complete list of species, as well as the habitats where they were surveyed, is available in Appendix 6-14. Table 6-34 provides the number of species per lifeform type, per season and per habitat type. The reconnaissance visit surveys, due to their different nature and purpose were not included in these detailed species lists.

Herbaceous species are the most represented, followed by tree species. They both represent 54% and 13% of the total number of species recorded, respectively. Table 6-34 shows that the Afromontane undifferentiated forest and Evergreen and semi-evergreen bushland and thicket are the habitat types with the highest total species diversity.

Table 6-34 Flora Diversity Surveyed within the LAA

	Total	Sampling season		Habitats where the species were surveyed									
		February 21	April 21	Afromontane bamboo	Evergreen and semi-evergreen bushland and thicket	Afromontane rain forest	Afromontane un-differentiated forest	Riverine wooded vegetation	Upland Acacia wooded grassland	Freshwater swamp	Water bodies	Edaphic wooded grassland on drainage-impeded or seasonally	Halophytic vegetation
Number of species per Lifeform													
Aquatics	9	9	9	0	4	0	1	0	0	3	0	0	0
Ferns	15	12	15	7	7	0	7	3	0	0	0	1	0
Grass	93	87	93	13	58	6	67	24	17	1	2	15	11
Herbaceous	483	418	483	62	279	38	349	127	61	19	7	68	31
Orchids	8	5	6	0	4	0	4	0	0	0	0	0	0
Parasitic/hemi-parasitic	9	7	9	0	6	0	9	3	0	0	0	0	0
Shrubs	86	77	86	6	48	5	59	28	5	2	2	3	7
Trees	117	107	117	26	58	3	74	26	3	2	6	11	6
Vines/climbers/ lianas	50	42	49	5	32	1	33	13	3	1	1	4	1
Xerophytes/ succulents	19	18	16	2	17	1	9	7	1	0	1	0	2
Number of IUCN Red-Listed Species[1]													
NT	1	1	1	0	1	0	0	0	0	0	0	0	0
VU	3	3	2	1	1	0	1	0	0	0	0	0	0
Total Number of Species													
	889	781	882	121	513	54	612	231	90	28	19	102	58

Note: [1] NT: Near Threatened; VU: Vulnerable

SPECIES OF CONSERVATION INTEREST

Five flora species of conservation interest were recorded during the surveys within the LAA, as presented in Table 6-35. These were not surveyed within the existing road reserve and this RoW is not habitat of interest for these species.

Table 6-35 Flora Species of Conservation Interest Surveyed in the LAA

Family	Species	Special Status			Habitats where the species were surveyed									
		IUCN Status	Endemic	Protected in Kenya	Afromontane bamboo	Evergreen and semi-evergreen bushland and thicket	Afromontane rain forest	Afromontane un-differentiated forest	Riverine wooded vegetation	Upland Acacia wooded grassland	Freshwater swamp	Water bodies	Edaphic wooded grassland on drainage-impeded or seasonally	Halophytic vegetation
Orchidaceae	*Ansellia africana*	VU				X								
Euphorbiaceae	*Euphorbia bussei*	NT				X								
Asteraceae	*Kleinia gregorii*	-	Kenya			X								
Lauraceae	*Ocotea kenyensis*	VU		VU	X			X						
Rosaceae	*Prunus africana*	VU		VU	X			X						

Notes: [1] IUCN status: CR=Critically Endangered; EN=Endangered; VU=Vulnerable,=; NT=Near Threatened
[2] Wildlife Conservation and Management Act (2013): VU=Vulnerable

THREATENED SPECIES ACCORDING TO THE IUCN

Three threatened species according to the IUCN were observed during surveys.

The Leopard Orchid (*Ansellia africana*), listed as Vulnerable, was present in the Evergreen and semi-evergreen bushland and thicket vegetation unit. Although this species is widespread, excessive collection is carried out for commercial purposes in Kenya, where entire host trees, with the orchids attached, are removed and most plants collected die due to the poor conditions and containers into which they are transferred leading to wholesale destruction in more readily accessible areas. There is also some pressure on Ansellia habitats through logging, clearing for agriculture and overgrazing (Crook, 2013).

Two vulnerable tree species according to IUCN with confirmed occurrence are Camphor (*Ocotea kenyensis*) (VU), Red stinkwood (*Prunus africana)* (VU). They were both found in the Afromontane bamboo and Afromontane undifferentiated forest vegetation units. *Ocotea kenyensis* is a timber species found in areas of moist forest of East and South Africa extending into Central Africa. It yields a superior hardwood which is heavily exploited through most of its range (World Conservation Monitoring Centre, 1998a). *Prunus africana* is a Pan-African montane tree species threatened by the harvesting of its bark for the European medicinal market. It is described as not remotely in danger of extinction, so long as some montane forest survives somewhere within its enormous range (World Conservation Monitoring Centre, 1998b).

The succulent tree *Euphorbia bussei* is considered Near Threatened according to the IUCN. It is known from Kenya and Tanzania and is threatened by agricultural expansion (Kabuye et *al.*, 2020).

Two other IUCN Red-listed species are likely to be present in the study area, although they were not observed during surveys:

- *Lagarosiphon hydrilloides* is listed as Endangered according to IUCN and generally found in still or slow-flowing freshwater at altitudes of 1650 to 3500 m asl. Although many suitable habitats where sampled, this species was not encountered in the survey area during the survey period but may be present based on plant herbarium collection locations.
- Another species of concern, sampled from Kenya and Uganda only, is *Ethulia schefflera*, Endangered according to IUCN, known to occur on swampy sites along streams, and in marshy grassland with black cotton soil. Literature indicates sample locations from Kedong, south of Mount Longonot National Park in Naivasha district. This species was not recorded in the Local Assessment Area during the survey periods but could potentially be present.

SPECIES PROTECTED IN KENYA

Two species surveyed within the LAA are designated as endangered and threatened plants in Kenya (KWS, 2021). These are Camphor (*Ocotea kenyensis*) and Red stinkwood (*Prunus africana)*, which are also listed on the IUCN Red-List and described above.

ENDEMIC AND/OR RESTRICTED RANGE SPECIES

None of the flora species surveyed meet IFC's definition of endemic and/or restricted range species.

However, *Ethulia schefflera* and *Lagarosiphon hydrilloides* can be considered as a restricted-range species. Although, they were not recorded in the LAA during the survey periods they are potentially present.

The Kenyan endemic, *Kleinia gregorii* was confirmed as present in the Evergreen and semi-evergreen bushland and thicket vegetation unit. Although this species is not assessed by IUCN (no status) and is not considered restricted-range, the fact that it is endemic to Kenya gives it special value.

INVASIVE SPECIES

The disturbed and transformed areas found within the LAA contain a high diversity and abundance of alien/exotic plants. Numerous "naturalized" invasive species were recorded in these areas and the dominant alien/exotic species recorded were: *Acacia mearnsii, Acacia melanoxylon, Agave americana, Agave sisalana, Austrocylindropuntia subulata, Azolla filiculoides, Bougainvillea spectabilis, Carica papaya, Casuarina equisetifolia, Cedar spp., Cereus jamacaru, Chenopodium album, Cirsium vulgare, Datura stramonium, Eichhornia crassipes, Ensete ventricosum, Eucalyptus spp., Grevillea robusta, Guilleminia densa, Jacaranda mimosifolia, Lantana camara, Lemna minor, Musa × paradisiaca, Nerium oleander, Opuntia ficus-indica, Pinus spp., Richardia brasiliensis, Ricinus communis, Schinus molle, Tagetes minuta, Yucca spp.* and *Zea mays*.

IMPORTANT HABITATS FOR FLORA

The most unique habitats for flora are found along drainage lines, river systems, wetlands and rocky ridges throughout the LAA. Each of these areas contains unique biodiversity elements that contribute to optimizing ecosystem functionality and providing various ecosystem services to wildlife, livestock and humans.

Areas which stand out in these respects include the rocky ridges along the highway around Lake Elmentaita in the Evergreen and semi-evergreen bushland and thicket (Be) habitat type, as well as the calcareous soils along drainage lines of the Be habitat type (Figure 6-44). These areas accommodate species such as *Aloe* spp., *Euphorbia* spp., *Orbea* spp and various orchid species such as *Ansellia africana* and *Eulophia speciosa*.

a) Ridges of the Evergreen and semi-evergreen bushland and thicket (Be) habitat type, south-east of Lake Elmentaita [sampling plot 428]

b) Unique vegetation occurring on calcareous soils along drainage lines of the Be habitat type [sampling plot 323].

Figure 6-44 Important Habitats for Flora

6.3.4 BIRDS

DIVERSITY

The surveys led to the identification of 439 bird species for the study area, with 375 species recorded during the dry season (February 2021) and 368 during the wet season (April 2021). Table 6-36 presents a summary of the total number of species, species of conservation concern, endemics and biome-restricted species observed in the LAA. Values in brackets refer to derived totals (%) compared against the number of species recorded for Kenya (expected) and the observed totals compared against the number of species expected in the LAA (observed). The detailed list of species and further analysis of bird diversity is available in the Avifauna Sectorial Report (FFMES, 2021d) available in Appendix 6-16.

The observed richness equates to 38% of the approximate 1,162 species listed for Kenya (Lepage, 2021). According to the Kenya Bird Map Project (2009) along with the availability of suitable habitat, an additional 162 species are also expected to occur, bringing the total of bird species in the LAA to 601 species. Many of these species were not detected since they are either naturally rare or occur in very low abundances in the area, while some were absent since they are only present during migratory passage (some of the Palearctic *Acrocephalus* and *Luscinia* species) or are nocturnal.

Approximately seven of the bird species observed on the survey area have not previously been recorded in the area according to Lewis and Pomeroy (1989) and the Kenya Bird Map Project. More information on these out-of-range species is available in Appendix 6-16:

Table 6-36 Summary table of the total number of species observed and expected in the LAA

Parameter	Expected (% of National estimate)	Observed (% of expected estimate)
Total number of species (Lepage, 2021)	601 (52%)	439 (73%)
Number of globally threatened/near threatened species (IUCN, 2021)	27 (31%)	19* (70%)
Number of East African endemic species (shared with Tanzania and Uganda)	14 (37%)	10 (71%)
Number of species endemic to Kenya	2 (18%)	1 (50%)
Number of species restricted to the Serengeti Plains Endemic Bird Area (Bennun and Njoroge,1999)	1 (33%)	1 (100%)
Number of species restricted to the Kenyan Mountains Endemic Bird Area (Bennun and Njoroge,1999)	4 (50%)	2 (50%)
Number of species restricted to the Afrotropical Highlands Biome (Bennun and Njoroge,1999)	50 (71%)	44 (88%)
Number of species restricted to the Somali-Masai Biome (Bennun and Njoroge,1999)	21 (22%)	7 (33%)
Number of species restricted to the Lake Victoria basin biome (Bennun and Njoroge,1999)	1 (11%)	1 (100%)

Note: * The near threatened Fisher's Lovebird (*Agapornis fisheri*) was excluded since the population in Kenya is feral and is not native to the country (it is native to Tanzania).

Data specific to the 161 bird point counts, excluding other types of observations, amounts to a total of 320 bird species and 7,898 individuals recorded for both wet and dry seasons. A mean of 18.0 species and 49.0 individuals were recorded per point count. The highest number of species was in the Afromontane Undifferentiated Forest Habitat site along a perennial stream (49 species per point count) and the lowest was in the Edaphic Wooded Grassland Habitat site at the Thika-Mango flyover (two species). The highest number of individuals recorded per point count was 875 individuals at the Manguo pond wetland, and the lowest was four individuals at the Thika-Mango flyover site in an Edaphic Wooded Grassland Habitat.

Analysis of relative bird abundance values obtained from the point counts show the LAA consists of three broad bird associations, including (1) an association dominated by forest-dependant bird species, and (2) an association dominated by typical woodland birds and (3) an association consisting of species with high affinities for open grassland and wetland habitat.

The highest number of species (species richness) was observed from the Afromontane Undifferentiated Forest with 189 species recorded, followed by the Evergreen and semi-evergreen bushland and thicket habitat where 185 species were recorded. Low richness values were observed from the Edaphic wooded grasslands and Afromontane Bamboo habitat with respectively 48 and 49 species recorded. The highest number of individuals was observed from the Riparian wooded vegetation while the lowest number of individuals was observed from the Edaphic wooded grassland (Table 6-37).

Table 6-37 Summary of the observed species richness and number of individuals confined to the broad-scale habitat types in the LAA.

Broad-scale Habitat	Number of Species (S)	Mean number of individuals (N)	Shannon-Wiener (H'(log_e))
Afromontane Rainforest	60	38.50	3.77
Afromontane Undifferentiated forest	189	67.06	4.19
Afromontane Bamboo	49	46.25	3.50
Halophytic Vegetation	90	40.20	3.97
Upper *Acacia* Wooded Grassland	66	37.44	3.81
Riparian Wooded Vegetation	137	82.92	4.15
Evergreen and Semi-evergreen Bushland and Thicket	185	36.22	4.59
Edaphic Wooded Grassland	48	27.36	3.39

The dominant (typical) species on the study area are presented in Table 6-38. Only those species that cumulatively contributed to more than 90% to the overall similarity are presented. The three typical bird species with the highest frequency of occurrence on the study area include the Dark-capped Bulbul (*Pycnonotus tricolor*), Grey-backed Camaroptera (*Camaroptera brevicaudata*) and Rattling Cisticola (*Cisticola chiniana*). The majority of these species are insensitive to habitat type and structure and are recorded from most of the habitat types in the LAA. Approximately 55% of the typical species are insectivorous (either in the lower or upper canopy) and 25% are granivores (feeding on seeds), while the remaining composition includes small frugivores (consuming small sized fruit) and facultative nectarivores (sunbirds). Five (25%) of the typical species are restricted to the Afrotropical Highlands biome.

Table 6-38 Typical bird species in the LAA

Species	Common Name	Average abundance	Consistency	% Contribution	Primary Trophic Guild
Pycnonotus tricolor	Dark-capped Bulbul	1.30	0.78	14.38	Frugivore: upper canopy gleaner
Camaroptera brevicaudata	Grey-backed Camaroptera	0.75	0.49	6.31	Insectivore: lower canopy foliage gleaner
Cisticola chiniana	Rattling Cisticola	0.98	0.41	5.83	Insectivore: upper canopy foliage gleaner
Laniarius major	Tropical Boubou	0.84	0.42	5.48	Insectivore: lower canopy foliage gleaner
Cinnyris venustus	Variable Sunbird	0.81	0.39	5.2	Nectarivore
Ploceus baglafecht*	Baglafecht Weaver	0.96	0.37	4.96	Granivore: Lower to upper canopy gleaner
*Crithagra striolata**	Streaky Seedeater	1.01	0.29	3.59	Granivore: Lower to upper canopy gleaner
Uraeginthus bengalus	Red-cheeked Cordon-bleu	0.82	0.31	3.45	Granivore: Ground to undergrowth gleaner
Cossypha caffra	Cape Robin-chat	0.43	0.31	3.28	Insectivore: lower canopy foliage gleaner
Apalis flavida	Yellow-breasted Apalis	0.53	0.26	2.22	Insectivore: upper canopy foliage gleaner
Serinus flavivertex	Yellow-crowned Canary	0.61	0.21	2.00	Granivore: upper canopy gleaner
*Cisticola hunteri**	Hunter's Cisticola	0.65	0.21	1.91	Insectivore: upper canopy foliage gleaner
Phylloscopus trochilus	Willow Warbler	0.68	0.27	1.89	Insectivore: upper canopy foliage gleaner
*Melaenornis fischeri**	White-eyed Slaty Flycatcher	0.56	0.25	1.84	Insectivore: air hawker under canopy
Prinia subflava	Tawny-flanked Prinia	0.50	0.24	1.77	Insectivore: upper canopy foliage gleaner
*Zosterops kikuyuensis**	Kikuyu White-eye	0.65	0.23	1.63	Insectivore: upper canopy foliage gleaner
Chalcomitra senegalensis	Scarlet-chested Sunbird	0.39	0.24	1.61	Nectarivore
Turdus abyssinicus	Abyssinian Thrush	0.89	0.23	1.55	Frugivore: upper canopy gleaner
Streptopelia capicola	Ring-necked Dove	0.44	0.22	1.34	Granivore: ground gleaner
Terpsiphone viridis	African Paradise-flycatcher	0.30	0.22	1.24	Insectivore: air hawker under canopy

Note: * Species restricted to the Afrotropical Highlands biome.

An analysis of the primary tropic guilds of the bird species in the LAA shows that 24.5% of the composition consists of herbivores. The high number of herbivores is contributed by congregations of plant-eating Anatid (ducks and geese) species which were confined to wetlands (e.g. Manguo Pond) and areas of inundated halophytic vegetation (e.g. the Rift Valley lakes). More than 19% of the composition is also composed of nectarivores (sunbird species) and a high diversity of granivores (mainly Ploceid weavers, Euplectine widowbird, waxbills and finches). In addition, between 10 and 12% of the composition in the LAA consists of insectivores (predominantly bird species that prey on insects and invertebrates) and frugivores (fruit-eating birds). Carnivores were represented by the least abundant guild, which includes birds of prey, various kingfishers and rollers (Figure 6-45).

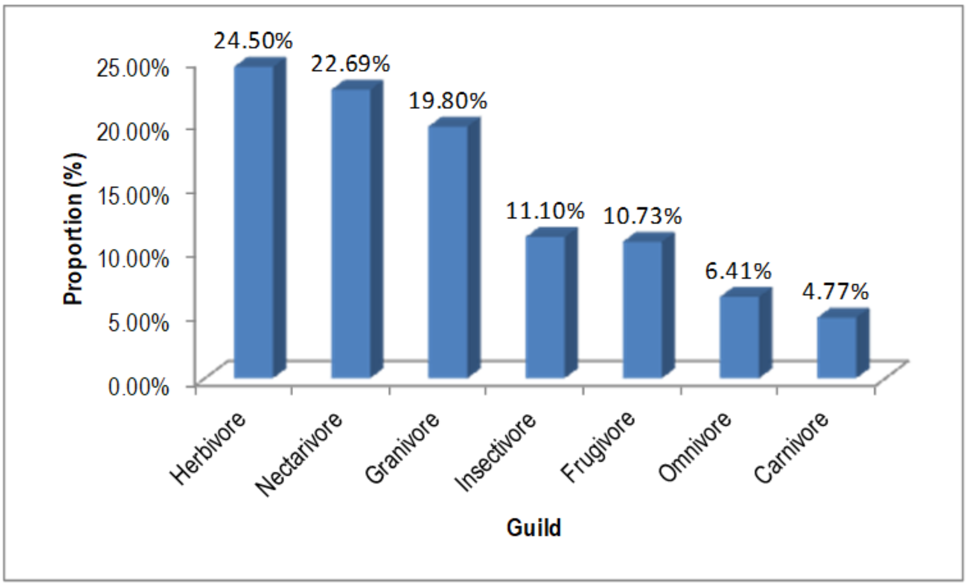


Figure 6-45 The proportion (%) of primary trophic guilds for bird species observed from the point counts in the LAA

Out of the observed species, 80 (18%) are migratory, representing both breeding and non-breeding visitors to the area. About 61 of the observed species represent Palearctic migrant birds and 19 species represents Intra-African migrant birds. In addition, 92 of the observed species (21%) are waterbird taxa. Many of these species occur in large numbers (e.g. >1,000 foraging individuals of Lesser Flamingos *Phoeniconaias minor* occurred along the shoreline of Lake Elmentaita) and are represented by large congregatory flocks of anatids (ducks and geese), Palearctic waders (scolopacid stints and sandpipers and charadriid plovers), cormorants, grebes, pelicans and wading birds represented by herons, egrets and storks.

SPECIES OF CONSERVATION INTEREST

THREATENED SPECIES ACCORDING TO THE IUCN

Nineteen (19) threatened and near threatened species were confirmed during the dry and wet surveys and thirteen (13) more are expected to occur in the LAA, based on their known (extant) and historical distribution ranges and the presence of suitable habitat (Table 6-39). These were not surveyed within the existing road reserve and this RoW is not habitat of interest for these species. Of the species observed:

- two are critically endangered (c. Rüppell's Vulture *Gyps rueppelli* and African White-backed Vulture *Gyps africanus*);
- five are endangered (c. Steppe Eagle *Aquila nipalensis*, Martial Eagle *Polemaetus bellicosus*, Bateleur *Terathopius ecaudatus*, Grey Crowned Crane *Balearica regulorum*, Secretarybird *Sagittarius serpentarius*);
- three are vulnerable (c. Tawny Eagle *Aquila rapax*, Southern Ground Hornbill *Bucorvus leadbeateri* and Sooty Falcon *Falco concolor*);
- nine are near threatened (c. Crowned Eagle *Stephanoaetus coronatus*, Pallid Harrier *Circus macrourus*, Lesser Flamingo *Phoeniconaias minor*, Curlew Sandpiper *Calidris ferruginea*, Chestnut-banded Plover *Charadrius pallidus*, Mountain Buzzard *Buteo oreophilus*, Grey-crested Helmetshrike *Prionops poliolophus*, Jackson's Widowbird *Euplectes jacksoni* and Kori Bustard *Ardeotis kori*).

Table 6-39 Threatened and Near-Threatened Bird Species Observed in the LAA

Family	Scientific Name	Common Name	IUCN Status	Number of individuals observed	Preferred Habitat Type	Habitat Type in which Observed	Primary Trophic Guild
Accipitridae	*Gyps africanus*	White-backed Vulture	CR	Approximately 5-10, feeding on carcass at Soysambu Conservancy	Breeds on tall, flat-topped trees. Mainly restricted to large rural or extensive bushland with game or free-roaming livestock	Evergreen and Semi-evergreen Bushland and Thicket	Scavenger
Accipitridae	*Necrosyrtes monachus*	Hooded Vulture	CR	None.	Lowland savanna, often commensal with human settlements. Considered to be a highly irregular foraging visitor to the survey area.	N/a	Scavenger
Accipitridae	*Gyps rueppelli*	Rüppell's Vulture	CR	Approximately 20 feeding on carcass at Soysambu Conservancy. Also observed overhead from Marula Estates	Widespread albeit partial to Conservancies with game.	Evergreen and Semi-evergreen Bushland and Thicket, RWV	Scavenger
Accipitridae	*Neophron percnopterus*	Egyptian Vulture	EN	None.	Rare in the area and probably represented by irregular foraging individuals.	N/a	Scavenger
Accipitridae	*Torgos tracheliotos*	Lappet-faced Vulture	EN	None.	An infrequent foraging visitor, probably only present on conservancies.	N/a	Scavenger
Accipitridae	*Aquila nipalensis*	Steppe Eagle	EN	Two observations of birds perched on a powerline at Marula Estates (February) and migrating birds along ESEBT habitat near the A* South highway	Open woodland and savanna	Evergreen and Semi-evergreen Bushland and Thicket	Insectivore: ground gleaner - primarily termites
Accipitridae	*Aquila heliaca*	Eastern Imperial Eagle	VU	None.	Open woodland and savanna along mountain ranges. Rare in survey area, probably individuals on passage (during migration).	N/a	Carnivore: ground hawker
Accipitridae	*Clanga clanga*	Great Spotted Eagle	VU	None.	Open woodland and savanna along mountain ranges. Birds on the survey area are probably individuals on passage (during migration).	N/a	Insectivore: ground gleaner
Accipitridae	*Polemaetus bellicosus*	Martial Eagle	VU	One observation of a single individual in February 2021	Extensive woodland and savanna, also open wooded grassland	Evergreen and Semi-evergreen Bushland and Thicket	Carnivore: ground hawker

Family	Scientific Name	Common Name	IUCN Status	Number of individuals observed	Preferred Habitat Type	Habitat Type in which Observed	Primary Trophic Guild
Accipitridae	*Terathopius ecaudatus*	Bateleur	EN	One observation of a single individual in February 2021 on Marula Estates	Extensive woodland and savanna, also open wooded grassland	Evergreen and Semi-evergreen Bushland and Thicket	Scavenger
Accipitridae	*Circus macrourus*	Pallid Harrier	NT	One observation of a pair in February 2021	Mainly open grassy woodland and floodplains	Evergreen and Semi-evergreen Bushland and Thicket	Insectivore: ground gleaner
Accipitridae	*Stephanoaetus coronatus*	Crowned Eagle	NT	Three independent observations from forest in the north, Soysambu Conservancy and from the Kinale Forest. An active nest occurs at Soysambu Conservancy in Riverine wooded vegetation.	Confined to forest or dense mesic woodland	Afromontane Undifferentiated Forest, Afromontane Rainforest and Riverine wooded vegetation	Carnivore: arboreal hawker - specialist primate hunter
Accipitridae	*Aquila rapax*	Tawny Eagle	VU	Two observations of birds roosting on powerlines at Marula Estates (mating pair) and overhead along the A8 South Highway	Extensive woodland and savanna, also open wooded grassland	Evergreen and Semi-evergreen Bushland and Thicket	Scavenger
Accipitridae	*Buteo oreophilus*	Mountain Buzzard	VU	Three observations from birds (all pairs) over forest habitat. Most abundant in Kinale Forest	Mainly forest	Afromontane Undifferentiated Forest, Afromontane Rainforest, Afromontane Bamboo	Carnivore: ground hawker
Accipitridae	*Gypaetus barbatus*	Bearded Vulture	NT	None.	Varied, mainly high altitude grassland in mountainous areas. Regarded as a highly irregular foraging visitor to UAWG and EWG.	N/a	Scavenger, mainly bone marrow
Acrocephalidae	*Acrocephalus griseldis*	Basra Reed Warbler	EN	None.	Confined to reedbeds and dense tangled vegetation in close proximity EGW and HalV. Known to be present during the austral summer at Lakes Nakuru and Naivasha. Could be associated with HalV habitat near lakes on survey area.	N/a	Insectivore: lower canopy foliage gleaner

Family	Scientific Name	Common Name	IUCN Status	Number of individuals observed	Preferred Habitat Type	Habitat Type in which Observed	Primary Trophic Guild
Ardeidae	*Ardeola idae*	Malagasy Pond Heron	EN	None, although yearly present in HalV habitat at Lake Elmentaita during the austral dry season.	Confined to dense marginal vegetation around freshwater lakes, ponds and pools. Possibly a regular non-breeding foraging visitor during the austral dry season to freshwater systems near Lake Elmentaita and potentially also Manguo Pond.	N/a	Carnivore: Freshwater forager
Bucorvidae	*Bucorvus leadbeateri*	Southern Ground Hornbill	VU	Observed at Soysambu Conservancy with at least two groups consisting of four individuals	Confined to open savannoid woodland and open savanna	Evergreen and Semi-evergreen Bushland and Thicket	Carnivore: Ground hawker
Charadriidae	*Charadrius pallidus*	Chestnut-banded Plover	NT	Single bird observed along the shoreline of Lake Elmentaita during April 2021	Large saline lakes and saltworks	Halophytic vegetation	Insectivore: Freshwater forager
Falconidae	*Falco concolor*	Sooty Falcon	VU	A pair observed overhead during April 2021 at Soysambu Conservancy	Varied, mainly savanna. A regular non-breeding visitor or passage migrant	Evergreen and Semi-evergreen Bushland and Thicket	Carnivore: Air hawker
Gruidae	*Balearica regulorum*	Grey Crowned Crane	EN	Several observations of paired birds up to large feeding flocks (>80 individuals) from various localities. Prominent in cultivated land on Marula Estates and at Manguo Pond	Varies, mainly confined to grassland adjacent to upland wetland systems (during breeding) as well as cultivated land (during foraging)	Evergreen and Semi-evergreen Bushland and Thicket, Edaphic wooded grassland	Omnivore: Ground Hawker
Motacillidae	*Macronyx sharpei*	Sharpe's Longclaw	EN	None, recent observations (according to the Kenya Bird Map) from EWG habitat in the south near Thika-Mango flyover region). These observations require vetting as this species is often confused with Yellow-throated Longclaw (*M. croceus*).	Upland slightly grazed tussock grassland. Not observed on survey area and regarded as highly irregular owing to the degraded condition of EWG habitat and persistent trampling and disturbances caused by livestock and human-induced activities (e.g. agriculture).	N/a	Insectivore: Ground Hawker
Otididae	*Ardeotis kori*	Kori Bustard	NT	At least two observations of foraging individuals in open ESEBT habitat along the A8 South Highway	Open savannoid woodland and open savanna	Evergreen and Semi-evergreen Bushland and Thicket	Carnivore: Ground Hawker
Phoenico-pteridae	*Phoeniconaias minor*	Lesser Flamingo	NT	Thousands (>1,000 individuals) of foraging individuals along the shoreline of Lake Elmentaita	Large saline lakes, dams and pans	Halophytic vegetation	Specialist feeder of cyanobacteria

Family	Scientific Name	Common Name	IUCN Status	Number of individuals observed	Preferred Habitat Type	Habitat Type in which Observed	Primary Trophic Guild
Ploceidae	*Euplectes jacksoni*	Jackson's Widowbird	NT	Single observation of one male and two females during April 2021	Moist grassland bordering Edaphic wooded grassland habitat	Edaphic wooded grassland	Granivore: lower canopy to ground gleaner
Sagittariidae	*Sagittarius serpentarius*	Secretarybird	EN	Several individuals (c. six observations) foraging in Marula Estates and Soysambu Conservancy during both April and February 2021	Open savannoid grassland and open savanna	Evergreen and Semi-evergreen Bushland and Thicket	Carnivore: Ground Hawker
Scolopacidae	*Calidris ferruginea*	Curlew Sandpiper	NT	Large numbers (>50 individuals) foraging along muddy shoreline habitat of Lake Elmentaita	Mudflats along large inland lakes, dams and pans. A regular and abundant summer foraging visitor to Lake Elmentaita	Halophytic vegetation	Insectivore: Freshwater forager
Scolopacidae	*Gallinago media*	Great Snipe	NT	None.	Dense inundated grassland along wetland systems (unchannelled seeps). Probably an uncommon summer foraging visitor to certain upland wetland systems, most notably Mangou Pond.	N/a	Insectivore: Freshwater forager
Scolopacidae	*Limosa limosa*	Black-tailed Godwit	NT	None.	Open muddy shoreline along the Rift Valley lakes. Probably a regular summer foraging visitor to the shoreline of Lake Elmentaita and Lake Nakuru.	N/a	Insectivore: Freshwater forager
Scolopacidae	*Numenius arquata*	Eurasian Curlew	NT	None.	Open muddy shoreline along the Rift Valley lakes. Probably an irregular summer foraging visitor to the shoreline of Lake Elmentaita.	N/a	Insectivore: Freshwater forager
Sturnidae	*Poeoptera femoralis*	Abbott's Starling	EN	None.	Afromontane Rainforest, present in the Kinale Forest block.	N/a	Frugivore: upper canopy gleaner
Vangidae	*Prionops poliolophus*	Grey-crested Helmetshrike	NT	Two observations of small foraging flocks at Marula Estate (February 2021) and Soysambu Conservancy near the Lake Elmentaita shoreline (April 2021)	*Acacia* woodland and Leleshwe woodland.	Evergreen and Semi-evergreen Bushland and Thicket	Insectivore: Upper canopy foliage gleaner

Note: N/a = This species was not observed during the survey but is potentially present in the area.

Four of the observed threatened bird species are primarily scavenging species. Two of these are critically endangered *Gyps* vultures (Rüppell's Vulture *G. rueppelli* and White-backed Vulture G. *afric*anus), one is a vulnerable *Aquila* eagle (Tawny Eagle *A. rapax*) and the last species represented by the endangered Bateleur (*Terathopius ecaudatus*). Some examples are illustrated in Figure 6-46.The conservation status of these four species was recently uplisted due to ongoing declines of more than 90% in these populations over the past three generations (>50 years), attributed to habitat loss (mainly where pastoral land is converted into agriculture), poisoning, direct persecution (mainly for medicinal and cultural reasons) as well as mortalities caused by collisions with electrical infrastructure (BirdLife International, 2017; 2018a, 2018b & 2020). In East Africa, poisoning through the use of the toxic pesticide carbofuran and the use of diclofenac, a non-steroidal anti-inflammatory drug often used for livestock, are some of the primary reasons for the decline observed in these species, especially for the two *Gyps* vulture species. The two *Gyps* vulture species also declined by 69% in central Kenya between 2001 and 2003 (Ogada and Keesing, 2010).

These species, with the exception of the Bateleur, are relatively widespread in the LAA (according to the Kenya Bird Map) where most of them are located in protected areas such as Lake Nakuru National Park and the Conservancies. The occurrence of Bateleur in the study region is scattered, with most of the records from Nakuru National Park and the eastern parts of Lake Elmentaita (according to the Kenya Bird Map). It appears that the LAA holds important sub-populations of these species in the country, which is directly attributed to the presence of game species (other important sub-populations occur in the Nairobi National Park and the Masai Mara area).

a) Feeding Rüppell's Vultures (*Gyps rueppelli*) at Soysambu conservancy

b) Roosting Tawny Eagle (*Aquila rapax*) on a pylon at Marula Estates

Figure 6-46 Example Threatened scavenging species

Four of the observed threatened bird species are large bodied terrestrial species which occur mainly on open savannoid grassland and upland wooded grassland (Figure 6-47). Two of these are endangered species (Secretarybird *Sagittarius serpentarius* and Grey Crowned Crane *Balearica regulorum*), one is a vulnerable species (Southern Ground-hornbill *Bucorvus leadbeateri*) and the last species is represented by the near threatened Kori Bustard (*Ardeotis kori*). According to extant records (Kenya Bird Map) it is evident that the Grey Crowned Crane is widespread on the LAA with several observations from both upland marsh/wetland habitat and low-land open savannoid grassland, including cultivated land. The Secretary bird is also widespread, although most of the observations stem from protected areas south of Naivasha and between Lakes Nakuru and Elmentaita. The Kori Bustard appears to be localized, with most of all recent observations south of Lake Naivasha, while observations of the Southern Ground-hornbill are scant and scattered. It appears that the presence of herbivore game species and well-managed livestock ranches are critically important for the persistence of these bird species on the LAA.

a) Grey Crowned Crane (*Balearica regulorum*),

b) Southern Ground-hornbill (*Bucorvus leadbeateri*)

c) Secretarybird (*Sagittarius serpentarius*)

d) Secretarybird (*Sagittarius serpentarius*)

Figure 6-47 Example of Threatened Large Terrestrial Birds observed in the LAA

Six of the observed threatened bird species include birds of prey species (apart from those mentioned earlier). Two of these are endangered species (Martial Eagle *Polemaetus bellicosus* and Steppe Eagle *Aquila nipalensis*), one is a vulnerable species (Sooty Falcon *Falco concolor*) and the remaining species represented by the near threatened Mountain Buzzard (*Buteo oreophilus*), Crowned Eagle (*Stephanoaetus coronatus*) and Pallid Harrier (*Circus macrourus*). According to extant records (the Kenya Bird Map) it is evident that the Martial Eagle and Steppe Eagle are mainly confined to Evergreen and Semi-evergreen Bushland and Thicket habitat in protected areas (conservancies and Lake Nakuru National Park), while the Mountain Buzzard and Crowned Eagle occurs in forested habitat, with the highest reporting rates from Afromontane Rainforest in the south of the LAA. An active nest is present in tall riverine forest vegetation at Soysambu) (Figure 6-48). The Sooty Falcon appears to be rare in the LAA with only a few records for the area from scattered localities. The Pallid Harrier appears to be more generalist in habitat preference and was widely observed from open savannoid grassland. The Sooty Falcon, Pallid Harrier and Steppe Eagle are non-breeding Palearctic visitors to the area.

a) Crowned Eagle (Stephanoaetus coronatus)

b) Active nest observed at Soysambu conservancy (see arrow).

Figure 6-48 Example of Threatened Birds of Prey in the LAA

Two of the observed bird species include smaller near-threatened passerine species (Figure 6-49). The Jackson's Widowbird (*Euplectes jacksoni*) is regarded as near-threatened since its preferred habitat, namely open montane grassland vulnerable towards habitat fragmentation and destruction owing to intensified agricultural development and livestock production (BirdLife International, 2016a). In addition, fire is also used to control tick loads during the dry season, which often result in the temporary displacement of this species from suitable habitat (BirdLife International, 2016a). The Jackson's Widowbird is uncommon in the LAA as recent records show that it occurs east of the LAA at the Kinangop Plateau (where it is uncommon according to Lens and Bennun, 1996) and near Mau Summit.

The Grey-crested Helmetshrike (*Prionops poliolophus*) was also recorded with scattered observations from the eastern shores of Lake Elmentaita, Marula Estates and in Lake Nakuru National Park. The Grey-crested Helmetshrike is near-threatened owing to its highly localised global distribution range and ongoing habitat transformation for agricultural production (BirdLife International, 2016b).

The Abbot's starling is thought as common in Kikuyu Escarpment Forest in the southern Aberdare Mountains (375 km^2), where flocks of up to 40 have been seen (UICN, 2021). The Kikuyu Escarpment Forest, of which the Kinale Forest block is part of, forms the core distribution of the species. The species is classified as endangered by the IUCN's Red List as it has a small population experiencing a continuing decline, owing primarily to the clearance and degradation of its forest habit. It was not identified during surveys but is expected to be observed, as probably resident in afromountain rainforest and afromountain bamboo forest corresponding to the Kinale Forest block.

The Basra reed warbler is also an as endangered species possibly be present in the study area. The study was conducted during the overwintering period where the species could be expected to be observed in the CH AoA, yet, no observations were recorded during the study period. While a lack of observations does not equal lack of presence, it does, however, suggest that suitable habitats for this species in the CH AoA may have been lacking, or transformed or degraded.

a) Grey-crested Helmetshrike (*Prionops poliolophus* - background) alongside a White-crested Helmetshrike	b) a Grey-crested Helmetshrike (*P. poliolophus*)	c) a White-crested Helmetshrike (*P. plumatus*)

Figure 6-49 Example of Threatened Small Passerines in the LAA

Three of the observed bird species are near-threatened waterbird and shorebird species. Two of these (Lesser Flamingo (*Phoeniconaias minor*) and Curlew Sandpiper (*Calidris ferruginea*) (Figure 6-50) show high reporting rates at Lake Elmentaita and Lake Nakuru, with lower rates reported for Lake Naivasha (according to the Kenya Bird Map) and both were observed in high numbers in the LAA on halophytic vegetation along Lake Elmentaita. The Chestnut-banded Plover (*Charadrius pallidus*) is currently only known from Lakes Turkana, Magadi and Natron in Kenya, while it occurs as vagrants/wanderers elsewhere. There are no recent records of Chestnut-banded Plover from the Project Development Area, apart from a single individual that was observed during April 2021 at Lake Elmentaita.

The Black-tailed Godwit (*Limosa limosa*) and Eurasian Curlew (*Numenius arquata*) are two near threatened species that could also occur along the shoreline of Lake Elmentaita during the austral summer, although none were observed during the February and April 2021 surveys. Both species are non-breeding Palearctic visitors, of which the Godwit is regarded as a regular foraging visitor, while the Curlew is an uncommon to irregular visitor to the Project Development Area.

a) Lesser Flamingo (*Phoeniconaias minor*)

b) Lesser Flamingo (*Phoeniconaias minor*) at Lake Elmentaita

c) Curlew Sandpiper (*Calidris ferruginea*)

d) Curlew Sandpiper (*Calidris ferruginea*)

Figure 6-50 Example of Waterbirds and Shorebirds in the LAA, at Lake Elmentaita

SPECIES PROTECTED IN KENYA

Schedule 6 of the Wildlife Conservation and Management Act, 2013 provides a list of threatened and protected bird species that occur in Kenya. The listed threatened species are regarded as outdated since the conservation categories of many of these birds have changed during recent conservation assessments (IUCN, 2021). However, it also provides a list of species that are protected in the country. Seventeen (17) protected bird species are expected to be present in the LAA, of which 12 species were observed during the survey campaigns. These include mainly iconic birds of prey (eagles), large wading birds (herons, storks and cranes), waterbirds (darters) and smaller bird taxa such as the Nyanza Swift (*Apus niansae*), Red-billed Oxpecker (*Buphagus erythrorynchus*), Kenya Sparrow (*Passer rufocinctus*) and Baillon's Crake (*Zapornia pusilla*).

ENDEMIC SPECIES AND/OR RESTRICTED RANGE SPECIES

From a conservation perspective, Kenya has five Endemic Bird Areas (c. Tanzania-Malawi mountains, Serengeti plains, Kenyan mountains, East African coastal forests and the Jubba and Shabeelle valleys) (Bennun and Njoroge, 1999; Stevenson and Fawnshawe, 2020). The country also spans six major biomes, each with its own distinct avifaunal association restricted to it: Afrotropical Highlands biome, Somali-Masai biome, East African Coast biome, the Lake Victoria Basin, and two outliers of Sudan-Guinea savanna biome and the Guinea-Congo forest biome (Bennun and Njoroge, 1999).

Fifty-two (52) of the observed bird species are restricted to a particular biome, of which 85% of bird species are restricted specifically to the Afrotropical Highlands biome were present. A high diversity of these species was located within the various forest habitat, most notably the Afromontane Rainforest and Afromontane Bamboo

Forest. Approximately 13% of the biome-restricted species is also confined to the Somali-Maasai biome which occurred predominantly in woodland habitat, especially the Evergreen and Semi-evergreen Bushland and Thicket habitat. The Afromontane Rainforest habitat unit forms an integral part of the Kenyan mountain Endemic Bird Area. The highway alignment is located in close proximity to the Kinangop grasslands, which is also the stronghold of the endemic and globally endangered Sharpe's Longclaw (*Macronyx sharpei*).

Ten species, endemic to East Africa were observed, including three species endemic to the Serengeti Plains and Kenyan Highlands Endemic Bird Area. Only one species (c. Kikuyu White-eye *Zosterops kikuyuensis*) observed in the study site is entirely endemic to Kenya. The prevalence of the majority of observed endemic species was higher in forest habitat.

The observed species are summarised as follows (all of these are endemic to East Africa):

- ***Species endemic to the Serengeti Plains Endemic Bird Area***: The Grey-crested Helmetshrike (*Prionops poliolophus*) is the only species present in the LAA. It is uncommon and was observed during two independent observations: (1) from tall *Acacia xanthophloea* woodland at Soysambu Conservancy along the edge of Lake Elmentaita. It was observed mixing with race *cristatus* of the White-crested Helmetshrike (*P. plumatus*). The (2) second observation consists of a small flock flying across the highway approximately 3 km north of the entrance gate to the Kigio Conservancy.
- ***Species endemic to the Kenyan Highlands Bird Area***: Observed species included the widespread and common Hunter's Cisticola (*Cisticola hunteri*) as well as Jackson's Widowbird (*Euplectes jacksonii*). The latter was recorded at a single locality corresponding to an upland wetland surrounded by grazed grassland.
- ***Species endemic to Kenya***: The Kikuyu White-eye (*Zosterops kikuyuensis*) was the only "true" Kenyan endemic species observed in the study area. It was commonly observed in mixed bird parties in forest and upland woodland habitat.
- ***Species endemic to East Africa***: Ten East African endemic species have been observed in the study area. Those with a frequency of occurrence include the Kikuyu White-eye (*Zosterops kikuyuensis*), Hunter's Cisticola (*Cisticola hunteri*), Kenya Sparrow (*Passer rufocinctus*) and Eastern Double-collared Sunbird (*Cinnyris mediocris*). Two of the species are often commensal with human-induced habitat and include the Kenya Sparrow (*Passer rufocinctus*) and the Swahili Sparrow (*P. suahelicus*).

Across these different levels of endemism, only one avifauna species listed qualifies as endemic and/or restricted range according to IFC' PS6 (IFC, 2019) (EOO<50,000 km2), that is the Kikuyu white eye (Z*osterops kikuyuensis*) which has an EOO of 28,200 km^2. This species was commonly sighted in the study area during the field surveys, particularly in forested and upper woodland habitats in the far east of the study area.

IMPORTANT HABITAT FOR BIRDS

There are nine Important Bird Areas (IBA) within the Biodiversity RAA, of which five are relevant to the project due to their close proximity to the Highway and represent important habitat for birds (BirdLife International, 2021). All five relevant IBA's are described along with their key bird composition in Table 6-40 below. The location of the IBA's is shown on Map 6-1 presenting the Regional Biodiversity Context. *Lake Elmentaita* is of particular interests, as it supports thousands to millions of foraging waterbirds, especially flamingos. It is also an important "staging" or "fuelling" site for Palearctic wader species on passage.

Moreover, other sections along the road alignment are of special interest for birds:

- *Manguo Pond*: An important wetland system that supports high richness of anatid species and breeding habitat for threatened species (e.g. Grey Crowned Crane *Balearica regulorum*). It also supports a high richness of waterbird species in general, and potential winter foraging habitat for the endangered Madagascar Pond-heron (*Ardeola idea*).
- *Marula Estate floodplains*: Some sections of rivers at Marula Estate often overspill during flood events into large floodplains which provide foraging habitat for large numbers of anatid species and Palearctic wader species. These are also important roosting sites for large numbers of roosting Spurwinged Goose (*Plectropterus gambiensis*), Egyptian Goose (*Alopochen aegyptiaca*) and Grey-crowned Crane (*Balearica regulorum*).

Table 6-40 Important Bird Areas within the Biodiversity RAA

IBA	Description	Key Bird species/compositions
1 Kikuyu Escarpment Forest (KE003)	Located near the south-eastern part of the LAA. It forms part of a forest reserve and is approximately 37,600 ha in total. It incorporates the Kinale and Gatamaiyu forests.	– It includes the core distribution of the globally vulnerable Abbott's Starling (*Poeoptera femoralis*). – The forest forms the eastern limit of many forest-dependant birds in Kenya (c. Orange Ground-thrush *Geokichla gurneyi*) and the western limit of the Red-chested Owlet (*Glaucidium tephronotum*). – The globally near-threatened Crowned Eagle (*Stephanoaetus coronatus*) is resident in the forest. – It supports three species restricted to the Kenyan mountains EBA[5] and supports 40 species restricted to the Afrotropical Highlands Biome.
2 Kinangop Grasslands (KE004)	Located to the west of the LAA on the Kinangop Plateau, and bounded at the west and north by the 2,400 m contour. It is unprotected and is approximately 77,000 ha in total.	– It supports the world stronghold of the endemic Sharpe's Longclaw (Macronyx sharpei). – It is an important flyway for Palearctic migratory species on passage. – It supports grassland habitat for localised bird species such as Black-winged Lapwing (*Vanellus melanopterus*), Wing-snapping Cisticola (*Cisticola ayresii*), Jackson's Widowbird (*Euplectes jacksoni*) and Long-tailed Widowbird (*E. progne*). – It supports four species restricted to the Kenyan mountains EBA
3 Lake Elmentaita (KE046)	A shallow alkaline lake located in the central part the study area and immediately west of the highway alignment. It is partly protected and is approximately 7,200 ha in total.	– The surrounding woodlands support a small population of the range-restricted Grey-crested Helmet shrike (Prionops poliolophus). – The lake holds internationally important numbers of Greater Flamingo (*Phoenicopterus ruber* – 23,800 individuals), Lesser Flamingo (*P. minor* – 588,400 individuals), Pied Avocet (*Recurvirostra avosetta* – 4,200 individuals), Great White Pelican (*Pelecanus onocrotalus* – 8,000 breeding pairs), Black-necked Grebe (*Podiceps nigricollis* – 3,000 individuals) and African Spoonbill (*Platalea alba* - 260 individuals). – The lake supports over 500,000 waterbird individuals. – It is an important staging (feeding) site for Palearctic waders when on passage. – It supports one species restricted to the Kenyan mountains EBA and one species restricted to the Serengeti Plains EBA.
4 Lake Naivasha (KE048)	A shallow freshwater lake located on the south-central part the study area and immediately west of the highway alignment. It is a Ramsar Site and is approximately 23,600 ha in total.	– The surrounding woodlands support a small population of the range-restricted Grey-crested Helmet shrike (*Prionops poliolophus*). – The globally endangered Basra Reed-warbler (*Acrocephalus griseldis*) is a winter visitor (a Palearctic migrant). – The lake holds internationally important numbers of Little Grebe (*Tachybaptus ruficollis* – 1,500 individuals), Red-knobbed Coot (*Fulica cristata* – 19,400 individuals) and African Spoonbill (*Platalea alba* - 412 individuals). – The lake supports up to 20,000 waterbird individuals. – It supports one species restricted to the Serengeti Plains EBA.
5 Lake Nakuru National Park (KE049)	A shallow alkaline lake located on the northern part of the study area and immediately south of the highway alignment. It is a Ramsar Site and National Park, and is approximately 18,000 ha in total.	– The surrounding woodlands support a small population of the range-restricted Grey-crested Helmetshrike (*Prionops poliolophus*). – The globally endangered Basra Reed-warbler (*Acrocephalus griseldis*) is a winter visitor (a Palearctic migrant). – The globally endangered Madagascar Pond-heron (*Ardeola idae*) is a winter visitor (from Madagascar). – It is an important staging (feeding) site for Palearctic waders when on passage. – The lake holds internationally important numbers of Little Grebe (*Tachybaptus ruficollis* – 7,860 individuals), Greater Flamingo (*Phoenicopterus ruber* – 9,940 individuals), Lesser Flamingo (*P. minor* – 1, 448,000 individuals), Black-winged Stilt (*Himantopus* – 3,120 individuals), Yellow-billed Stork (*Mycteria ibis* – 1,620 individuals), Grey-headed Gull (*Chroicocephalus cirrocephalus* – 9,040 individuals), Gull-billed Tern (*Gelochelidon nilotica* – 1,390 individuals), Great White Pelican (*Pelecanus onocrotalus* – 44,430 individuals), Black-necked Grebe (*Podiceps nigricollis* - 600 individuals) and African Spoonbill (*Platalea alba* - 580 individuals). – The lake supports over 1, 000,000 waterbird individuals. – It supports one species restricted to the Serengeti Plains EBA.

5 EBA - Endemic Bird Area

6.3.5 AMPHIBIANS AND REPTILES

DIVERSITY

Surveys conducted within the Biodiversity LAA allowed the identification of a total of 28 reptile species and 15 amphibian species. Table 6-41 presents a concise summary of the field results. Detailed results are available in the sectorial report (FFMES, 2021e) in Appendix 6-17.

A total of 535 observations were made at active searches sampling points, comprising 25 species of reptiles and 13 species of amphibians. In most cases these observations were of single specimens. Multi-specimen observations were also made, e.g. frog choruses and batches of tadpoles. A total of approximately 1,370 specimens were observed during the active searching of sampling sites.

The 12 trap arrays deployed during the April 2021 resulted in the sampling of 23 specimens from 11 species, during a trap-effort of 600 trap-days. The traps contributed to the identification of two species (7%) of reptiles that were not encountered during the active searching stints or from incidental records. Productivity of this sampling technique may have been affected by the fact that the wet season was drier than expected and that a few of the trap arrays incurred various disturbances, e.g. some were trampled by domestic livestock, one trap was ripped by a wild carnivore, and a few arrays were vandalized by people.

The contributions of incidental records are noteworthy. Most of these were obtained whilst moving between sampling sites, therefore inadvertently improving on the spatial coverage. Several other members of the FFMES biodiversity team also recorded opportunistic records of reptiles and amphibians in the course of their respective surveys. The most valuable source of these was the freshwater team that sampled frogs and tadpoles as a by-catch. Collectively the incidental contributions added 170 observations of 22 species of which 2 (7%) were not recorded by means of active searching or trapping.

Table 6-41 Summary of results of the two herpetofauna surveys that were conducted during February and April 2021 within the LAA.

Survey details	Field campaign		Total
	Feb 2021	April 2021	
No. of survey days	10	12	22
No. of grids surveyed (traps, search & incidental)	55	92	127
No. of sample sites surveyed by active searching	74	120	157
No. of sites surveyed by trap arrays	-	12	12
No. of trap days	-	600	600
No. of reptiles recorded from traps	-	10	10
No. of amphibians recorded from traps	-	13	13
No. of reptile species recorded from traps	-	6	6
No. of amphibian species recorded from traps	-	5	5
% of all recorded reptile species captured in traps	-	21.4%	21.4%
% of all recorded amphibian species captured in traps	-	29.4%	29.4%
Total no. of reptile records/observations	153	303	456
Total no. of amphibian records/observations	100	172	272
Total no. of reptile species (traps, search & incidental)	11	27	28
Total no. of amphibian species (traps, search & incidental)	9	15	15

Based on records from the two field surveys, plus digital data sets, literature and personal communications, 57 reptile species occur in the LAA, comprised of 40 species of confirmed occurrence plus another 17 species of potential occurrence, and 40 amphibian, comprised of 18 species of confirmed occurrence plus another 22 species of potential occurrence. The species recorded during the February and April 2021 surveys are listed in Table 6-42. The complete list of species likely to occur is available in the sectorial report in Appendix 6-17.

Table 6-42 Summary table of amphibian and reptile species sampled in the LAA

Order	Family	Scientific name	Common name	Conservation status or endemism				Field campaign		Habitats where the species were surveyed									
				IUCN Red List [1]	Protected in Kenya [2]	Kenya Endemic	East African Endemic	February 21	April 21	Afromontane bamboo	Afromontane rain forest	Afromontane undifferentiated forest	Edaphic wooded grassland on drainage-impeded or seasonally flooded soils	Evergreen and semi-evergreen bushland and thicket	Freshwater swamp	Halophytic vegetation	Riverine wooded vegetation	Upland Acacia wooded grassland	Water bodies
	Bufonidae	*Mertensophryne lonnbergi*	Lönnbergs Toad	VU		X	X		X	X	P	P	P				P	P	
	Bufonidae	*Sclerophrys garmani*	Garman's Toad					X	X	P	P	X	P	P	P		X	X	P
	Bufonidae	*Sclerophrys kerinyagae*	Kerinyaga Toad		T		X	X	X			X	P					P	
	Hyperoliidae	*Hyperolius glandicolor*	Taita Reed Frog					P	X	P	P	X	P	P	P		P	P	P
	Hyperoliidae	*Hyperolius viridiflavus*	Common Reed Frog		P			X	X	P	P	X	X	X	X		P	P	P
	Hyperoliidae	*Kassina senegalensis*	Senegal Running Frog					X	X	X	P	X	P	X	P		P	P	
	Phrynobatrachidae	*Phrynobatrachus keniensis*	Kenya Puddle Frog			X	X	X	X	X	X	X	X	X			X	P	
Anura	Pipidae	*Xenopus borealis*	Northern Clawed Frog				X	X	X	X	P	X	X	P	P		X	X	P
	Ptychadenidae	*Ptychadena anchietae*	Plain Grass Frog						X				P	P	P		P	X	P
	Ptychadenidae	*Ptychadena mahnerti*	Mahnert's Ridged Frog				X		X	X	P	P							
	Ptychadenidae	*Ptychadena nilotica*	Nile Grass Frog					X	X	P	P	X	P	X	X	P	X	P	P
	Pyxicephalidae	*Amietia nutti*	Nutt's River Frog					X	X	P	P	X					P		
	Pyxicephalidae	*Amietia wittei*	De Witte's River Frog				X	X	X	P	P	X	X	P			P		
	Pyxicephalidae	*Cacosternum plimptoni*	Plimpton's Dainty Frog				X	X	X	X	P	X	X	P				P	
	Pyxicephalidae	*Tomopterna cryptotis*	Cryptic Sand Frog						X			X	P	P			X	P	
	Agamidae	*Acanthocercus gregorii*	Gregory's Tree Agama					X	X			X	P	X		X	X	P	X
	Agamidae	*Agama caudospinosa*	Elmentaita Rock Agama					X	X			X		X		X	X	P	X
	Chamaeleonidae	*Trioceros bitaeniatus*	Side-striped Chameleon					X	X			X	P	X	P		X	X	P
	Chamaeleonidae	*Trioceros hoehnelii*	High-casqued Chameleon		P			X	X	P	X	X	X	X			P		
	Chamaeleonidae	*Trioceros jacksonii*	Jackson's Chameleon		P				X	X	X	P					P		
	Gekkonidae	*Hemidactylus mabouia*	Tropical House Gecko					X	X			X	P	X			X	P	
	Gekkonidae	*Hemidactylus squamulatus*	Nyika Gecko						X			X	P	P			P	P	
Squamata: Sauria	Gekkonidae	*Lygodactylus keniensis*	Kenya Dwarf Gecko					X	X			X	P	X			X	P	
	Gekkonidae	*Lygodactylus capensis*	Common Dwarf Gecko						X					X			P	X	
	Gerrhosauridae	*Gerrhosaurus flavigularus*	Yellow-throated Plated Lizard						X				P	X			P	P	
	Lacertidae	*Adolfus jacksoni*	Jackson’s Forest Lizard					X	X	P	P	X	P	X			X	X	
	Scincidae	*Mochlus sundevallii*	Sundevall's Writhing Skink						X			X	P	P			P	P	
	Scincidae	*Trachylepis megalura*	Long-tailed Skink						X			X	P		P			P	
	Scincidae	*Trachylepis striata*	Striped Skink					X	X			X	P	X		X	X	X	X
	Scincidae	*Trachylepis varia*	Variable Skink					X	X			X	P	X		X	P	P	X
	Varanidae	*Varanus niloticus*	Nile Monitor						X			P	P	X	P	P	P		P

Order	Family	Scientific name	Common name	Conservation status or endemism				Field campaign		Habitats where the species were surveyed									
				IUCN Red List [1]	Protected in Kenya [2]	Kenya Endemic	East African Endemic	February 21	April 21	Afromontane bamboo	Afromontane rain forest	Afromontane undifferentiated forest	Edaphic wooded grassland on drainage-impeded or seasonally flooded soils	Evergreen and semi-evergreen bushland and thicket	Freshwater swamp	Halophytic vegetation	Riverine wooded vegetation	Upland Acacia wooded grassland	Water bodies
Squamata: Serpentes	Atractaspididae	*Aparallactus jacksoni*	Jackson's Centipede Eater						X			P	P	X			P	P	
	Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater						X			P	P	X	P		P	P	P
	Colubridae	*Philothamnus battersbeyi*	Battersby's Green Snake						X			P	P	X	P		P	P	P
	Lamprophiidae	*Boaedon fuliginosus*	African House Snake					X	X			X	P	X			P	P	
	Leptotyphlopidae	*Leptotyphlops merkeri*	Merker's Thread Snake					X	X				P	X			X	P	X
	Psammophiidae	*Psammophis mossambicus*	Olive Sand Snake						X			P	P	X	P		P	P	P
	Psammophiidae	*Psammophis sudanensis*	Northern Stripe-bellied Sand Snake						X				P	X				P	
	Psammophiidae	*Psammophylax multisquamis*	Kenyan Striped Skaapsteker						X				P	X				P	P
	Pseudaspididae	*Duberria atriventris*	Dusky-bellied Slug-eater						X	P	P	P	P	X	P		P	P	P
	Pythonidae	*Python natalensis*	Southern African Rock Python				X		X	P	P	P	P	P	P		X	P	P
	Typhlopidae	*Afrotyphlops lineolatus*	Angola Blind Snake					X	X	P	P	P	P	X			P		
	Viperidae	*Bitis arietans*	Puff Adder		P				X				P	X			P	P	P

Notes : 1 IUCN status: VU=Vulnerable
2 Wildlife Conservation and Management Act (2013): T=Threatened; P=Protected

SPECIES OF CONSERVATION INTEREST

Table 6-43 below summarizes the species of conservation interest flagged by Bennun et al. (2018) during a past critical habitat screening and provides remarks on their potential occurrence. Confirmed and potential occurrences of threatened, protected and endemic and/or restricted-range species are discussed below.

Table 6-43 List of herpetofauna species that were highlighted in the Bennun et al. (2018) report. being of special significance for the project, and that were specifically targeted during the field surveys.

Scientific name	IUCN	Occur1	Remarks
Ptychadena mahnerti	LC	Y	Confirmed occurrence in study area.
Cacosternum kinangopensis	LC	N	Unlikely to co-occur with C. plimptoni.
Phrynobatrachus keniensis	LC	Y	Confirmed occurrence; common in study area.
Hyperolius montanus	LC	Y	Not found during surveys, but likely to occur here.
Mertensophryne lonnbergi	VU	Y	Confirmed occurrence in study area.
Mertensophryne mocquardi	DD	Y	Not found during surveys, but may possibly occur.
Phrynobatrachus irangi	EN	N	Unlikely to occur in study area.
Cacosternum plimptoni	LC	Y	Confirmed occurrence; common in study area.
Amietia wittei	LC	Y	Confirmed occurrence; common in study area.
Hyperolius cystocandicans	EN	Y	Not found during surveys, but confirmed occurrence.
Phrynobatrachus kinangopensis	VU	Y	Not found during surveys, but may possibly occur.
Trioceros jacksoni	LC	Y	Confirmed occurrence in study area.
Bitis worthingtoni	LC	Y	Not found during surveys, but confirmed occurrence.

1. The likelihood of their respective probability of occurring within the study is shown as Y (= confirmed or of potential occurrence) or N (= not likely to occur).

THREATENED SPECIES ACCORDING TO THE IUCN

Two reptiles and three amphibians are listed as threatened or near-threatened on the IUCN Red-List. Some 34 of 57 reptile species that may potentially occur within the study area have yet to be evaluated along IUCN criteria, None of these are likely candidates for any of the IUCN categories of being threatened, and these are tentatively considered to be of LC. In contrast, all of the 40 amphibian species that may potentially occur within the study area have been assessed, with 37 of them being of LC. Most of these species were not surveyed within the existing road reserve. and this RoW is not an habitat of interest for these species. However, one exception should be mentioned that is Endorheic wetlands present within the RoW. These road-side flooded terrain can provide breeding habitat for a substantial variety of frogs, including threatened species like Lönnberg's Forest Toad (VU).

BITIS WORTHINGTONI – VU.

- The Kenya Horned Viper does occur within the LAA, in the region of Naivasha and potentially also on the Mau escarpment. This is the only red-listed reptile species with special status in the context of the road upgrading project.

MERTENSOPHRYNE LONNBERGI – VU.

- A small population of Lönnberg's Toad was recorded during the April 2021 survey. A pair in amplexus and another two males were observed in flooded terrain about 50 m from the road, thus within the Local Assessment Area. This species probably also occurs as scattered subpopulations at various sites along the A8 Highway south of Naivasha. The Lönnbergs Toad is a species of montane grassland, moorland and forest patches, that survives in agricultural land. This species is endemic to the Kenyan Highlands above 1,800 m asl, east of the Rift Valley, on Aberdares Mountains (most commonly collected on the Kinangop Plateau), on Mount Kenya and in the vicinity of Limuru (IUCN SSC Amphibian Specialist Group, 2016a).

TRACHYLEPIS IRREGULARIS – NT.

- The Alpine Meadow Skink is associated with high-altitude ($3{,}000^{+}$ m) moorland. This species may potentially occur in the general region of the study area, perhaps at the highest reaches of the Mau escarpment. However, it probably does not occur within the 2 km road-buffer (biodiversity LAA) and as such this species is not deemed to be of consideration in the context of the road upgrading project.

PHRYNOBATRACHUS KINANGOPENSIS – NT

- Several specimens and calling individuals of puddle frogs were observed (i.e. genus *Phrynobatrachus* during the 2021 surveys, but identification down to species level was somewhat ambiguous. It is assumed that all of the records are *P. keniensis*, but more species (including *P. kinangopensis*) could be involved. Based on generalised distribution information, the Kinangop Puddle Frog (*P. kinangopensis*) may possibly occur within the LAA to the south of Naivasha. The Kinangop Puddle Frog is associated with rain-filled temporary pools in montane grassland and forest. This species is endemic to the Kenyan Highlands east of the Rift Valley (IUCN SSC Amphibian Specialist Group. 2016b).

HYPEROLIUS CYSTOCANDICANS (EN)

- The Tigoni Reed Frog is a montane forest species which can tolerate some minimal disturbance. It breeds in temporary, and sometimes permanent, pools with reeds and leafy vegetation. It can be found in farmlands that are mainly adjacent to protected forests. It's known distribution overlaps marginally with the study area in the southern-most reaches in the region of Limuru/Tigoni.

Another species was flagged by Bennun et al. (2018) in a past critical habitat screening report for the project. However, it is considered unlikely to occur in the study area.

PHRYNOBATRACHUS IRANGI – EN

- Although the Irangi Puddle Frog is known from high-altitude montane forest localities on the outskirts of the study area, this species has not yet been recorded close to the Highway Project during the survey periods and in existing records of the species. It is considered unlikely to occur in the study area.

SPECIES PROTECTED IN KENYA

The sixth schedule of the Wildlife Conservation and Management Act (WCMA) (2013) of the Kenya Wildlife Service lists the nationally "Critically Endangered, Vulnerable, Nearly Threatened and Protected" animal species. The WCMA listing contains various discrepancies to the IUCN listing. Apart from *Hyperolius cystocandicans*, described above as NT and considered Vulnerable according to the WCMA, the following WCMA listed species are present or potentially present within the LAA:

PYTHON SEBAE – EN (IUCN = NE).

- Two cryptic species of large python occur in Kenya, but the WCMA only lists the Central African Rock Python. It is generally quite difficult to distinguish between this species and the similar-looking Southern African Rock Python. According to Spawls et al. (2018), the more likely candidate for the high-altitude region of the study area is *Python natalensis*. We recorded the presence of python in the study area, based on fragments of sloughed skin that were found. It is not essential to know precisely which particular python species (if not perhaps both) occurs in the study area. It is sufficient for the purpose of this study to know that pythons do inhabit this area, and that the conservation status of both species would likely be evaluated as LC once assessed along IUCN criteria.

SCLEROPHRYS KERINYAGAE (LISTED AS BUFO KERINYAGAE) – THREATENED (IUCN = LC).

- The Kerinyaga Toad is an East African endemic. A few specimens were recorded during the 2021 field surveys.

HYPEROLIUS VIRIDIFLAVUS – PROTECTED (IUCN = LC).

- The Common Reed Frog is indeed extremely common, and its listing (incorrectly as *Hyperolius marmoratus*) on the WCMA is puzzling. Many specimens were recorded during the 2021 field surveys.

NAJA NIGRICOLLIS – PROTECTED (IUCN = NE).

- The Black-necked Spitting Cobra is a common species distributed in several African countries. Although not yet evaluated by IUCN, this species would qualify for LC status. It is certainly not a species of special status in terms of conservation status or distribution.

BITIS ARIETANS – PROTECTED (IUCN = NE).

- The Puff Adder is one of the most common and wide-spread snakes in Africa. Although not yet evaluated by IUCN, this species would qualify for LC status. It is certainly not a species of special status in terms of conservation status or distribution.

TRIOCEROS HOEHNELII – PROTECTED (IUCN = LC).

- The listing of the High-casqued Chameleon as a protected species is presumably due to the popularity of chameleons in the exotic pet trade. It is common within the study area, with >80 specimens observed at numerous localities within the study area.

TRIOCEROS JACKSONII – PROTECTED (IUCN = LC).

- The listing of the Jackson's Chameleon as a protected species is presumably due to the popularity of chameleons in the exotic pet trade. A few specimens were recorded from the southern quarter of the study area.

ENDEMIC AND/OR RESTRICTED RANGE SPECIES

Out of the confirmed and potential reptile occurrences within the LAA, 10 of 57 species are endemic to East Africa, and 2 of these are endemic to Kenya: Elmentaita Rock Agama (*Agama caudospinosa*), Kenya Horned Viper (*Bitis worthingtoni*)

Out of the confirmed and potential amphibian occurrences within the LAA, 15 of 40 species are endemic to East Africa, and 6 of these are endemic to Kenya: Mocquard’s Toad (*Mertensophryne mocquardi*), Silver-bladdered Reed Frog (*Hyperolius cystocandicans*), Mountain Reed Frog (*Hyperolius montanus*), Kinangop Puddle Frog (*Phrynobatrachus kinangopensis*), Lönnberg’s Toad (*Mertensophryne lonnbergi*), Kenya Puddle Frog (*Phrynobatrachus keniensis*).

Seven species recorded (or expected to occur) can be considered as restricted-range species (IFC, 2019), as their EOOs are smaller than 50,000 km^2. They are the Kenya River Frog (*Phrynobatrachus keniensis*), the Mountain Reed Frog (*Hyperolius montanus*), the Lönnbergs Toad (Mertensophryne lonnbergi), the Tigoni Reed Frog (*Hyperolius cystocandicans*), the Kinangop River Frog (*Phrynobatrachus kinangopensis)*, the Jackson's Three-horned Chameleon (*Trioceros jacksonii*) and the Kenya Horned Viper (*Bitis worthingtoni*).

Furthermore, *Cacosternum kinangopensis* is a restricted range species very similar to *Cacosternum plimptoni* that was flagged in a previous critical habitat screening for the Project (Bennun et *al*., 2018). The two species of dainty frogs that are known to occur in Kenya are classical cases of cryptic species. Species identifications is very difficult and not readily possible when trying to tell them apart based on morphological characters. This is because 1) the two species are morphologically similar and 2) each species display a substantial variety of colour morphs that may be shared between the two taxa. The best ways to separate the two species are by means of molecular and/or cell analyses. We did the latter and concluded that the populations along the Nairobi-Nakuru-Mau Summit road are *Cacosternum plimptoni*. It is possible that *Cacosternum kinangopensis* also occur in the general region, but it is more likely that this species will be associated with higher altitude localities towards the Kinangop Plateau and is hence considered unlikely to occur in the study area.

IMPORTANT HABITATS FOR AMPHIBIANS AND REPTILES

Much of the original habitat of the Regional and Local Assessment Areas has been anthropogenically transformed, but several remnant clusters of natural or semi-natural habitat still remain. From a herpetofaunal perspective these allow for the continued, albeit patchy, occurrence of habitat specialist species. Habitat generalist species are more likely to persist under these transformed conditions, with some species (e.g. Striped Skinks, Tropical House Geckos) seemingly flourishing in anthropogenic environments. Whereas the ecological value of large protected areas is not in dispute, the contributions of much smaller or localised habitat features within degraded conditions can be noteworthy. The following examples are of relevance to the Local Assessment Area:

ALIEN VEGETATION HEDGES

Alien vegetation is very often unsuitable to the species that would otherwise have inhabited a particular area. However, it was noticed during the 2021 survey that hedges of various alien plant species were in fact well occupied by chameleon species (Figure 6-51), especially so by High-casqued Chameleons. Three species of chameleons were recorded from hedges in urban, peri-urban and rural settings. The most common species was the High-casqued Chameleon, with >80 observed. The specimen in Figure 6-51 b) is a Side-striped Chameleon.

a) b)

Figure 6-51 Examples of Alien Vegetation Hedges

ROAD-SIDE ROCKY RIDGES

Rocky habitat is present at a few nodes along both of the road study areas that are being assessed. Some of these rocky ridges are situated literally within the Project Development Area, i.e. within the existing Road Reserve and Project footprint. These provide habitat for rupicolous species such as agamid lizards and skinks. Some of these rocky ridges are natural, whereas others are artificially stacked. Either way, they provide suitable habitat for rock-living lizards. These belts of azonal habitat are relatively uncommon within the LAA Area and should therefore be flagged as sensitive nodes. Figure 6-52 shows Striped Skinks, Gregory's Tree Agamas (a & b) and Elmentaita Rock Agamas (c & d).

a)

b)

c)

d)

e)

Figure 6-52 Examples of Clusters of Rocky Habitat (e) are present along a few sections of Highway

ROAD-SIDE FLOODED TERRAIN AND DITCHES

Endorheic wetlands such as road-side flooded terrain next to roads provide breeding habitat for a substantial variety of frogs. These artificial wetlands are in fact of greater importance as frog breeding habitat than, for example streams and rivers (i.e. riverine systems). These endorheic wetlands (Figure 6-53) can be utilized by a dozen or more species during the peak of the frog breeding season, including threatened species like Lönnberg's Forest Toad (VU) that was recorded here (c) during the April 2021 survey.

a)

b)

c)

d) Lönnberg's Toad (VU) was recorded breeding here during the April 2021 survey.

Figure 6-53 Examples of Road-side flooded terrain and ditches

6.3.6 MAMMALS

DIVERSITY

A total of 64 species were noted in the LAA. Four species were noted only in February 2021 and 19 were noted only in April 2021, while 41 of them were noted during both surveys. These results are explained by the greater success in small mammal trapping in April (including data provided by the herpetology team) and by data from the short-term camera trapping in the agricultural matrix, which provided information on a different group of species than the first season focused on the conservation areas. Table 6-44 presents a summary of mammal species encountered during surveys. Sections below present the results obtained with each survey method. Detailed results are available in the sectorial report (FFMES, 2021f) in Appendix 6-18.

Table 6-44 Summary table of Mammal Species Sampled in the LAA

Family	Species	Common Name	Special status		Field Campaign		Habitat surveyed								
			IUCN Red List[1]	Protected in Kenya[2]	February 21	April 21	Upper acacia wooded grassland	Riverine wooded vegetation	Halohytic vegetation	Freshwater swamp	Evergreen and semi-evergreen bushland and thicket	Edaphic wooded grassland	Afromontane un-differentiated forest	Afromontane rainforest	Afromontane bamboo
Bathyergidae	*Heliophobius argenteocinereus*	Silvery mole-rat				x					x				
Bovidae	*Redunca bohor*	Bohor reedbuck			x			x							
	Sylvicapra grimmia	Common/bush duiker			x	x	x	x			x		x		x
	Syncerus caffer	Cape buffalo	NT		x	x			x		x				
	Tragelaphus sylvaticus	Cape bushbuck			x	x		x							x
	Madoqua cavendishi	Cavendish's dik			x	x		x			x		x		
	Taurotragus oryx	Common eland			x	x		x			x				
	Aepyceros melampus	Common impala			x	x		x	x		x				
	Kobus defassa	Defassa waterbuck			x	x		x	x		x				
	Oryx callotis	Fringe-eared oryx	VU		x	x		x			x				
	Nanger granti	Grant’s gazelle			x	x					x				
	Cephalophus johnstoni / harveyi	Johnston's / Harvey's duiker				x									x
	Alcelaphus cokii	Kongoni			x	x					x				
	Eudorcas nasalis	Serengeti Thomson’s gazelle			x	x		x	x		x				
	Connochaetes mearnsi	Serengeti white-bearded wildebeest			x	x		x			x				
	Damaliscus jimela	Serengeti topi			x	x		x			x				
	Raphicerus campestris	Steenbok				x	x				x				
Canidae	*Otocyon megalotis*	Bat eared fox			x	x		x			x				
	Canis mesomelas	Black backed jackal			x	x			x		x				
Cercopithecidae	*Colobe guéréza*	Guereza			x	x			x		x		x	x	x
	Papio anubis	Olive baboon			x	x		x	x		x		x		
	Cercopithecus albogularis	Syke's monkey			x	x		x			x		x	x	x
	Chlorocebus pygerythrus	Vervet monkey			x	x	x	x			x				
Elephantide	*Loxodonta africana*	African savanna elephant	EN	EN		x								x	
Equidae	*Equus quagga*	Plains zebra	NT		x	x		x	x		x		x		
Felidae	*Panthera pardus*	Leopard	VU	EN	x	x					x		x		
	Panthera Leo	Lion	VU	EN											
	Leptailurus serval	Serval				x	x								
Giraffidae	*Giraffa camelopardalis Ssp camelopardalis*	Giraffe (Nubian)	CR	EN	x	x		x			x				
	Giraffa camelopardalis Ssp tipperlskirchi	Giraffe (Masai)	EN		x	x		x			x				
Gliridae	*Graphiurus kelleni*	Kellen’s African dormouse			x						x				
Herpestidae	*Galerella sanguinea*	Common slender mongoose				x	x								
	Herpestes ichneumon	Egyptian mongoose			x	x	x	x			x		x		
	Ichneumia albicauda	White-tailed mongoose			x	x		x			x		x		x
Hippopotamidae	*Hippopotamus amphibius*	Common hippopotamus	VU	VU	x	x		x			x				
Hyaenidae	*Hyena Crocuta*	Spotted hyena			x	x					x		x		
	Hyaena	Striped hyena	NT	EN		x	x								

Family	Species	Common Name	Special status		Field Campaign		Habitat surveyed								
			IUCN Red List[1]	Protected in Kenya[2]	February 21	April 21	Upper acacia wooded grassland	Riverine wooded vegetation	Halohytic vegetation	Freshwater swamp	Evergreen and semi-evergreen bushland and thicket	Edaphic wooded grassland	Afromontane un-differentiated forest	Afromontane rainforest	Afromontane bamboo
Hystricidae	*Hystrix cristata*	Crested porcupine			x	x	x	x			x		x		
Leporidae	*Lepus victoriae*	African savanna hare				x	x						x		
	Lepus capensis	Cape hare			x	x					x		x		
Muridae	*Arvicanthis niloticus / nairobae*	African grass rat - Nairobi grass rat			x						x				
Muridae	*Otomys angoniensis*	Angoni vlei rat			x	x		x					x		
	Oenomys hypoxanthus	Common rufous-nosed rat				x							x		
	Grammomys ibeanus / dolichurus	East African / woodland thicket rat				x		x							
	Mus triton	Gray-bellied mouse				x					x		x		
	Lophuromys margarettae	Margaret's brush-furred rat			x	x							x		
	Rhabdomys dilectus	Mesic four-striped grass rat				x							x		
	Mastomys natalensis	Natal multimammate mouse			x	x							x		
	Rattus	Roof rat				x	x				x		x		
	Mus minutoides	Sub-Saharan pygmy mouse			x	x		x			x		x		
	Lemniscomys striatus	Typical striped grass mouse			x	x	x	x			x		x		
Mustelidae	*Aonyx capensis*	African clawless otter	NT		x	x					x	x	x		
	Mellivora capensis	Honey badger				x	x				x				
	Ictonyx striatus	Zorilla			x	x		x			x		x		
Nesomyidae	*Dendromus messorius*	Banana African climbing mouse				x							x		
	Dendromus insignis	Montane African climbing mouse				x							x		
	Cricetomys ansorgei	Southern giant pouched rat				x									x
Orycteropodidae	*Orycterop afer*	Aardvark			x	x	x				x		x		
Procaviidae	*Procavia capensis*	Rock hyrax			x	x					x		x		
Sciuridae	*Heliosciurus rufobrachium*	Red-legged sun squirrel			x	x					x		x		
	Xerus rutilus	Unstriped ground squirrel			x						x				
Spalacidae	*Tachyoryctes splendens*	African root rat			x	x	x				x	x	x		x
Suidae	*Potamochoerus larvatus*	Bushpig				x		x							
	Phacochoerus africanus	Common warthog			x	x		x	x		x		x		
Viverridae	*Civettictis civetta*	African civet			x	x					x		x		
	Genetta maculata	Large spotted genet				x					x				x
Totals			10	6	45	60	14	28	9	0	46	2	32	3	9

Notes: [1] IUCN status: CR=Critically Endangered; EN=Endangered; VU=Vulnerable; NT=Near Threatened
[2] Wildlife Conservation and Management Act (2013); EN=Endangered; VU=Vulnerable.

ACTIVE SEARCH FOR PRESENCE INDICES AND DIRECT OBSERVATIONS BY SAMPLING POINT

The 96 sites surveyed by the active search of presence indices and direct observations, allowed the collection of 301 points of raw data, and the recording of 29 species. The number of direct observations is less than what was obtained by observation from roads. The sampling point method has been shown to be effective in improving the identification of the presence of small carnivores (100 raw data); this presents functionally interesting data, however, it is often not possible to identify the exact species which left the track or sign. This method was used mainly in the afromontane areas of the north and south of the study area as well as in degraded and rural landscapes. With 301 data points obtained, the sampling results can be considered good yet not exceptional. In particular, few direct observations were made and thus the proportion of presence indices recorded is important. This explains a low level of identifications to the species level (64%). However, the number of data obtained is still small in terms of the effort, which can be weighed by the degree of degradation and the invasive nature of the sampling method on the mammal fauna in question.

DIRECT OBSERVATIONS BY ROAD

In total, 318 points of mammal presence were noted with this survey method (115 in February and 173 in April). A total of 26 species and 5,257 individuals were recorded. The survey and logistical effort were less than that of active searches at sampling points, yet provided an equivalent amount of data and the identification rate for species was much better (95%). This method provided important data on conservation areas, including the plateau south of Naivasha. This data also covers large species with a strong displacement capacity and a risk of crossing the road (therefore with an increased risk of collisions with vehicles). This method also allowed for the collection of data regarding species listed on the IUCN Red List of Threatened Species (57% of zebra records, 35% of giraffe records and 50% of buffalo records).

SHORT-TERM CAMERA TRAPPING

As detailed in section 5.3.2.6, 50 camera traps were deployed for short term periods (two to five days) at a total of 45 sampling locations during the dry and wet season survey periods (February and April), accounting for a total of 638 trap days. In the combined two survey periods, a total of 140,000 photographs were taken and a total of 372 validated "mammal events" (258 in February and 114 in April) relating to 38 species were recorded. This made camera trapping the most effective method for species-specific detection. They are particularly useful for medium to small species and carnivores. Ten species were only recorded by the camera traps, for example: white-tailed mongoose (*Ichneumia albicauda*), zorilla (*Ictonyx striatus*), bohor reedbuck (*Redunca bohor*) and serval (*Leptailurus serval*).

This was an important method which greatly enriched the database. Quantitative distribution of data supports the results of active searches and direct observations with little data in afromontane areas compared to lower-altitude areas.

LONG-TERM CAMERA TRAPPING

As described in section 5.3.2.6, the set of 50 camera-traps set out in Soysambu and Marula Estates allowed to capture pictures of wildlife passing by for a combined total effort of 3,415 active camera-trap days. After the processing of pictures to eliminate empty ones, pictures with humans or cattle, a total of 40,348 pictures of wildlife were compiled, allowing the identification of 34 mammal species. All of these species were known for occurring in the two private conservancies.

Further analysis of data from the long-term camera trap campaign focused on the characterization of locations of high species abundance and diversity to support the identification of optimal locations of wildlife crossing. The analysis targeted four key conservation species selected for their conservation concern and their proneness to collision with vehicles: African Buffalo (*Syncerus caffer*); Giraffe (*Giraffa camelopardalis*); Plain’s zebra (*Equus quagga*); and Spotted Hyena (*Crocuta Crocuta*). The detailed results of the analysis are presented in the camera trap-study in Appendix 6-19. They are discussed in section below on wildlife movement and connectivity.

SMALL MAMMAL TRAPPING

A total of twelve species were recorded from a total of 59 individuals captured. In February, issues associated with theft and destruction of the traps allowed for the capture of only 20 individuals from six species. In April, 39 individuals were captured from nine species. The catch rate was 5.54 animals per 100 trap nights in February and 3.23 in April.

This method required the greatest field effort when compared to the volume of data generated. However, it remained essential to properly integrate small mammals into the inventory. The theft and destruction of a large number of Sherman traps during the first field survey led to the cessation of Sherman trap deployment in February and the use of lethal traps in April. The use of these traps may have led to a bias in the results.

ADDITIONAL DATA

Additional data was provided by the herpetology and ornithology teams. Their findings totalled 86 data points, for 27 species and 123 individuals. Pitfall trapping, used by the herpetology team, allowed for the capture of 23 small mammals. (12 *Crossidura* sp, two *Lemniscomys striatus*, three *Mus minutoides*, four *Mus triton*, one *Dendromus insignis* and one *Dendromus messorius*). The records of Dendromus insignis and Mus triton were the only records taken during the entire field survey. The contribution of the data from the herpetology team became particularly valuable when the use of Sherman traps by the mammal team had to be halted and large rodent snap traps had to be used instead.

SPECIES OF CONSERVATION INTEREST

The identification of species of conservation concern and endemism was guided by Wilson and Mittermeier's (2009) "Handbook of the Mammals of the World". This list is based on the work of Wilson and Reeder (Wilson, Reeder, 2005) and thus presents many differences in the status and rank of taxa (species vs sub species) when compared to the IUCN's listing. In general, in the Handbook of the Mammals of the World, a higher number of taxa, particularly rodents and ungulates, are elevated to the status of species. For example, the Serengeti White-bearded Wildebeest (*Connochaetes mearnsi*) is recognized as a species with limited distribution by Wilson and Mittermeier but is considered a sub-species of the Common Wildebeest (*Connochaetes taurinus*) by the IUCN. With regard to the global conservation status of species, where differences were recorded, the status listed by the IUCN was retained.

THREATENED SPECIES ACCORDING TO THE IUCN

According to the IUCN Red List, a total of one Critically Endangered, two Endangered, five Vulnerable and four Near-Threatened mammal species were recorded during the surveys. These were not surveyed within the existing road reserve and this RoW is not habitat of interest for these species. These are described below, followed by others:

AFRICAN SAVANNA ELEPHANT (LOXODONTA AFRICANA) EN - 1 RECORD, 1 INDIVIDUAL

- Evidence of the presence of African Elephants was discovered by the FFMES team ornithologist in the Kinale Forest (eastern edge of Zone 5). While this evidence was recorded outside the study area (5 km east of the road), it is important to acknowledge this observation considering the African Elephant's conservation status and its ability to move great distances, making it susceptible to crossing the road. The evidence was dung, which considering the speed of degradation of such evidence in a wet and humid rainforest system, highlights that the animal presence in the Kinale Forest was less than 3 months old.

FRINGE-EARED ORYX (ORYX CALLOTIS) VU - 12 RECORDS, 95 INDIVIDUALS COMBINED

- All data relating to this species was collected within the perimeter of the Marula Estates Conservation Area. Observations of some individuals with plastic sleeves on their horns perhaps indicate that these individuals were farm bred animals or part of a larger conservation project. Previous census data shows a maximum of 45 individuals in Marula Estates in 2014 and a minimum of eight in 2018. The species was not recorded on Soysambu Conservancy. Such recordings are in close proximity yet still outside of this species' distribution as listed by the IUCN. However, it is important to consider that the IUCN's maps (https://www.iucnredlist.org/search) often have poor precision levels. In Kenya, the Fringe-eared Oryx is found in the south and south-east of the country in more arid habitats than those found in the study area (East, 1998). Such distribution thus further supports the notion that these individuals have been introduced, and are not naturally occurring in the landscape. The global population of this species is estimated at 3,000 / 4,000 adult individuals (IUCN, 2021); however, records show a declining population as population estimates in the late 1990s numbered some 5,240 individuals (East, 1998). Furthermore, in Kenya, the population of Oryx sp. (*Beisa* and *Callotis*) declined by 78.7% between 1977-1980 and 2011-2013 (Ogutu *et al*.,2016).

MAASAI GIRAFFE (*GIRAFFA CAMELOPARDALIS SSP TIPPERLSKIRCHI*) EN – NUBIAN GIRAFFE (*GIRAFFA CAMELOPARDALIS SSP CAMELOPARDALIS*) CR – 20 RECORDS, 47 INDIVIDUALS COMBINED

- Two subspecies are present in the study area. *Ssp Tipperlskirchi* is considered to be naturally occurring and *ssp camelopardalis* is present as a result of translocation of wild populations into regional conservation areas or Nakuru National Park. The world population of the *ssp camelopardalis* subspecies is estimated at 2,098 individuals (808 in Kenya) including 1,468 adults, with an overall positive demographic trend. This subspecies has virtually disappeared from its natural range in Kenya (Fennessy *et al*., 2018). Records from previous surveys show the presence of 41 giraffes of the *Tipperlskirchi* subspecies in Marula Estates (May 2018) and 133 individuals without sub-species precision in Soysambu Conservancy (2019). Our observations indicate giraffe presence in the study area, specifically in the two conservation areas of Soysambu Conservancy and Marula Estates, on the eastern edge of Lake Naivasha and on the plateau south of the city of Naivasha. Individuals noted south of Naivasha and Marula Estates were of the *Tipperlskirchi* subspecies and those noted on Soysambu Conservancy were of the *camelopardalis* subspecies.

LEOPARD (*PANTHERA PARDUS*) VU – 9 RECORDS, 9 INDIVIDUALS COMBINED

- Leopards were recorded on both the Soysambu Conservancy and Marula Estates conservation areas as well as the transitional escarpment zone between the Naivasha plateau and the southern afromontane area of the study area (zone 4). In this area of rugged terrain and natural woodland cover, numerous signs of the presence of this species were identified. This area is also rich in small antelopes and Olive Baboons (*Papio Anubis*), key prey for leopards.

LION (PANTHERA LEO) (VU) – TWO RECORDS, 2 INDIVIDUALS COMBINED

- Female lions were recorded in the Soysambu Conservancy. Both observations were made at the same camera-trap location. Bi-Annual census data from Soysambu shows lions are occasionally present in small groups within this protected area.

COMMON HIPPOPOTAMUS (*HIPPOPOTAMUS AMPHIBIOUS*) VU - 6 RECORDS, 31 INDIVIDUALS COMBINED

- Hippopotamus were recorded in three separate areas during the field surveys: Lake Elmentaita, notably on the north shore in the Soysambu Conservancy, at three points in the Marula Estates Conservation Area and on the eastern edge of Lake Naivasha. The latter is most problematic with regard to the road expansion. There is evidence to indicate that the Hippopotamus residing in Lake Naivasha feed on the meadows bordering the road at night. In Marula Estates, there is evidence to indicate that some of the animals use rivers that appear to suffer from very low water levels in the dry season. This could hypothetically lead to the movement of individuals in search of water points and potentially lead to road crossings.

PLAINS ZEBRA (*EQUUS QUAGGA*) NT - 142 RECORDS, 1,580 INDIVIDUALS COMBINED

- Plains' zebras were abundant in the conservation areas of Soysambu Conservancy and Marula Estates. Previous records report the presence of 1,801 individuals in Marula Estates (2018) and 4,179 individuals in Soysambu Conservancy (2019). This species is absent from the mountainous parts of the study area but is present outside of any protective perimeters south of Naivasha. In this zone Plains zebra were found right next to the road and in close proximity to urban areas. This presents a high risk of collision and indeed, the body of an individual, possibly a victim of a collision, was found during the April field survey in the lower part of zone 5, a location quite a distance from the majority of observations.

CAPE BUFFALO (*SYNCERUS CAFFER*) NT - 17 RECORDS, 93 INDIVIDUALS COMBINED

- Most (16) records were from the Soysambu Conservancy and Marula Estates conservation areas. One additional record was within the Kenya Wildlife Services sanctuary where a single animal was encountered when retrieving the cameras deployed in that location. Apart from this single record, the species appear confined within the protected areas and not likely to represent a major issue for the road unless the fencing is compromised.

AFRICAN CLAWLESS OTTER (*AONYX CAPENSIS*) NT - 3 RECORDS, 3 INDIVIDUALS COMBINED

- The signs of African Clawless Otters (footprints) were recorded at three separate points on small streams in the study area. Two were on mountain streams (south and north of the LAA) and one on an almost dry stream north of Elmentaita Lake in the Soysambu Conservancy.

STRIPED HYENA (*HYAENA HYAENA*) NT – 1 RECORD, 2 INDIVIDUALS

- Camera trapping recorded two individuals in the northern part of the study area (zone 2), west of Nakuru. This sector is quite disturbed, has a strong human presence and is well developed for agriculture. The presence of the species was also recorded on the Marula Estates census in 2018 (1 individual).

SERENGETI TOPI (*DAMALISCUS LUNATUS SSP. JIMELA*) – VU- 4 RECORDS, 17 INDIVIDUALS COMBINED

- This species was noted only in the Marula Estates conservation area.

SPECIES PROTECTED IN KENYA

Schedule 6 of the Wildlife Conservation and Management Act, 2013 provides a list of threatened and protected mammal species that occur in Kenya. Five mammal species surveyed within the LAA are designated as Endangered:

- African savanna elephant (Loxodonta Africana)
- Leopard (*Panthera pardus*)
- Lion (*Panthera Leo*)
- Nubian Giraffe (*Giraffa camelopardalis* Ssp *camelopardalis*)
- Striped hyena (*Hyaena*)

Also, the Common hippopotamus (*Hippopotamus amphibius*) is listed as Vulnerable. All of these species are also on the red list of threatened species and described above.

ENDEMIC AND/OR RESTRICTED RANGE SPECIES

No endemic or restricted-range species were surveyed within the study area, according to IFC's definition (2019).

However, the Aberdare mole shrew (*Surdisorex norae*) is likely to be present in the wider RAA, and was flagged in a previous critical habitat screening report (Bennun et *al.*, 2018) . It can be considered restricted range. This species is endemic to the east side of the Aberdare Mountain Range. The distribution of this species probably follows the top of this mountain range hence it is unlikely to be found in the LAA, close the road.

It is important to note that some of the mammals flagged as restricted range in that same report (Bennun et *al.*, 2018) - , i.e. *Sylvisorex granti*, *Crocidura montis -Dendromus insignis*– all have EOOs larger than 50,000 km^2, and thus do not meet restricted range definition.

Several species noted as present in the study area are worth noting because they are considered as sub-species of a species with a larger distribution. Although not considered endemic or restricted range species, they are listed below with the species they are recorded as by the IUCN:

MARGARET'S BRUSH-FURRED RAT (*LOPHUROMYS MARGARETTAE*) NOT EVALUATED – 5 RECORDS, 5 INDIVIDUALS

- This taxon is classified to the species level by Wilson and Mittermeier's (2009) "Handbook of the Mammals of the World". However, this species is not listed on the IUCN's Red *List, it is instead incorporated into the Yellow-spotted Brush-furred Rat (Lophuromys* flavopunctatus) which is listed as 'Least Concern'. Despite this, the presence of this species in the study area is interesting. Margaret's Brush-furred Rat is believed to be potentially threatened by habitat alteration, particularly that which includes the use of fire (Taylor, 2017). Five individuals were captured with rodent traps. All captures took place in the higher altitude regions of the study area, in the north at 2,400 m and in the south at 2,600 m. Such captures align with previous records which indicate that this species is confined to areas above 2,000 m in Ugandan and Kenyan mountain ranges.

SERENGETI THOMSON'S GAZELLE (*EUDORCAS NASALIS*) - IUCN NAME: THOMSON'S GAZELLE (*GAZELLA THOMSONI*) (98 RECORDS, 1,245 INDIVIDUALS COMBINED)

- Common in the open plains of the Soysambu Conservancy and Marula Estates conservation areas. Well represented as free ranging animals in the grasslands of the plateau south of Naivasha. The species has a limited body size but does represent a significant risk if crossing the road.

CAVENDISH'S DIK-DIK (*MADOQUA CAVENDISHI*) - IUCN NAME: KIRK'S DIK-DIK (*MADOQUA KIRKII*) (52 RECORDS, 61 INDIVIDUALS COMBINED)

- Present in areas of fairly dense thicket. This species appears much more abundant in the southern part of the study area, the eastern part of the Marula Estates conservation area, the hills on the eastern border of Lake Elmentaita and along the wooded escarpment south of Naivasha.

SERENGETI WHITE-BEARDED WILDEBEEST (*CONNOCHAETES MEARNSI*) - IUCN NAME: COMMON WILDEBEEST (*CONNOCHAETES TAURINUS*) (9 RECORDS, 35 INDIVIDUALS COMBINED)

- Noted in the Marula Estates conservation area but particularly south of Naivasha in close proximity to the lake and on the grasslands of the plateau, free ranging. Conservation area census data does not indicate the presence of the species in Soysambu Conservancy (2019) and mentions 84 individuals in Marula Estates in 2018.

IMPORTANT HABITATS FOR MAMMALS

The presence of mammalian fauna of the study area is uneven. In general, the spaces characterised by human activities have a substantially lower mammal species richness. This is the case for the most urbanised areas but also for agricultural areas in the northern part of the study area (west of Nakuru) and some areas south of Naivasha.

Functional groups of smaller species such as small antelopes and small carnivores have a wider and more homogeneous distribution on the study area. This is likely an indication of the adaptation of these species to human activities or of their ability to co-exist within the generally agricultural habitat matrix developed by humans.

Afromontane areas are generally neglected by medium-sized to large mammal species with the exception of rare recordings. This is the case for the majority of ungulates, whose absence is likely connected with the degradation of most habitats but could also be related to climatic factors and the nature of the original, undisturbed habitats.

The concentration of species and particularly ungulates can be observed in three areas: the two conservation areas of Soysambu Conservancy and Marula Estates as well as on the plateau south of Naivasha. These areas are also key habitat zones for many species listed on the IUCN Red List of Threatened Species.

The southern afromontane area, i.e. the escarpment and mountain forests south of Naivasha, is of greater interest than that of the north, in the Mount Longoni/Koibatek forest area. The proximity of preserved environments and the persistence of a more substantial area of natural environments along the Naivasha plateau escarpment probably explains this. The northern area presents a dearth of preserved natural environments and is subject to greater human pressure. The southern afromontane area still presents suitable habitat for small ungulates (e.g., dik-dik, duiker, etc.) and large carnivores (e.g., leopard, spotted hyena, etc.) and it remains pristine enough to be traversed by large herbivores of concern such as plain zebras and elephants.

Further considerations should also be placed on the role of the southern part of the study area (south of Naivasha) acting as an axis of movement for large mammals migrating between the Aberdare Mountains and the protected areas in the west. This area therefore represents a key natural connectivity zone that needs to be considered for the placement of underpasses or overpasses.

WILDLIFE MOVEMENT AND CONNECTIVITY

To better understand wildlife movement and ecological connectivity in the Project area, two specific studies were completed: a long-term camera trap study and a habitat suitability and ecological connectivity modelling. These studies are available in Appendices 6-19 and 6-20, respectively. A summary of results is presented below. These aim to guide the recommendations for wildlife crossings, which is discussed in the Wildlife Mitigation Report (Appendix 8-2) and the Biodiversity Action Plan.

HABITAT SUITABILITY AND ECOLOGICAL CONNECTIVITY MODELLING

The habitat suitability and ecological connectivity modelling quantified ecological connectivity for three key target species (i) Giraffe (*Giraffa spp*.), because of their conservation value, and (ii) Plains zebra (E*quus quagga*) and (iii) African Buffalo (*Syncerus caffer*), because they are the most often involved in collisions. The modelling was undertaken at two scales:

- Biodiversity Regional Assessment Area (RAA) – as defined in Chapter 5 for this ESIA;
- Contextual Assessment Area which includes the Regional Assessment Area and the surrounding area within 170 km.

The aim of this study was to assess the impact of the proposed highway upgrade on wildlife connectivity and support the selection of wild crossings via the following five tasks:

- Apply web-based public participatory mapping and surveys with local experts and stakeholders to identify key conservation species, and obtain feedback on the methods and outputs;
- Map Contextual Assessment Area species distribution;
- Map connectivity in the Contextual Assessment Area to characterise the importance of habitat near the highway development for connecting critical sections of the region;
- Characterise connectivity in the Regional Assessment Area to assess the impacts of the highway on fragmentation;
- Assess optimal locations for wildlife crossings.

The modelling of the larger Contextual Assessment Area was undertaken to include more ecological data to improve the robustness of the species distribution model, and also to quantify the contribution of the habitat within the Regional Assessment Area to connections from and into the Contextual Assessment Area.

The modelling of the Contextual Assessment Area suggested that the RAA is isolated ecologically from the surrounding areas. The habitat suitability modelling for the RAA identified two large, connected agglomerations of protected areas and habitat. The agglomeration in the north included Lake Nakuru National Park, and Soysambu Conservancy. The agglomeration in the south included Marula Estate, and other private estates and wildlife conservancies around Lake Naivasha, together with formal protected areas such as Hell's Gate and Mount Longonot National Parks lake. Large areas of habitat, least-cost paths and high movement probability were more commonly found to the west of the highway than to the east.

The greatest area of habitat intersected by the road was in the southern agglomeration around the Marula Estate. According to the modelling, the wildlife crossings in this area are likely to provide the greatest benefit to ecological connectivity and persistence for the target species and support movement between core habitat i.e. large areas of highly suitable habitat. In addition, all of the wildlife crossings are likely to contribute to the persistence of the target species, and many other species that would also use these structures.

The modelling of the habitat, connectivity patterns and wildlife crossing assessment for the three targets species characterised a complex range of ecological patterns which can be used to guide decision support. The habitat suitability and connectivity mapping produced robust outputs which concurred with the expert feedback and other mapping products in the region.

CAMERA TRAP ANALYSIS

This study focused on the analysis of camera trap data collected by the long-term camera trapping to identify locations with high species abundance and diversity of selected species to support the identification of optimal locations of wildlife crossing structures.This analysis focused on the same three key target species as the habitat suitability and connectivity modelling: African buffalo (*Syncerus caffer*); Giraffe (*Giraffa spp*.); and Plains zebra (*Equus quagga*); as well as on the Spotted hyena (*Crocuta crocuta*). Hyenas were analysed because of their proneness to collision with vehicles, because they are predators and will thus have different requirements to the three species of herbivore, and also because of the efficiency of artificial intelligence (AI) to identify individuals of this species. Data from other species was analysed qualitatively and are included in the baseline description above.

The following features were assessed:

- Camera operational activity times;
- Capture rates (number of detections per camera divided by the number of days the camera was functional) for individual species and all species;
- Characterisation of differences in capture rates based on wet and dry months;
- Spatial distribution of captures.

The analysis separated the area where cameras were deployed in three sites, Soysambu and Marula Estate east and west of the highway. In Soysambu, Marula West and Marula East, there were 15, 17 and 18 cameras deployed respectively. The location of camera-traps is shown in Figure 5-9 of chapter 5 and also in Figure 6-55 below. Over the course of the camera survey the number of deployed cameras, active cameras, detection and number of individuals detected decreased over time.

The total number of target species detections (i.e. one or more individuals of Zebra, Giraffe, Buffalo or Hyena identified in a single photo) taken at 30-minute independent intervals was 1,917 and a total of 3,283 individuals were detected. Zebra were the most numerous species detected (n = 2,953) followed by Buffalo (n = 153), Giraffe (n = 100) and Hyena (n = 77) (Figure 6-54). Zebra were detected at almost all cameras, (n = 46) and Giraffe were detected at the least (n = 12). A site-level covariance analysis showed that Hyena, Zebra and Buffalo are mostly present at the same locations as indicated by positive covariances. In contrast, Giraffes were mostly present in areas where other species were less abundant as described by their negative covariance with other species.

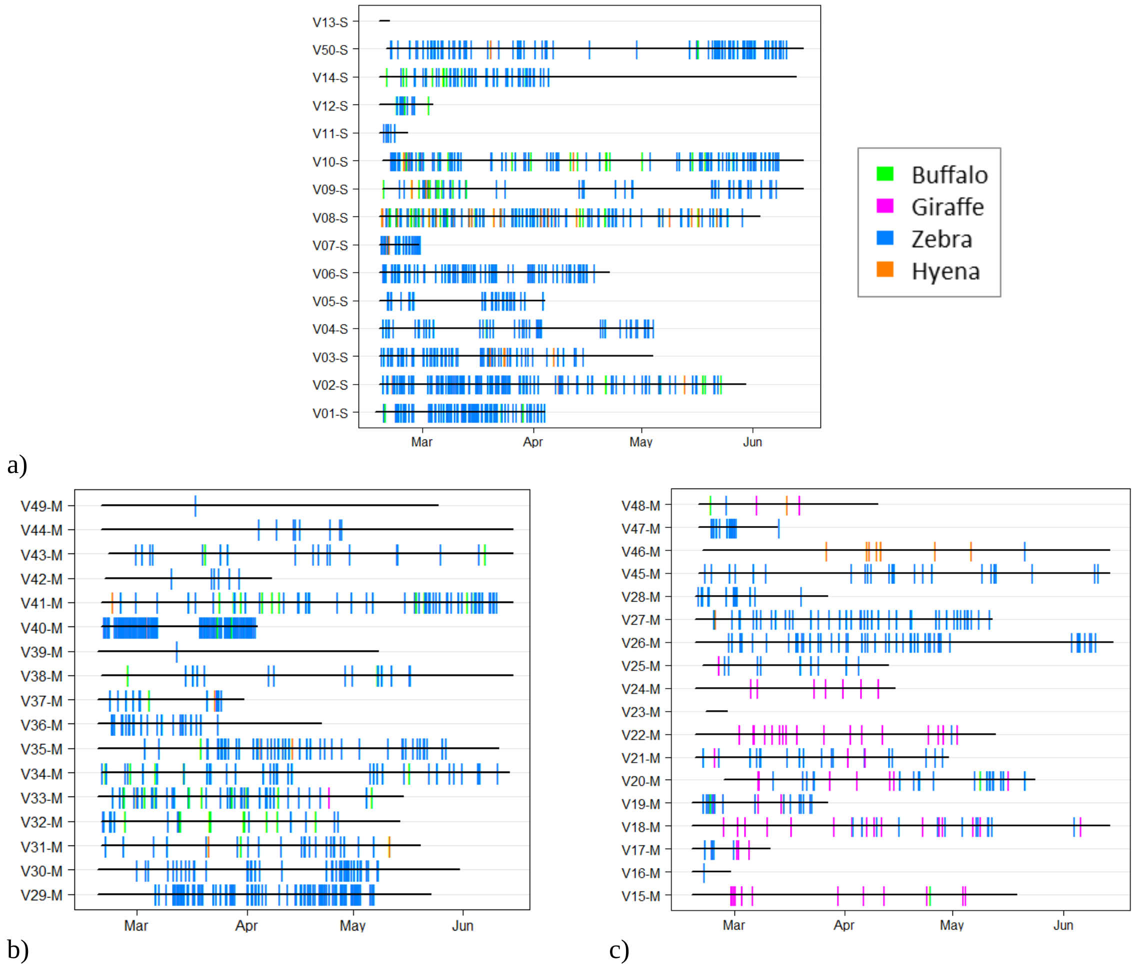


Figure 6-54 Detection check for all 4 species. Figures have been divided based on the camera trap locations in the (a) Soysambu, (b) Marula West and (c) Marula East

Overall, it appears that there were more frequent detections of the four target species in Soysambu and Marula West. Of the four target species, Zebra were detected most frequently and was found across all locations, but with the majority of detections in Marula East and West. For the Buffalo, there were more detections in Marula West and Soysambu, though many cameras failed to detect the species. In contrast, Giraffes were mainly found in Marula East, with no detections in Soysambu and almost no detections in Marula West. Finally, for Hyena, this species was detected in all three sites though in low numbers. Figure 6-55 compares total capture rate and capture rates for each species per camera location.

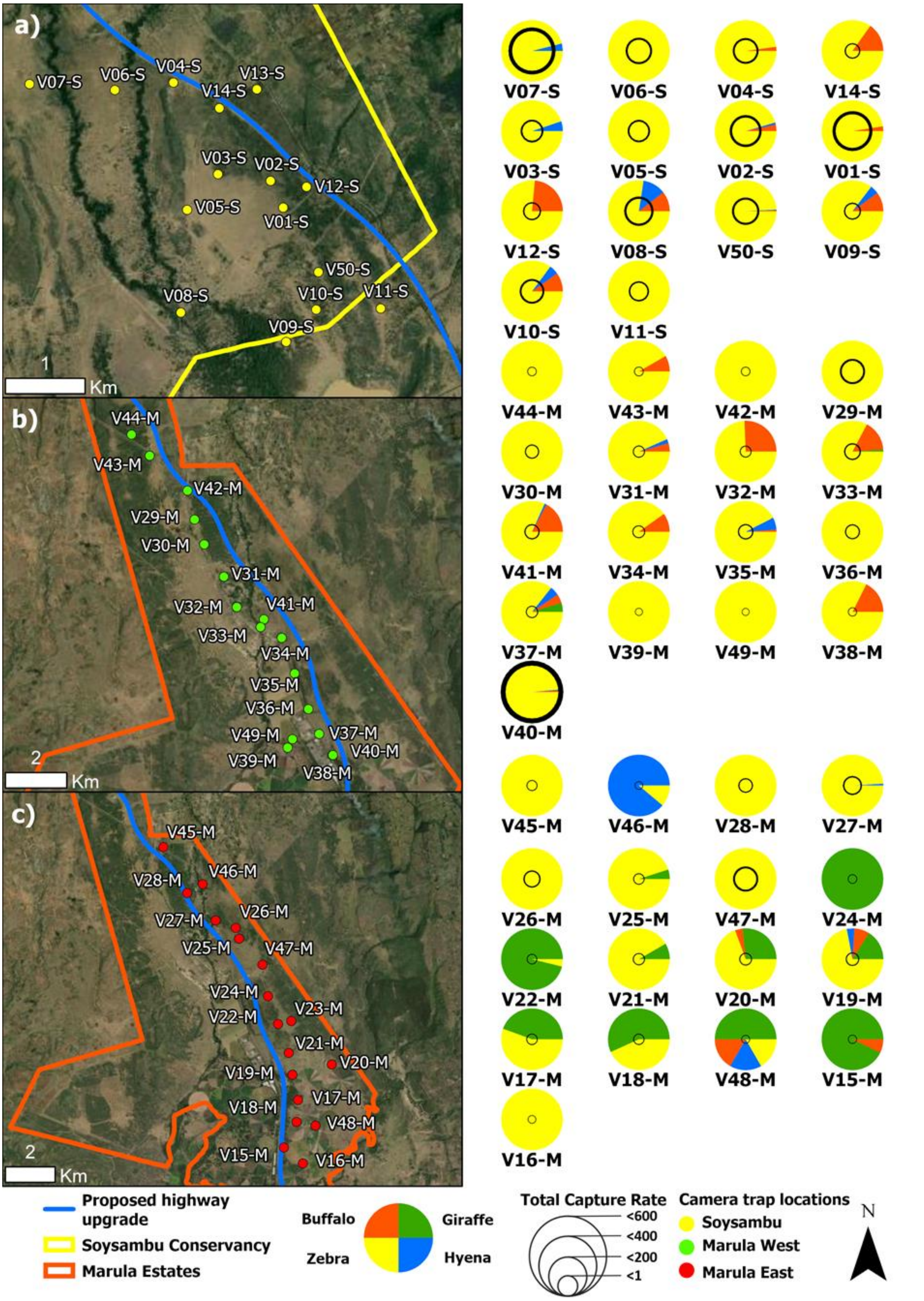


Figure 6-55 **Comparison of total capture rate and capture rates for each species per camera. Figures have been divided based on the camera trap location in the (a) Soysambu, (b) Marula West and (c) Marula East**

Comparing between the survey months, the dry month of February had a higher capture rate compared to the wet months of March to May. Overall, there was a dip in the overall capture rate during the wet months from March to May. However, the patterns of capture rates per species over time seemed relatively consistent, especially for camera locations with high capture rates. As would be expected, cameras with lower samples tended to fluctuate more between time periods.

The camera trap data provide a good indication of the species found and their relative abundance at specific locations in the RAA. These data provide useful support for guiding the assessment and selection of wildlife crossing areas for mitigating the impact of the road on connectivity. The data need to be considered within the context of other datasets and on the ground expert advice.

6.3.7 FRESHWATER ECOLOGY

The general study area is directly located within three Freshwater Ecoregions (Figure 6-56) which span over a significant range in altitudinal gradients, namely:

- Lake Victoria;
- Southern Eastern Rift; and
- Tana, Athi and Coastal Drainage (FEOW, 2021).

A small section of the most westerly footprint of the Project is situated in the Lake Victoria Catchment towards Mau Summit which includes more immediately the Yala River headwaters. Most of the Project footprint is situated in the Southern Eastern Rift Ecoregion, which encompasses various sub-catchments, which ultimately drain lakes Baringo, Nakuru, Elmentaita and Naivasha. The Southern Eastern Rift Valley comprises of shallow lakes, rivers and streams, hot and cold-water springs, marshes, swamps, and salt pans which occur within the ecoregion (FEOW, 2021). The Tana, Athi and Coastal Drainage Ecoregion is situated in the most easterly area towards Rironi and drains a series of small lotic systems towards the Aberdares and Nairobi.

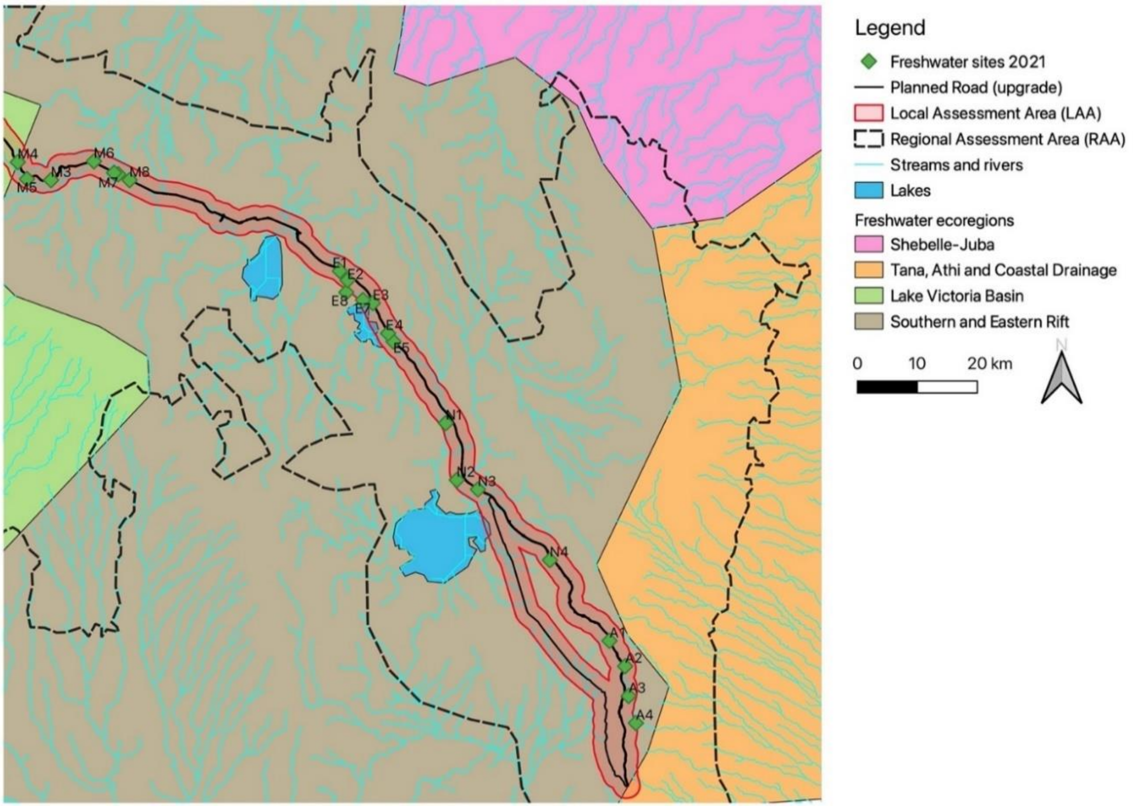


Figure 6-56 Freshwater Ecoregions in the LAA

AQUATIC HABITAT

HABITAT TYPES

Sites were divided into different freshwater habitat types according to various characteristics. More photographs and channel features for each site are provided in the Freshwater Ecology Sectorial Report (FFMES, 2021g) in Appendix 6-21.

RIVERS

Rivers, for the purpose of this study, are described as main stem flowing water systems with an open canopy, a defined channel and riparian zone. Sites in this class are deep (> 2 m), wide (> 5 m) and relatively fast flowing (an example is shown in Figure 6-57a). The sites that classified as rivers are all large systems that are direct or indirect tributaries of lakes in the study area, namely the Malewa River (Naivasha catchment) and Molo River (Molo catchment).

Rivers to the west of the study area draining north to Lake Baringo catchment and south-west to the Lake Victoria catchment arise in Afromontane Forest, Afromontane Bamboo and Upper Acacia Wooded Grassland vegetation. Rivers in the central parts of the study area draining lakes Nakuru, Elmentaita and Naivasha are fringed by Evergreen and semi-evergreen bushland and thicket. To the eastern part of the study area, the rivers draining to the Kikuyu Escarpment and the Aberdare Range are fringed primarily by Afromontane Bamboo, Afromontane Forest, and some Edaphic vegetation elements.

STREAMS

Streams refer to small lotic, permanent freshwater systems in the study area which exhibit a well-defined riparian fringe and a distinct zonation between riparian vegetation and surrounding terrestrial vegetation (Figure 6-57b). Streams are tributaries or headwaters of mainstream rivers. They are generally shallow (1 - 2 m), relatively narrow (0.5 - 5 m) and consist of a variety of substrate spanning from alluvial (sandy) to bedrock and boulder systems. Various stream systems are crossed by the proposed road upgrade along the alignment.

Perennial stream vegetation associations follow the river vegetation associations mentioned above.

NON-PERENNIAL STREAMS

Non-perennial streams are associated with edaphic features in the landscape. These system flow intermittently or seasonally in response to rainfall events and are biotically less sensitive than perennial systems. Non-perennial streams refer to small lotic, seasonal systems in the study area that flow intermittently, and which exhibit well-defined riparian fringe. Non-perennial streams are tributaries or headwaters of mainstream rivers and other permanent streams. They are shallow (1 - 2 m), narrow (0.5 - 5 m) and consist of a variety of substrate spanning from alluvial (sandy) to bedrock and boulder systems. Various non-perennial systems are crossed by the road alignment.

WETLANDS

Wetlands are low energy systems where the water table is near, or at the ground surface, which are natural or anthropogenic in nature (Figure 6-57c and d). Wetlands are characterized by slow flowing, shallow waters without a high cover of emergent vegetation. They are dominated by grasses, sedges and forbs and encompass areas of disperse flows. Wetlands were noted towards the south-east sections of the road alignment along the Bathi River draining towards the Aberdares.

a) River (Molo River)

b) Perennial stream

c) Non-perennial stream

d) Wetland

e) Artificial wetland

Figure 6-57 Examples of freshwater habitat types noted in the freshwater survey (a), (b), (c), (d) and (e)

ASSESSMENT OF AQUATIC HABITAT INTEGRITY

The IHI assessment (Kleynhans, 1996) was applied to ascertain the change of instream and riparian habitat from natural conditions on a site and catchment basis (see section 5.3.2.6 for methodology). The habitat integrity assessment showed that 48.7 % of the sites assessed were in a Largely Modified state, where a considerable loss of natural habitat, biota and basic ecosystem functions has occurred. The remainder of the sites (51.3%) were Moderately Modified to Largely Natural where ecosystem function was less impacted, and the sites have the potential to support a relatively natural community (Figure 6-58).

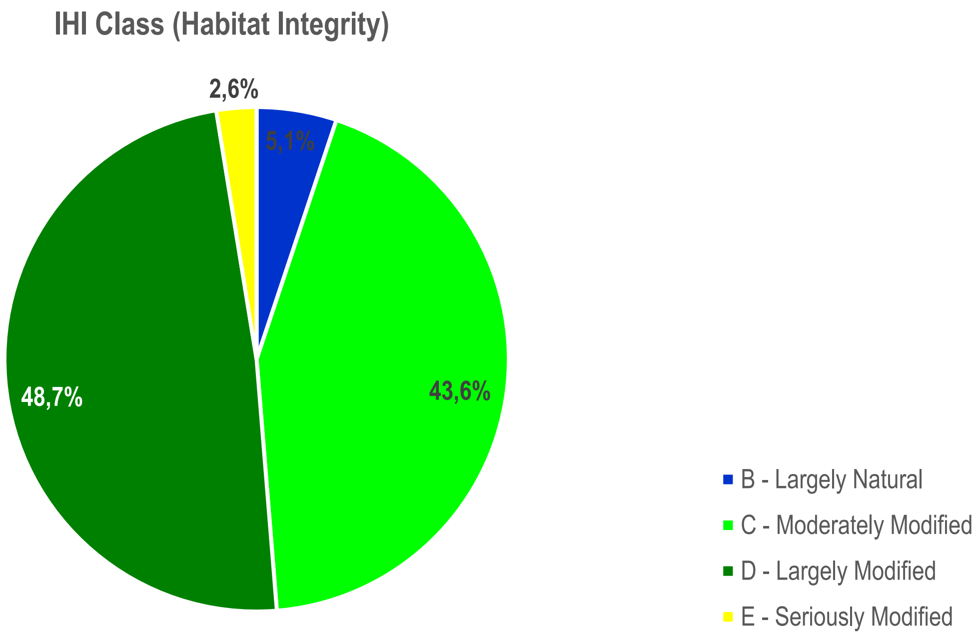


Figure 6-58 Pie chart illustrating the percentage distribution of the associated IHI categories for the freshwater study sites

The study area obtained an average IHI percentage of 60.4%, indicating an overall *Largely to Moderately Modified* state along the road alignment, with the riparian habitat integrity scoring considerably lower (56%) compared to that of the instream habitat (64.9%). A principal component analysis (PCA) was completed on the full habitat integrity data matrix to determine clustering and variable importance where a higher value represents higher importance (Figure 6-59). Lake Elmentaita sites had the highest habitat integrity whereas Lake Naivasha sites had the poorest habitat integrity. The five variables with highest importance for driving habitat deterioration are:

- Vegetation removal;
- Flow modification;
- Water abstraction;
- Exotic vegetation and fauna; and
- Channel modification.

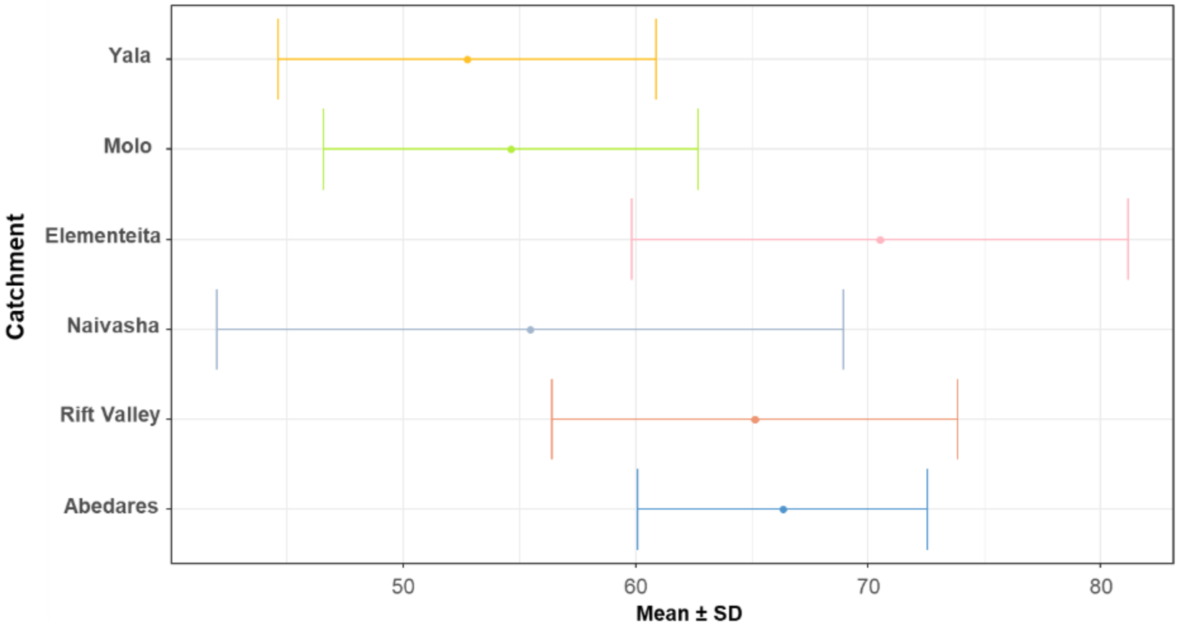


Figure 6-59 Average IHI represented per catchment with Standard Deviation (SD)

MACROINVERTEBRATE HABITAT ASSESSMENT

Macroinvertebrate habitat availability (quality and quantity) is an important part of an ecosystem as it forms a template for the biotic communities. Habitat availability and diversity are major determinants in the overall community structure of aquatic macroinvertebrates. For this reason, it is important to evaluate habitat quality and quantity when applying biomonitoring methodologies and assessing ecosystem health.

Concerning macroinvertebrate habitat in the different catchments, the Aberdare and Elmentaita catchments obtained the lowest average Invertebrate Habitat Assessment System (IHAS) % scores (Figure 6-60). Concurrently, the Molo and Naivasha catchments obtained the highest habitat availability with all these sites predominantly consisting of Stones in Current (SIC) and Gravel Sand and Mud (GSM - other habitat) with available overhanging vegetation.

The different biotopes included in this assessment were Stones in Current (SIC) Vegetation (Veg) and Other/General (McMillan, 1998). Other/General, less dominant habitats comprised of Stones Out of Current (SOOC), Gravel, Sand and Mud (GSM) and bedrock. The biotopes dominating most of the sites included GSM. Sites assessed reflected Poor to Adequate habitat diversity for aquatic macroinvertebrates.

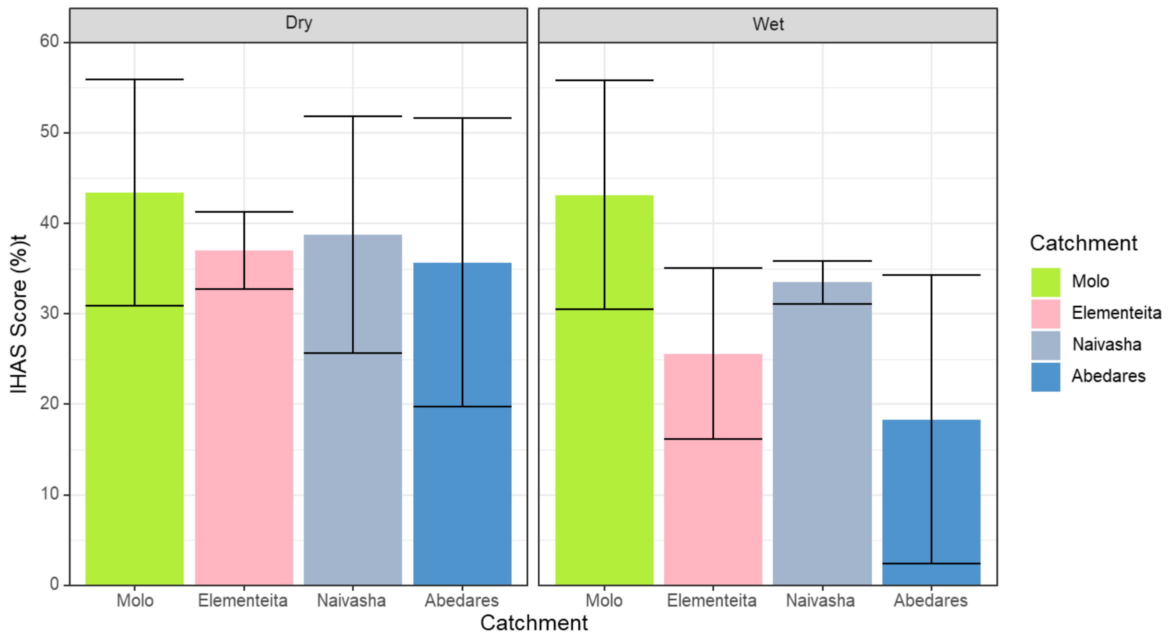


Figure 6-60 Average total IHAS % for the different catchments associated with the study area during the dry and wet seasons.

FISH HABITAT ASSESSMENT

The fish habitat assessment allows for the comparison and interpretation of fish data between sites, highlighting dominant cover and velocity-depth classes associated with each habitat type, which drives the fish community. The dominant velocity classes associated with the study area were slow-deep (SD), slow-shallow (SS) and slow-very-shallow (SVS) at most of the sites assessed. This would support a more general community with less rheophilic fishes and species that are used to slow lotic conditions.

The study area consisted of a diverse range of habitat types and cover with sand and bedrock dominating substrate types, and root wads and emergent vegetation showing the highest percentage of habitat cover at the majority of the sites assessed (Figures 6-61 to 6-63). Most freshwater systems had a good mix of habitat and should, in theory be able to support a natural community of fishes.

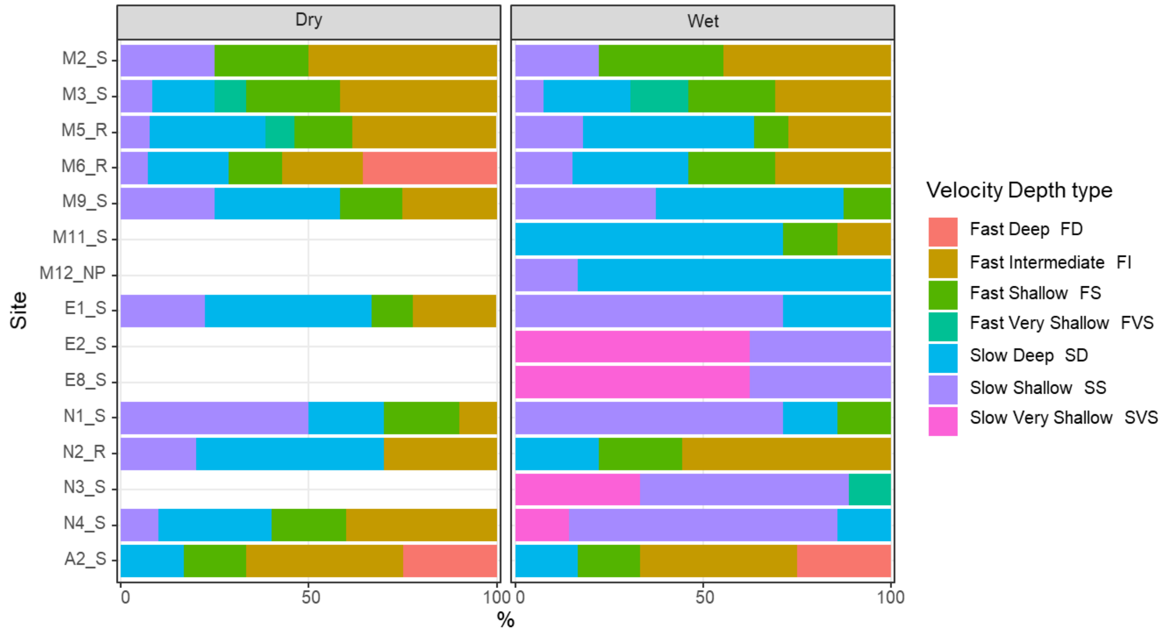


Figure 6-61 Fish habitat showing velocity-depth types per fish sampling site, per sampling season

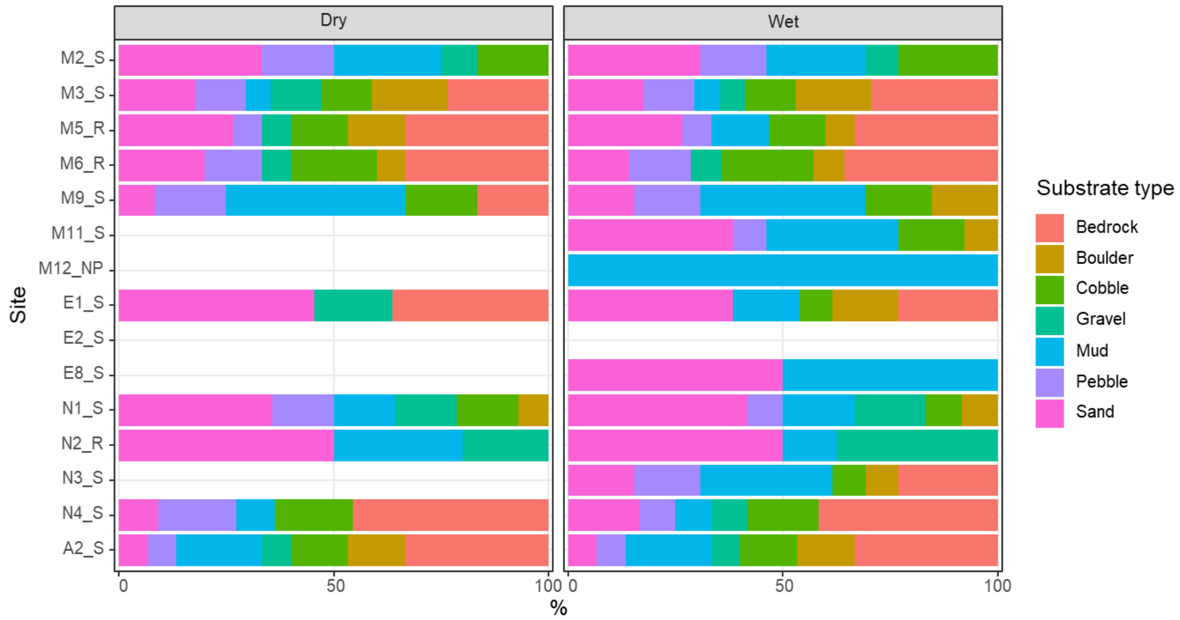


Figure 6-62 Fish habitat showing substrate types per fish sampling site

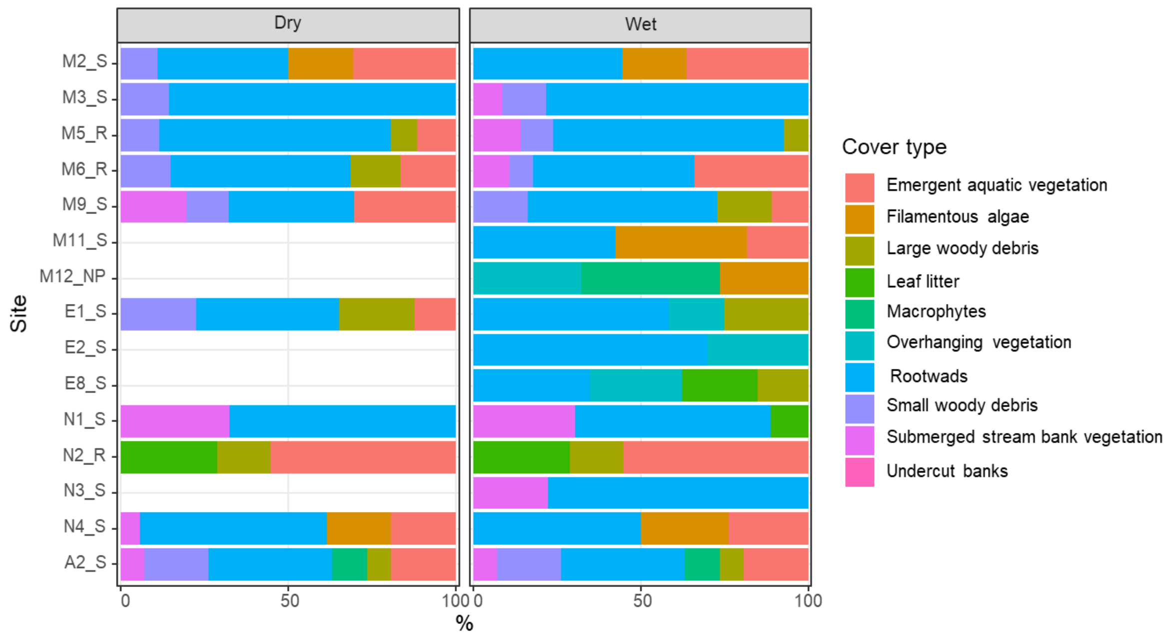


Figure 6-63 Fish habitat showing cover types per fish sampling site

DIATOM ASSESSMENT

The diatom assessment includes the ecological classification of water quality for each site according to the diatom assemblage during this assessment, a spatial analysis of the dominant species and their ecological preferences at each site, and a temporal analysis of the diatom community between February 2021 to April 2021.

ECOLOGICAL CLASSIFICATION FOR WATER QUALITY

The ecological classification for water quality according to Van Dam et al. (1994) and Taylor et al. (2007), includes the preferences of diatom species in terms of pH, nitrogen, oxygen, salinity, humidity, saprobity and trophic state as provided by OMNIDIA (Le Cointe et al., 1993). Results are presented in Table 6-45. The overall diatom assemblages comprised of species with a preference for:

- Fresh brackish (<500 µS/cm), circumneutral (pH 6.5 - 7.5) to alkaline (pH > 7.5) waters with moderate to very high levels of nutrients;
- The nitrogen requirements for all the sites ranged from N-Autotrophic tolerant, indicating a tolerance for elevated concentrations of organically bound nitrogen to N-Heterotrophic facultative, indicating a requirement for periodically elevated concentrations of organically bound nitrogen;
- The dissolved oxygen saturation ranged from moderate (50%) to very high (~100%) for all the sites;
- The pollution levels indicated that there was low to moderate levels of pollution reflecting unpolluted to strongly polluted conditions present at all the sites.

These results show that most sites are moderately polluted and in the eutrophic stage.

Table 6-45 **Ecological descriptors for the sites based on the diatom community (Van Dam et al., 1994 and Taylor et al., 2007)**

Site	pH	Salinity	Organic Nitrogen uptake	Oxygen Levels	Pollution Levels	Trophic State
M3_S	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Moderately polluted	Eutrophic
M6_R	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Moderately polluted	Eutrophic
M9_S	Circumneutral	Fresh brackish	N-Autotrophic tolerant	Very high	Moderately polluted	Eutrophic
M11_S	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Moderately polluted	Eutrophic
N1_S	Circumneutral	Fresh brackish	N-Autotrophic tolerant	Moderate	Moderately polluted	Eutrophic
N2_R	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Moderately polluted	Eutrophic
E1_S	Circumneutral	Fresh brackish	N-Heterotrophic facultative	Moderate	Moderately polluted	Eutrophic
E4_S	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Strongly polluted	Eutrophic
E8_NP	Circumneutral	Fresh brackish	N-Heterotrophic facultative	Moderate	Strongly polluted	Eutrophic
R2_S	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Moderately polluted	Eutrophic
A1_S	Alkaline	Fresh brackish	N-Autotrophic sensitive	High	Unpolluted to slightly polluted	Indifferent
A2_S	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Unpolluted to slightly polluted	Indifferent
A5_W	Alkaline	Fresh brackish	N-Autotrophic tolerant	Moderate	Strongly polluted	Indifferent

DIATOM SPATIAL ANALYSIS

A total of 63 diatom species were recorded at the 13 sites and the dominant species recorded included *Nitzschia* sp., *Navicula* sp. and *Gomphonema* sp. These taxa are cosmopolitan in nature and have wide ecological amplitudes. It is important to consider these dominant species in conjunction with the entire diatom assemblage when analyzing the results. Ecological information is provided below for the dominant and sub-dominant species to make ecological inferences for the 13 sites:

MOLO RIVER CATCHMENT

The ecological water quality at sites M3_S and M6_R on the Molo River System reflected ***Poor* and *Moderate* conditions** with low levels of organic pollution, respectively (Table 6-46). Site M3_S was dominated by taxa that pointed to eutrophic running water with medium to high conductivity. This site appears to be disturbed and owing to the low levels of organic pollution, the disturbance may be attributed to an excess in nutrients. Site M6_R was dominated by taxa that pointed to meso-to eutrophic conditions with medium to high electrolyte content. This site appears to be disturbed by an excess of nutrients. Sites M9_S and M11_S reflected *Poor* conditions with moderate levels of organic pollution (Table 6-46). Both sites were dominated by taxa that pointed to eutrophic and polysaprobic freshwater habitats with high electrolyte content and tolerant to organic pollution. These two sites appeared to be disturbed by organic pollution.

LAKE ELMENTAITA CATCHMENT

The ecological water quality at sites E1_S, E4_S and E8_S all reflected ***Poor* conditions** with low to moderate levels of organic pollution (Table 6-46). Site E1_S on the Mereronai River System was dominated by taxa that reflected eutrophic, mesosaprobic conditions with moderate electrolyte conditions. Site E4_S was dominated by taxa that pointed to eutrophic conditions with medium to high electrolyte content and pollution tolerant. Site E8_S was dominated by taxa that pointed to oligo-to mesotrophic conditions with high electrolyte content, bordering on brackish conditions. All three sites appeared to be disturbed by moderate levels of organic pollution, except for site E8_NP which showed low levels of organic pollution suggesting that an excess of nutrients (i.e., nitrogen and phosphorous- naturally occurring) may be present at this site.

LAKE NAIVASHA CATCHMENT

The ecological water quality at site N1_S on the Morendat River system reflected ***Poor* conditions** with moderate levels of organic pollution (Table 6-46). This site was dominated by taxa that pointed to eutrophic and polysaprobic freshwater habitats with high electrolyte content and associated with polluted conditions. The subdominant taxa pointed to oligo to mesotrophic freshwater habitats with medium electrolyte content. This site appeared to be disturbed by organic pollution (i.e., high levels of organic matter, for example from runoff of manure or sewage). Whereas the ecological water quality at site N2_R on the Malewa River reflected ***Moderate* conditions** with low levels of organic pollution (Table 6-46). This site was dominated by taxa that reflected meso-to eutrophic running water with medium to high conductivity. This site appeared to be relatively undisturbed by organic pollution.

RIFT VALLEY CATCHMENT

The ecological water quality at site R2_S reflected ***Moderate* conditions** with low levels of organic pollution (Table 6-46). This site was dominated by taxa that pointed to meso-to eutrophic running water with medium to high conductivity and tolerant to slightly polluted conditions.

ABERDARES CATCHMENT

The ecological water quality for the sites on the Bathi River system reflected ***Good* to *Moderate* conditions** with low levels of organic pollution (Table 6-46). All three sites were dominated by taxa that pointed to oligo-to mesosaprobic conditions with medium to high electrolyte content. Site A2_S reflected ***Good* conditions** with no evidence of organic pollution present, suggesting that this site is undisturbed. Whereas sites A1_S and A5_W reflected ***Moderate* conditions** with low levels of organic pollution, suggesting that there may be slightly higher levels of nutrients (i.e., nitrogen and phosphorus) present at these sites.

Table 6-46 Diatom index scores for the study sites indicating the ecological water quality

Site	%PTV[1]	SPI[2]	Ecological Category (EC)	Class
M3_S	7.1	9.6	D	Poor
M6_R	4	10.6	C/D	Moderate
M9_S	26.5	8.9	D	Poor
M11_S	24.4	7.9	D/E	Poor
E1_S	22.9	9.5	D	Poor
E4_S	23.1	8.3	D	Poor
E8_S	16.3	7.7	D/E	Poor
N1_S	23.4	8.3	D	Poor
N2_R	2.3	13.7	C	Moderate
R2_S	13.9	12.4	C	Moderate
A1_S	6.1	13.8	C	Moderate
A2_S	0	15.5	B	Good
A5_W	6.2	12.3	C	Moderate

Notes : [1] PTV= Percentage Pollution Tolerant Valves
[2] SPI= Specific Pollution Sensitivity Index

DIATOM TEMPORAL ANALYSIS

It is important to monitor temporal trends in the diatom community to determine any variation in the ecological conditions of the aquatic environment and the associated impacts if any. A few sites were only measured once and thus no temporal analyses was possible. Temporal analyses were surmised for all the sites over the entire monitoring period (February 2021 and April 2021) (Table 6-47) The main points are briefly discussed below:

- The ecological water quality at site A2_S, E4_S and N1_S remained in a stable state since the previous survey reflecting ***Moderate* to *Poor* conditions**. The level of organic pollution also appeared to remain in a stable state since the previous survey, reflecting low to moderate levels of pollution. Site M9_s reflected stable conditions despite the increase in the level of organic pollution;
- The ecological water quality at sites E1_S, N2_S and M6_R appeared to show a decline reflecting ***Moderate* and *Poor* conditions** from the February 2021. The level of organic pollution for site E1_S increased, however, for sites N2_R and M6_R the level of organic pollution remained in a stable low condition compared to the previous survey;
- Over the entire monitoring period, sites A2_S and N2_R reflected the best ecological conditions with the low levels of organic pollution compared to the other sites. Sites E4_S and N1_S on average reflected the poorest conditions with high levels of organic pollution compared to the other sites.

Table 6-47 Temporal trend analysis of the diatom results (February 2020- April 2021)

Site	SPI		Trend	%PTV		Trend
	Feb-21	Apr-21		Feb-21	Apr-21	
M6_R	13	10.6	▼	0.9	4	▶
M9_S	8.3	8.9	▶	11.9	26.5	▼
E1_S	10.2	9.5	▼	9.7	22.9	▼
E4_S	9.7	8.3	▶	27.2	23.1	▶
N1_S	8.3	8.3	▶	22	23.4	▶
N2_R	14.3	13.7	▼	0	2.3	▶
A2_S	15.1	15.5	▶	1.4	0	▶

In summary, the diatom assessment showed the following:

- The diatom assemblages were generally comprised of species characteristic of fresh brackish, circumneutral to alkaline waters with low to high levels of nutrients. The pollution levels indicated moderately polluted conditions at most sites;
- The ecological water quality showed spatial variation between the sites on the different systems. All the sites reflected ***Moderate* to *Poor*** conditions with low (<20%) to moderate (20-40%) levels of organic pollution, Except for site **A2_S (Bathi River)** which reflected ***Good* conditions** with no evidence of organic pollution present;
- The disturbances at the sites reflecting ***Poor* conditions** may be associated with runoff from the surrounding landscape or from anthropogenic inputs into the system; however, it is difficult to distinguish between the impacts;
- Since the previous survey, the ecological water quality at site A2_S, E4_S, M9_S and N1_S remained in a stable state reflecting ***Moderate* to *Poor* conditions**;

- The ecological water quality at sites E1_S, N2_R and M6_R appeared to show a decline reflecting ***Moderate* and *Poor* conditions** since the previous survey;
- Over the entire monitoring period, sites A2_S and N2_R on average reflected the best ecological conditions with low levels of organic pollution compared to the other sites, whereas site E4_S and N1_S reflected the poorest conditions with high levels of organic pollution compared to the other sites.

MACROINVERTEBRATE DIVERSITY

Shannon-Wiener and Pielou's indices were used as the main indicators of diversity. Results of Shannon's index showed that diversity and evenness were on average similar between catchments, with the Naivasha catchment and the Elmentaita catchment showing marginally lower diversity scores than the Molo and Aberdare catchments. Diversity values were similar to studies undertaken in the Moiben River Basin in Kenya which has similar land uses and levels and a high population density (Masese *et al*., 2009).

Three macroinvertebrate stress response methods were applied in this study, namely number of Taxa (Families), Average Score Per Taxon (ASPT) and Percentage Ephemeroptera-Plecoptera-Trichoptera (%EPT), all of which are a measure of macroinvertebrate sensitivity. The higher the ASPT and %EPT scores the more sensitive the site is with regards to the taxa present.

The number of taxa sampled over all sites in the study area ranged from 10 to 27 taxa, with the highest average number of taxa sampled in the Molo catchment (18-18.3 families) and the lowest in the Elmentaita catchment (11-14.7 families). These numbers are low in comparison to other studies in similarly impacted areas in Kenya which recorded 31-41 taxa for impacted sites (Masese *et al*., 2009)

The ASPT results indicate all catchments were similar in terms of average ASPT scores over all seasons, ranging from 3.9-5.5, thus showing similar sensitivities over the study area in terms of macroinvertebrates. The exception was the Elmentaita catchment in April 2021, which showed a sharp decline in the ASPT value (3.9).

Average %EPT scores were comparable between catchments but showed overall lower score in the present study when compared to the Masese et *al* (2009). The Molo catchment had the highest sensitivities based on aquatic macroinvertebrates, where the other catchments assessed in the study area had an overall lower sensitivity.

The overall study area showed poor to adequate habitat availability for macroinvertebrate colonization. Since macroinvertebrate communities are strongly affected by habitat variables, the lack of habitat availability is an important limiting factor affecting the diversity of the assemblage (Holmes *et al*., 2011). From data collected in the study, it was noted that the habitat type assessed were drivers of diversity, however, land use impacts which affect water quality are the biggest drivers of the lower sensitivities in the general study area. Detailed baseline results are contained within Appendix 6-21

FISH DIVERSITY

Eleven (11) species of fish in five families were sampled in the various habitat types in the 2021 surveys (Table 6-48). Four species were exotic species, representing 36% of the total fish community (*Cyprinus carpio, Gambusia affinis, Poecilia reticulata* and *Oncorhynchus mykiss*), which include habitat modifying and competitive predatory species which affect natural fish communities.

Fish diversity was highest in the Molo and Naivasha catchments, however, it was still low overall. The fish communities were mostly dominated by 1 species in high numbers, as is indicated by the evenness values.

Fish species richness was generally low across all catchments regardless of the season. Fish species richness was highest at site N2_R on the Malewa River in April 2021, but on average the Molo catchment showed the highest species richness in terms of fish. Interestingly, the headwater sites of the Molo catchment produced no species of fish despite good habitat availability and hydrology. The reason for this is not clear but may be due to several water control weirs along the upper course of the river that block movement of fish up to the headwaters of the system.

Table 6-48 Fish abundances for sites sampled in the February and April 2021 study

Family	Species	Molo River												Lake Elmentaita				Lake Naivasha							Aberdares	
		M2 _S	M2 _S	M3 _S	M3 _S	M5 _R	M5 _R	M6 _R	M6 _R	M9 _S	M9 _S	M1 1_S	M12 _NP	E1_ S	E1_ S	E2_ S	E8_ S	N1 _S	N1 _S	N2 _R	N2 _R	N3 _S	N4 _S	N4 _S	A2 _S	A2 _S
		Feb	Apr	Feb	Apr	Feb	Apr	Feb	Apr	Feb	Apr	Apr	Apr	Feb	Apr	Apr	Apr	Feb	Apr	Feb	Apr	Apr	Feb	Apr	Feb	Apr
Clariidae	*Clarias gariepinus*								4				1	5	20					1	2					
Clariidae	*Clarias cf. werneri*							1													1					
Cyprinidae	*Cyprinus carpio*																				3					
Cyprinidae	*Enteromius kerstenii*																			9	21					
Cyprinidae	*Enteromius neumayeri*							214	396	1	45															
Cyprinidae	*Enteromius paludinosus*									2	9			7	54			18	9	24	58					
Poeciliidae	*Gambusia affinis*									7	8															
Poeciliidae	*Poecilia reticulata*									26	75															
Cichlidae	*Pseudocrenilabrus philander*												1													
Cichlidae	*Pseudocrenilabrus multicolor ssp. victoriae*																			6	4					
Salmonidae	*Oncorhynchus mykiss*																								12	19

SPECIES OF CONSERVATION INTEREST

THREATENED SPECIES ACCORDING TO THE IUCN

All species of fish sampled in this survey are LC according to the IUCN Red List and relatively widely distributed. The *Clarias* and *Enteromius* species are freshwater migrants, however, these are widely distributed and common in the greater study area.

The previous Critical Habitat Screening (Bennun et *al.*, 2018) identified *Lacustricola* (previously *Aplocheilichthys*) sp. nov. Baringo and *Labeo victorianus*, two critically endangered fish, as potentially present in the RAA. Neither of these species were sampled in the baseline surveys.

Lacustricola sp. nov. Baringo inhabits the Lake Baringo catchment, whose headwaters (Molo River) arise on the western rim of the Rift Valley, around the end of the Project Road alignment near Mau Summit. The species was collected in 1969 in an inventory of the fish fauna of Lake Baringo (Mann, 1971; Ssentongo, 1974). The second registered collection was by the German ichthyologist L. Seegers in 1983 (Seegers, 1997). Sentongo (1974) listed several collection sites, namely large, slow-flowing sections of the Molo River and tributaries, and the swampy parts of Lake Baringo:

- At the fringes of Lake Baringo itself, in stagnant swampy pools at the south and east side of the Lake;
- In the Perkerra River, a left bank tributary of the Molo River that flows into the lake at its southern most point;
- In the Molo River just south of the Perkerra crossing;
- Downstream the Molo River at Longumkum.

Based on the locality of these sampling points and the preference of the species for slow flowing and lentic habitat, it was not sampled in the study area as the Molo River along the road alignment does not contain suitable habitat for the species.

Labeo victorianus, locally known as Ningu, is as an endemic cyprinid of the Lake Victoria basin. It occurs in shallow, inshore waters of Lake Victoria (Van Oijen, 1995) and affluent rivers such as the Nzoia (Whitehead, 1959; Corbet, 1961, Cadwalladr, 1965) and Yala (Whitehead,1959) rivers which have their headwaters in the western section of the study area. *Labeo victorianus* is a Critically Endangered species and overlaps in its distribution significantly with the RAA, however, it does not overlap significantly with the direct footprint of the project. The headwaters of the Yala River draining into the Lake Victoria catchment (west section of the road alignment) are in the species range, however, the Yala catchment in the study area is highly degraded and most tributaries were dry in both surveys. The species is a potamodromous species, ascending both large rivers and streams during the rainy season (Whitehead 1959) to spawn. Spawning grounds are flooded grasslands beside both permanent and temporary streams (Eccles 1992). The many impacts of bridges and degraded habitat sections on the Yala River would suggest that the species is unlikely to migrate far up the systems within proximity of the Project study area.

The Critical Habitat Assessment Screening (Bennun et al., 2018) further identified *Bulinus permembranaceus* as a potential present species. This vulnerable restricted range species is found in pools and small streams between 1,940 to 2,760 m asl in the Aberdare Range, Kinangop Plateau and Mau Escarpment in Mau Narok, Molo and Kipkabus (Brown, 1994). *Bulinus* species were sampled at various sites in the study area in the February and April 2021 baseline studies. The species sampled are either *Bulinus tropicus* (LC) or less likely B. *permembranaceus*, however molecular work would be required to verify the species. As these species were sampled at higher altitudes, the species could possibly be the vulnerable *B. permembranaceus* and the species can be considered as potentially present.

SPECIES PROTECTED IN KENYA

None of the surveyed species is threatened or protected according to Schedule 6 of the Wildlife Conservation and Management Act, 2013.

ENDEMIC AND/OR RESTRICTED RANGE SPECIES

As mentioned above, *Lacustricola sp*. nov. *Baringo* and *Labeo victorianusm* are endemic and restricted range fish species that were flagged as potentially present during screening and literature review. Further review of their know occurrences and preferred habitat revealed they are unlikely to be present in the study area.

The restricted-range *Bulinus permembranaceus* was possibly identified in the study area and can be considered as potentially present.

Finally, Bennun et al., 2018 also listed the species Potamonautes jeanneli in their evaluation. The EOO for the species is small enough to be considered restricted range. The species distribution is limited to the east side of the Aberdare Mountain Range hence it is potentially present in the RAA, but highly unlikely to be found in the LAA.

6.3.8 STANDARDISED BIODIVERSITY SENSITIVITY ANALYSIS

A Standardised Biodiversity Sensitivity Analysis (SBSA) was completed by FFMES (2021h) which allowed to develop a map of the sensitivity with respect to biodiversity for the landscape of concern for the Kenya project. The complete report is available in Appendix 6-22. Sensitivity analyses are typically used to spatially represent the potential conflict zones between humans and biodiversity (Schumacher et al. 2001). These analyses are typically run when isolated data sets need to be collated and when inferences need to be made from limited amounts of information. This is especially the case when large scale study areas (such as the landscape scale considered in the case of the Rironi to Mau Summit Highway Expansion and Upgrade Project) need to be evaluated and where it is impossible to have a detailed and exhaustive sampling in each biodiversity discipline (such as birds, mammals, invertebrates, etc.), but where “representative” sampling is required (Bourgeron et al. 2001) and has been conducted to enable adequately robust inferences to be made for areas of comparatively similar potential (Schumacher et al. 2001).

The approach seeks to integrate the work and perception regarding a range of lifeforms investigated by each specialist through providing a standardised framework of landform and geographical features for the study area within which they have been requested to classify sensitivity in a similar manner, in relation to their field of work. Each specialist has to interpret each variable in the framework and rank it on a scale of one to five in terms of the sensitivity / response of the organisms under consideration to the variable specified

The SBSA was undertaken in an extended LAA, corresponding to a 10 km buffer along the highway, because it is deemed to better provide a contextual overview of the landscape that may be affected by direct and indirect impacts of the project development.

For all instances, the biodiversity lifeforms investigated through the baseline work (plants, birds, mammals, reptiles, amphibians, fish) were evaluated on the basis of their life cycle. The lifecycle aspects were used as the response of a lifeform to a habitat type, or a feature may vary during the various stages of its lifecycle and may as a result modulate the end score in relation to a variable. The following aspects of the life cycle were evaluated when pertinent (Silvy, 2012):

- Feeding habitat: where the food is obtained and where it has the best quality for the long-term survival of the lifeform considered;
- Breeding habitat: where the act of reproduction is best conducted (i.e. where necessary displays of fitness are most likely to result in the act and where the chances of encounters with consorts are optimal;
- Nesting habitat: where the young are brought to life and reared to adulthood in the most optimal manner (avoidance of predation and maximised chances of reaching adulthood);
- Resting habitat: where a species can find the best chances of spending rest periods through minimised predation and optimal shelter from the environment.

The following 13 features were used, representing a total of 104 Variables to evaluate by each specialist:

- Vegetation A – 19 variables – VECEA vegetation layers used to evaluate the response to biodiversity lifeforms to the assumed naturally occurring vegetation types;
- Vegetation B – 19 variables – VECEA vegetation layers with a specific consideration of the suitability with respect to IUCN listed species in terms of their life cycle phases;
- Vegetation C – 12 variables – Land use layers – LULUCA based layers that highlight the level of naturalness of the landscape were used;
- Distance to villages / settlements – 6 variables, representing six classes of distance to such human features;
- Distance to roads or tracks developed by humans – 5 variables, representing five classes of distance to such human features;
- Distance to rivers or streams or waterlines – 5 variables, representing five classes of distance to such natural features;
- Altitudinal classes – 8 variables were defined (altitude range from 990 to 3,983 m altitude) for the greater landscape and used for assessment;
- Slope (analysis in degrees from 0 - >20 degrees) – 5 variables (0 – 5°, 5 – 10°, 10 – 15°, 15 – 20°, >20°);
- Aspect – 5 variables (Flat, North, East, South, West). The general orientation of each pixel in the landscape was defined into these five variable values;
- Wetness Index (based on SAGA GIS software[6]) – 5 variables. This feature represents a combined analysis of soil moisture (very low to very high) and soil texture (very coarse texture to very fine texture);
- Water Lines – 5 variables to illustrate the length of individual streams or water line before they merge with another and the associated successive increases in size until they form the larger river systems for the landscape;
- Topographical ruggedness (based on SAGA GIS software) – 5 variables. Ruggedness is defined through a further analysis of soil texture and slope. It represents the likely combined presence of topographical level cavities, crevasses and "chaotic nature" formations promoted by increasingly complex associations of slope and ground texture;
- Landform (Topographic Position Index Analysis) derived from the Shuttle Radar Topography Mission (SRTM) – 10 variables. Each pixel of the study area was tested for its "landform position".

Results show the LAA area had a generally low sensitivity for biodiversity with 42% of the area classified in that sensitivity class while a further 21% was classified as very low sensitivity (Figure 6-64). The higher sensitivity classes combined (classes 3, 4 & 5) totalled 37% of LAA. At a broader level, considering the extended LAA within the 10 km buffer zone, while the same picture appears, there was a generally higher proportion of the landscape falling within the higher sensitivity classes (47%). This highlights that the landscape closer to the road is generally less sensitive than the bigger landscape in consideration here.

[6] http://www.saga-gis.org/en/index.html - accessed 2018

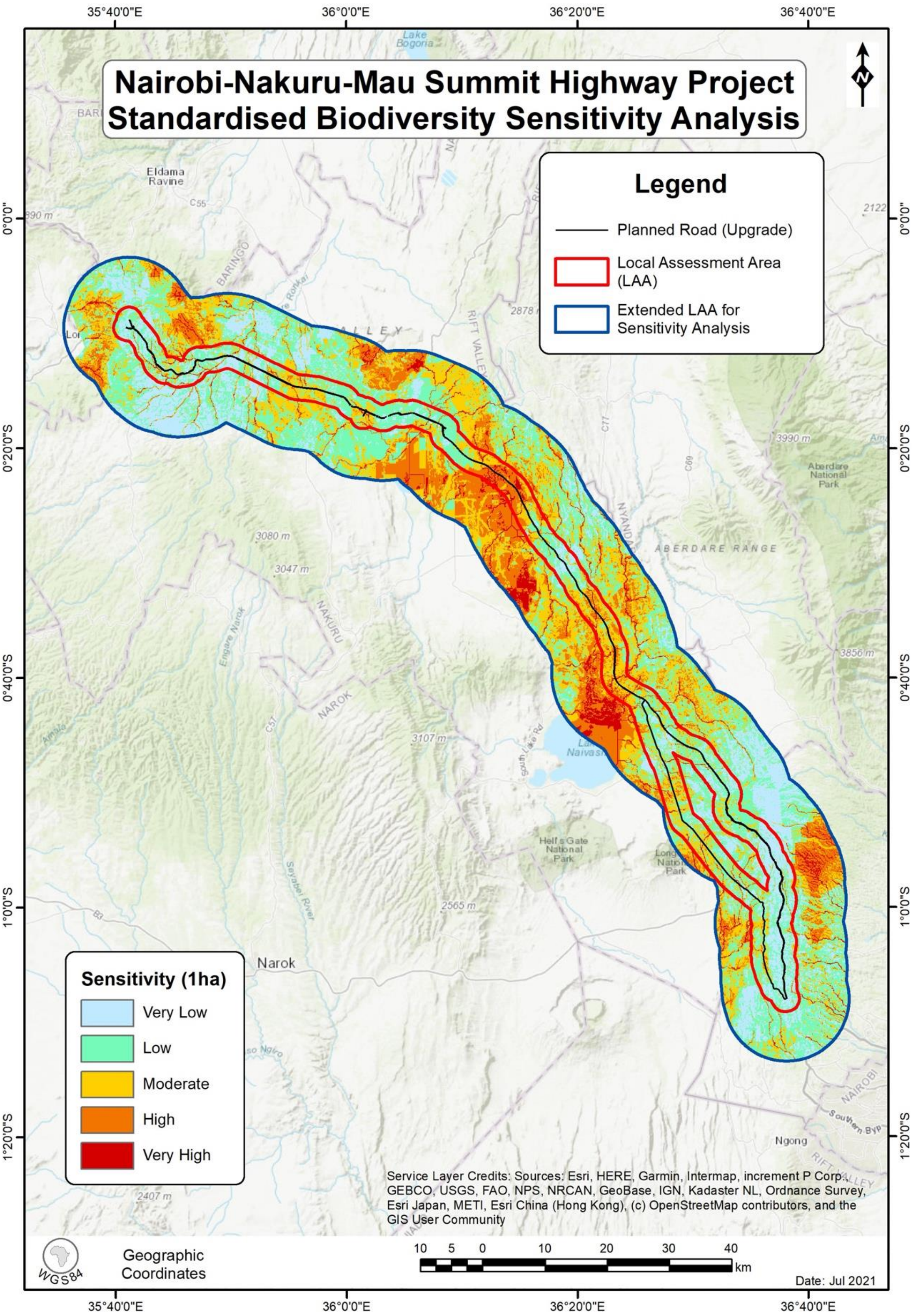


Figure 6-64 **Sensitivity analysis results in the Extended LAA presented at fine scale resolution using 1 ha sized pixels**

6.3.9 CRITICAL HABITAT ASSESSMENT

Critical Habitat identification is required by PS6 to manage risks and avoid, mitigate, and offset impacts to areas with high biodiversity value. Critical habitats are a subset of modified or natural habitats. Modified, natural and critical habitat refers to the biodiversity value of the area as determined by species, ecosystems and ecological processes.

- Modified habitats are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition;
- Natural habitats are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
- Critical habitats are areas with high biodiversity value, including:
  - Criteria 1: habitat of significant importance to Critically Endangered (CR) and/or Endangered (EN) species;
  - Criteria 2: habitat of significant importance to endemic and/or restricted-range species;
  - Criteria 3: habitat supporting globally significant concentrations of migratory species and/or congregatory species;
  - Criteria 4: highly threatened and/or unique ecosystems; and/or;
  - Criteria 5: areas associated with key evolutionary processes.

In areas of critical habitat, it must notably be demonstrated that a project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values, and the project's mitigation strategy must be designed to achieve net gains of those biodiversity values.

The Critical Habitat Assessment (CHA) was completed following IFC PS6 standard of 2012 (IFC PS6, 2012) and guidance notes of 2019 (IFC PS6, 2019). The detailed CHA (FFMES, 2021i) is available in Appendix 6-23, where sections of specific relevance to the definition of the three habitat classes recognised in the PS6 and required for the project are highlighted and discussed. The sections below present the determination of modified and natural habitat, the conclusions of the CHA and a critical habitat overview which details the potential interactions of critical habitat qualifying biodiversity features with the Project.

6.3.9.1 DETERMINATION OF MODIFIED AND NATURAL HABITAT

The land cover / land use classes of the LULUCA done by FFMES (2021a; Appendix 6-13) were considered for the separation between natural and modified habitat classes to fit the IFC PS6 definition. The LULUCA shows the greater part of the RAA landscape is degraded and substantial conversion of natural land into an agricultural estate has intervened. The general outlook is one of a switch from a landscape that was 60% natural in 2000 to one that is 55% under the direct influence of mankind in 2020 with agricultural expansion and plantations representing two major sources of change in the study area.

The LULUCA performed compared the RAA at three points in time: 2000, 2010 and 2020. The overwhelming majority of the degradation of the natural habitat observed can be considered as part of a long-term process, which highlights that most land use transitions are from a complex to a simpler state, corresponding to degradation of natural habitat into simpler forms of it, some of which can be considered as modified habitat.

The LULUCA provides an insight of what was "modified" prior to 2000 and remained modified to 2020. Conversely, this analysis also shows that portions of land have remained in a natural state since 2000. Some sections of land that represent naturally occurring vegetation and habitat show recent changes or persisting periods of change, however, based on information gathered through the vegetation baseline work, a potential for regeneration is evident if left alone, demonstrated in the LULUCA by the fact that some sections of land were noted as recovering to a more natural stage. These land use and land cover classes, by virtue of the potential to regenerate qualify as natural habitat and must be considered as such.

Figure 6-65 illustrates the modified and natural habitat delineation within the RAA. The detailed CHA Report in Appendix 6-23 can be consulted to see the description of which land use classes were considered as modified habitat and natural habitat in consideration of changes observed between the 2000 – 2020 period and also analysis of changes in the 2000 – 2010 and 2010 – 2020 periods for in between trends.

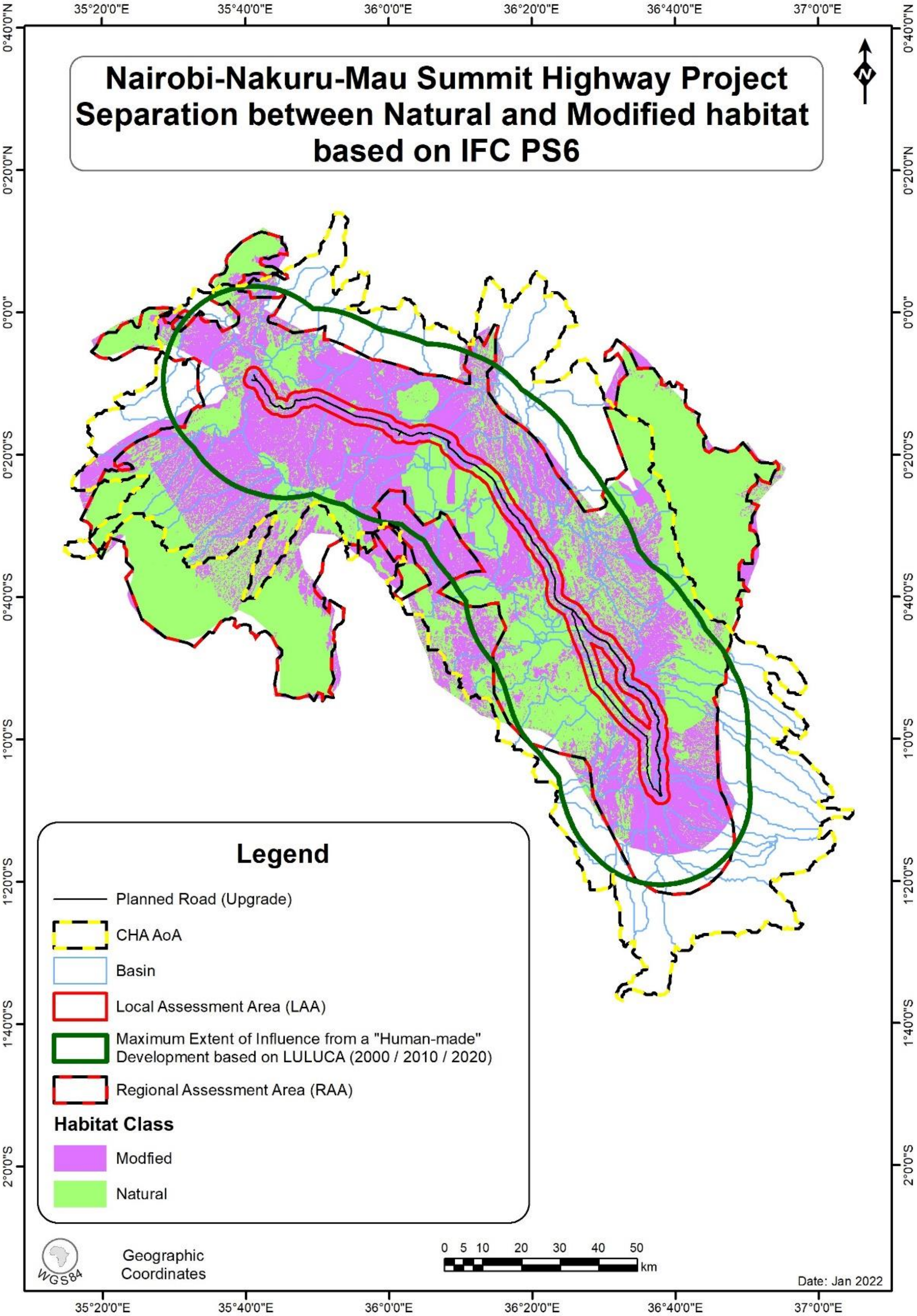


Figure 6-65 **Representation of the separation between Natural and Modified habitat in the RAA**

6.3.9.2 CRITICAL HABITAT

DEFINITION OF THE CRITICAL HABITAT AREA OF ANALYSIS

The RAA was initially used for the Critical Habitat Screening completed by TBC in 2018 (Bennun et *al.*). While this RAA provides a large-scale vision for the area to understand the regional implications, its use as a blanket area for the application of a critical habitat classification is considered as not practical for a project targeting a road where direct impacts are unlikely to exceed a 2 km distance away from the road itself (Van der Ree, 2015) and where indirect impacts are unlikely to reach beyond 15 km. Hence, adjustments are required.

Based on the LULUCA work, within the RAA the furthest distance between a land use class pixel and a clearly human created element (town, village or road) in 2020 is 22.3 km, meaning no part of the RAA was further than 22.3 km from a road or a village. While the road project is likely to have an indirect influence on increasing traffic, the 2000 – 2020 context highlights that this distance did not change since 2000. The project is therefore considered as unlikely to alter the landscape further than this distance and an adjusted Critical Habitat AoA (CH AoA) representing a distance of 23 km on either side of the road alignment is considered as an adequate representation of the risk zone of the project.

However, as nature does not follow straight lines, and as suggested in the IFC PS6 GN 59 (2019), an ecologically appropriate Area of Analysis needs to be considered, which should take into account the distribution of species or ecosystems (within and sometimes extending beyond the project's area of influence) and the ecological patterns, processes, features, and functions that are necessary for maintaining them. According to GN 59 of IFC PS6 (2019), these boundaries may include catchments, large rivers, or geological features. In this respect, it is considered that catchments are both a representation of river systems and geology/terrain, and therefore best represent ecologically meaningful and appropriate units that have a distinct "on the ground" nature (Linke et al. 2019) when compared to an "arbitrary" distance as generated through the LULUCA analysis such as suggested above. As a way to combine both recommendations, the watersheds of the HydroSHED[7] component of the HydroBASINS (Lehner and Grill, 2013) database by World Wildlife Fund are used, at resolution level 10 (for greater detail) and all watersheds of this level having a portion of its area within the 23 km distance away from the road (on either side) are deemed as representative of the Area of Analysis. As such the resulting CH AoA spans at least 23 km on either side of the project alignment and extends beyond that limit to ensure that the relevant appropriate and ecologically meaningful portions of the land are considered.

The CH AoA is represented in Figure 6-66.

[7] HydroSHEDS is a mapping product that provides hydrographic information for regional and global-scale applications in a consistent format. It offers a suite of geo-referenced datasets (vector and raster) at various scales, including river networks, watershed boundaries, drainage directions, and flow accumulations. HydroSHEDS is based on elevation data obtained in 2000 by NASA's Shuttle Radar Topography Mission (SRTM). This dataset provides polygons of nested, hierarchical watersheds, based on 15 arc-seconds (approx. 500 m at the equator) resolution raster data. The watersheds range from level 1 (coarse) to level 12 (detailed), using Pfastetter codes. Technical documentation: https://hydrosheds.org/images/inpages/HydroBASINS_TechDoc_v1c.pdf

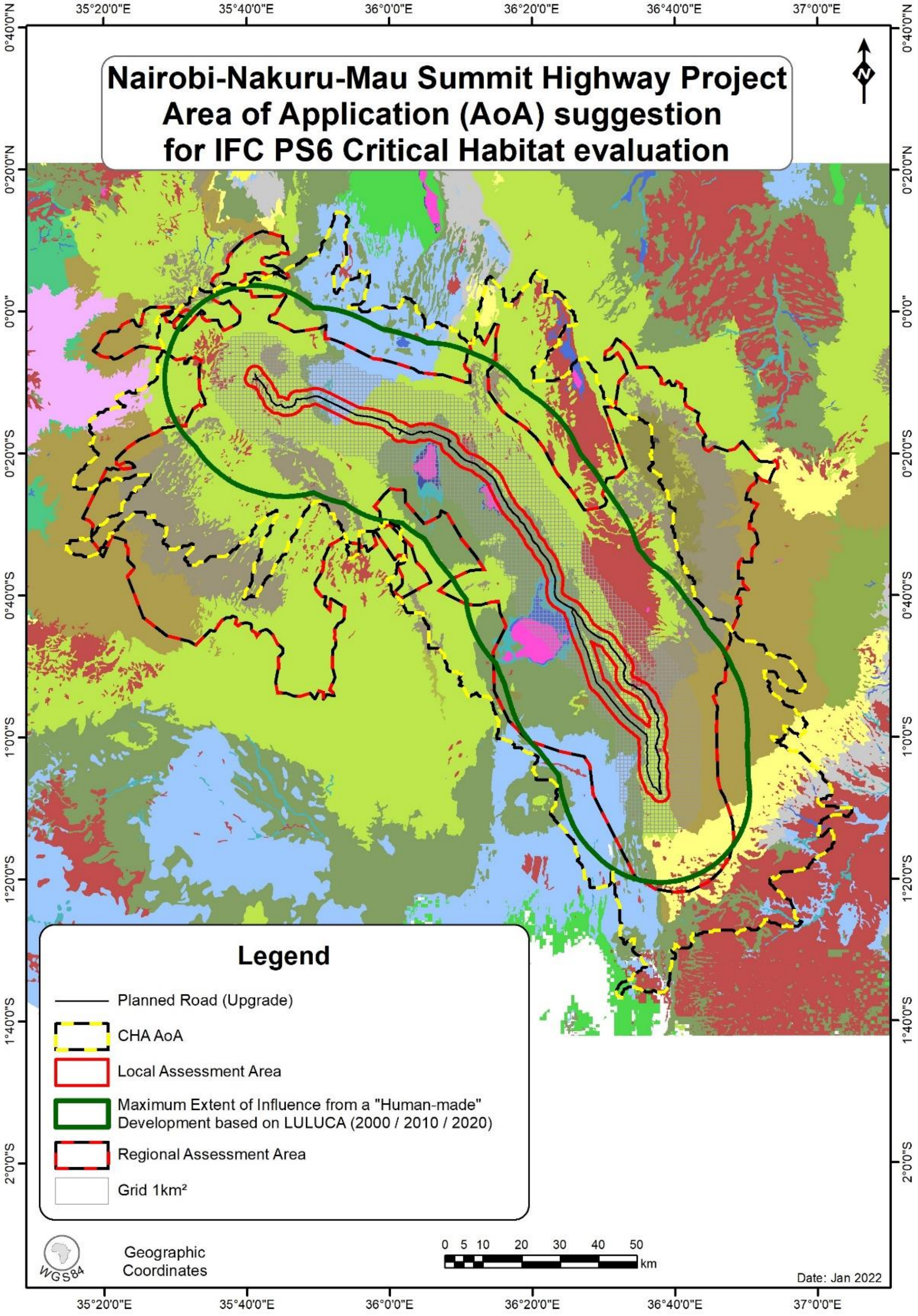


Figure 6-66 Critical Habitat Assessment Area of Analysis

CRITERIA 1 TO 5 REVIEW

CRITERIA 1 CRITICALLY ENDANGERED (CR) AND/OR ENDANGERED (EN) SPECIES

Table 6-49 summarises the criteria qualifying biodiversity features according to Criteria 1- Critically Endangered and/or Endangered species, subspecies and subpopulations for the CHA AoA. This is a direct listing for species that have been either observed or are considered likely to occur based on the IUCN lists and available supporting literature for the region of interest.

Further justification for species meeting or not the thresholds for criteria 1 is found in the CHA report in Appendix 6-23.

CRITERIA 2 ENDEMIC OR RESTRICTED-RANGE SPECIES

Table 6-50 summarises the assessment of biodiversity features against Criteria 2- Endemic and/or Restricted-range species for the CHA AoA. Again, this is a direct listing for species that have a restricted range and with likely presence in the study area that should be considered at this stage.

Further justification for species meeting or not the thresholds for criteria 2 is found in the CHA report in Appendix 6-23.

Table 6-49 Summary table of the Critical Habitat Qualifying Features as per IFC PS6 -Criteria 1 Critically Endangered and/or Endangered species

Group	Domain	Scientific name	Common name	IUCN	Confirmed present in AoA by studies conducted	Source if not confirmed	Note on inclusion - species may not have been observed but presence may be possible - precautionary approach	Criteria met (Yes or No)	Reasoning for meeting criteria or not
Mammals	Terrestrial	*Giraffa camelopardalis Ssp camelopardalis (formerly rothschildi)*	Giraffe (Nubian, formerly Rotschi	CR	Yes		Based on Fennessy et al. (2016) the Rothschild's giraffe should be subsumed into the nominate Nubian giraffe. This change in classification suggests an uplisting of the IUCN status from VU to CR for this sub species is likely although it does not yet reflect on the IUCN website. The Giraffe Conservation Foundation lists the Nubian giraffe as critically endangered. The species was encountered in the Soysambu conservancy	Yes	Soysambu Conservancy supports a globally important concentration of the critically endangered Nubian giraffe.
		Loxodonta africana	African savanna elephant	EN	Yes		Species noted by a relatively fresh dung evidence (<3 months old) in the Gatamaiyo Forest Nature Reserve (within the RAA)	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Giraffa camelopardalis Ssp Tippelskirchi	Giraffe (Masai)	EN	Yes		The species was encountered in the Marula estates and along the edges of lake Naivasha.	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Oryx beisa spp callotis	Fringe-eared Oryx	J (decreasi	Yes		This species was encountered in the Marula estates	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Panthera pardus	Leopard	J (decreasi	Yes		This species was recorded via camera trapping on Marula estates	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
Birds	Terrestrial	*Gyps africanus*	White-backed Vulture	CR	Yes		The species was encountered in the Soysambu Conservancy	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Necrosyrtes monachus	Hooded vulture	CR	No	IUCN (2021)	Expected not observed	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Gyps rueppelli	Rüppell's Vulture	CR	No		The species was encountered in the Soysambu Conservancy and observed in the Marula Estates	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Neophron percnopterus	Egyptian Vulture	EN	No	IUCN (2021)	Expected not observed	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Torgos tracheliotos	Lappet-faced Vulture	EN	No	IUCN (2021)	Expected not observed	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Aquila nipalensis	Steppe Eagle	EN	Yes		The species was observed in the Marula Estates	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Terathopius ecaudatus	Bateleur	EN	Yes		A single observation of the species was recorded in February 2021 on Marula Estates	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Acrocephalus griseldis	Basra Reed Warbler	EN	No	IUCN (2021)	Expected not observed	Yes	The Nairobi-Nakuru-Mau Summit region supports a globally important concentration of this species

Note: [1] CR= Critically Endangered; EN= Endangered; VU=Vulnerable; NT=Near-Threatened; LC= Least Concern

Table 6-49 Summary table of the Critical Habitat Qualifying Features as per IFC PS6 -Criteria 1 Critically Endangered and/or Endangered species (continued)

Biodiversity feature				IUCN	Confirmed present in AoA by studies conducted	Source if not confirmed	Note on inclusion - species may not have been observed but presence may be possible - precautionary approach	Criteria met (Yes or No)	Reasoning for meeting criteria or not
Group	Domain	Scientific name	Common name						
		Ardeola idea	Malagasy Pond Heron	EN	No	IUCN (2021)	Expected not observed	Yes	The Nairobi-Nakuru-Mau Summit region supports a globally important concentration of this species
		Balearica regulorum	Grey crowned crane	EN	Yes		Several observations of the species in large groups, particularly in Marula Estates and at Manguo Pond	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Macronyx sharpei	Sharpes Longclaw	EN	No	IUCN (2021)	Expected not observed	Yes	The eastern section of the Nairobi-Nakuru-Mau Summit region supports a globally important concentration of this species
		Sagittarius sepentarius	Secretary bird	EN	Yes		Several individuals observed on both Marula Estates and Soysambu Conservancy	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Polemaetus bellicosus	Martial Eagle	EN	Yes		One individual was observed during the February survey	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Poeoptera femoralis	Abbot's Starling	EN	No	IUCN (2021)	Expected not observed	Yes	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Falco concolor	Sooty Falcon	J (decreasi	Yes		A pair were observed at Soysambu Conservancy	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Bucorvus leadbeateri	Southern Ground Hornbill	J (decreasi	Yes		The species was observed at Soysambu Conservancy	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
		Aquila rapax	Tawny Eagle	J (decreasi	Yes		The species was observed in Marula Estates and along the A8 South Highway	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species
Amphibians	Terrestrial	*Hyperolius cystocandicans*	Tigoni Reed Frog	EN	No	IUCN (2021)	Recorded in study area	No	Based on the species' EOO it is highly likely that the Nairobi-Nakuru-Mau Summit region supports 0.5% of the global population of this species
Plants	Terrestrial	*Lagarosiphon hydrilloides*		EN	No	IUCN (2021)	Expected not observed	Yes	Rivers and streams in the Nairobi-Nakuru-Mau Summit complex support a globally important concentration of this species
	Terrestrial	*Ethulia scheffleri*		EN	No	IUCN (2021)	Expected not observed	Yes	Rivers and streams and seasonally flooded landscapes in the Nairobi-Nakuru-Mau Summit region support a globally important concentration of this species
	Terrestrial	*Ansellia africana*	Leopard Orchid	J(decreasi	Yes		Recorded in evergreeen and semi-evergreen bushland and thicket habitat	No	The Nairobi-Nakuru-Mau Summit region does not support a globally important concentration of this species

Note: [1] CR= Critically Endangered; EN= Endangered; VU=Vulnerable; NT=Near-Threatened; LC= Least Concern

Table 6-50 Summary table of the Critical Habitat Qualifying Features as per IFC PS6 -Criteria 2: Endemic and/or Restricted-range species

Biodiversity feature				IUCN	Confirmed present in AoA by studies conducted	Source if not confirmed	Note on inclusion - species may not have been observed but presence may be possible - precautionary approach	Criteria met (Yes or No)	Reasoning for meeting criteria or not
Group	**Domain**	**Scientific name**	**Common name**						
Mammals	Terrestrial	*Surdisorex norae*	Aberdare mole shrew	LC	No	IUCN (2021)	This species is endemic to the east side of the Aberdare Mountain Range in central Kenya, in the S-E of the CH AoA	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species
Birds	Terrestrial	*Cisticola hunteri*	Hunter's Cisticola	LC	Yes		The species is restricted to the Kenyan Mountains Endemic Bird Area	No	The Nairobi-Nakuru-Mau Summit region does not regularly hold >10% of the global population of this species
		Euplectes jacksoni	Jackson's Widowbird	NT	Yes		The species is restricted to the Kenyan Mountains Endemic Bird Area	No	The Nairobi-Nakuru-Mau Summit region does not regularly hold >10% of the global population of this species
		Prionops poliolophus	Grey-crested helmetshrike	NT	Yes		The species is restricted to the Serengeti Plains Endemic Bird Area	No	The Nairobi-Nakuru-Mau Summit region does not regularly hold >10% of the global population of this species
		Zosterops kikuyuensis	Kikuyu White-eye	LC	Yes		The species is endemic to Kenya	No	The Nairobi-Nakuru-Mau Summit region does not regularly hold >10% of the global population of this species
Herpetofauna	Terrestrial	*Phrynobatrachus keniensis*	Kenya River Frog	LC	Yes		The species is endemic to Kenya	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species
		Hyperolius montanus	Mountain Reed Frog	LC	No	IUCN (2021)	This species is endemic to the Kenyan highlands	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species
		Mertensophryne lonnbergi	Lönnberg's Toad	VU	Yes		This species is endemic to the Kenyan highlands	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species
		Mertensophryne mocquardi	Mocquards Toad	DD	No	IUCN (2021)	This species is endemic to Kenya	No	Despite unclear distribution, the Nairobi-Nakuru-Mau Summit region does not regularly hold >10% of the global population of this species
		Hyperolius cystocandicans	Tigoni Reed Frog	NT	No	IUCN (2021)	The species is endemic to the Kenyan highlands	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species. However this species is classified as endangered and therefore meets the requirements of criteria 1 and thus will not be considered under criteria 3
		Phrynobatrachus kinangopensis	Kinangop River Frog	VU	No	IUCN (2021)	This species is endemic to the Kenyan highlands	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species
		Trioceros jacksonii	Jackson's Three-horned Chameleon	LC	Yes		This species is range restricted	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species
		Bitis worthingtoni	Kenya Horned Viper	VU	No	IUCN (2021)	The species is endemic to the Gregory Rift Valley in Kenya	Yes	The Nairobi-Nakuru-Mau Summit region regularly holds >10% of the global population of this species
Freshwater Ecology	Terrestrial	*Bulinus permembranaceus*		VU	Yes		This species is endemic to the Aberdare Range, specifically the Kinangop Plateau and the Mau Escarpment	No	The Nairobi-Nakuru-Mau Summit region does not regularly hold >10% of the global population of this species
		Potamonautes jeanneli		LC	No	IUCN (2021)	The species distribution is limited to the east side of the Aberdare Mountain Range	No	The Nairobi-Nakuru-Mau Summit region does not regularly hold >10% of the global population of this species

Note: [1] CR=Critically Endangered; EN: Endangered; VU: Vulnerable; NT: Near-Threatened; LC: Least Concern

CRITERIA 3 MIGRATORY OR CONGREGATORY SPECIES

The threshold requirements which need to be met in order for an area to qualify as critical habitat under criterion 3 are:

- Areas known to sustain, on a cyclical or otherwise regular basis, ≥1 percent of the global population of a migratory or congregatory species at any point of the species lifecycle;
- Areas that predictably support ≥10 percent of the global population of a species during period of environmental stress.

A group of 138 bird species which are not already listed in the previous criteria (1 & 2) have been identified as migratory and/or congregatory and likely to visit the CH AoA. From the list of 138 species specifically evaluated, only five species had >1% of the global EOO represented within the CH AoA. These species are:

- Common ringed plover *Charadrius hiaticula*;
- Madagascan cuckoo *Cuculus rochii;*
- Lesser Black-backed Gull *Larus fuscus;*
- Red-throated Pipit *Anthus cervinus;*
- Semi-collared Flycatcher *Ficedula semitorquata.*

The range of habitats types listed for the species are considered as likely to feature within the CH AoA and therefore the five species are considered as meeting the requirements for criteria 3 for critical habitat. As none of these species features on the threatened list of the IUCN, for practical purposes, the critical habitat zone for these species is considered as met through the combination of the following critical habitat features in the CH AoA rather than using a blanket approach that would span the full CH AoA indiscriminately:

- Ramsar sites:
  - Lake Naivasha
  - Lake Nakuru (also a World Heritage Site)
  - Lake Elmentaita (also a World Heritage Site)
- Protected areas:
  - Aberdares National Park
  - Lake Nakuru National Park
  - Mount Longonot National Park
  - Hell’s Gate National Park
- Private conservancies:
  - Soysambu Conservancy
  - Marula Estates
- Important Bird Areas:
  - Kikuyu Escarpment Forest
  - Kinangop Grasslands
  - Lake Naivasha

- Lake Elmentaita
- Lake Nakuru
- The Mau Forest Complex
- Mau Narok-Molo grasslands and
- Aberdare Mountains

CRITERIA 4

To date there is no Kenyan ecosystem listed on the IUCN's red list of ecosystems. However, the Kenya Wildlife Service (2021) has listed Lake Elmentaita, Marula Estates, Lake Nakuru, Soysambu Conservancy, Eburru Forest, Mt Suswa Conservancy, Nairobi National Park and the Mau Forest Complex as endangered ecosystems. There is no data available to indicate the Kenya Wildlife Service's methodology behind this endangered ecosystem selection. Considering that this classification has been established by the nationally relevant conservation authority, by following GN80 b (IFC PS6 GN, 2019) recommendations, it is considered that these areas are, by default, meeting the threshold for classification as critical habitat under criteria 4.

CRITERIA 5

In the west of the study area lies an escarpment zone which creates a transition in the landscape from upland, high moisture, Afromontane areas with altitudes of up to 2,500m, to lowland areas with regular drought regimes with altitudes of up to 1,900m. The majority of the study area is located in the upland high moisture area, however, this topography creates two ecotones between the different ecological systems. This meets critical habitat under criteria 5, more precisely the 'environmental gradient' key evolutionary process and the 'connectivity' key evolutionary process. The former is considered important for genetic diversity maintenance and speciation in the study area. However, the latter is considered to be somewhat weak in the Nairobi-Nakuru-Mau Summit landscape based on its fragmented nature which limits the migratory capacity of many species.

Based on the standardised sensitivity analysis undertaken using baseline data, and the standardised sensitivity analysis undertaken using scoping data (FFMES, 2021h), it was determined that high to very high sensitivity habitat within the EOA may be considered as drivers for evolutionary processes and thus be qualified at critical habitat.

These include:

- Lake Nakuru National Park – for which almost 49% of the area is flagged as high sensitivity (sensitivity class 4);
- Soysambu Conservancy – for which 86% of the area is flagged as high sensitivity (sensitivity class 4);
- Afromontane rainforest;
- Water bodies;
- Riverine wooded vegetation;
- Edaphic grasslands on drainage-impeded, seasonally flooded soil or freshwater swamp;
- Closed woodlands and forests;
- Water;
- Wetlands.

OTHER CONSIDERATIONS

In addition to the IFC's critical habitat criteria, the critical habitat assessment also takes into account these considerations.

AREAS THAT MEET THE CRITERIA OF THE IUCN'S PROTECTED AREA MANAGEMENT CATEGORIES IA, IB AND II.

A review of IUCN protected area categories highlights no specific category 1a or 1b protected areas in the project AoA. However, there are 32 category II protected areas in Kenya, with four in close proximity of the project. Hell's Gate National Park, Lake Nakuru National Park and Mount Longonot National Park are all located within the project's AoA and would both be considered as critical habitat. Aberdare National Park is located just outside of the project's AoA, however, it is located within the project's RAA and based on its high biodiversity value can be considered as critical habitat.

KEY BIODIVERSITY AREAS (KBAS), WHICH ENCOMPASS INTER ALIA RAMSAR SITES, IMPORTANT BIRD AND BIODIVERSITY AREAS (IBAS), IMPORTANT PLANT AREAS (IPAS).

There are multiple KBAs within the study area all of which can be considered as critical habitat. There are three Ramsar sites; Lake Nakuru (Site 476), Lake Elmentaita (Site 1498) and Lake Naivasha (Site 724). All are located in the project's AoA. There are five Important Bird Areas (IBAs) located in the project's regional assessment area; Kikuyu Escarpment Forest, Kinangop Grasslands, Lake Naivasha, Lake Elmentaita and Lake Nakuru. There are a further three IBAs within the project's RAA; the Mau Forest Complex, Mau Narok-Molo grasslands and the Aberdare Mountains. No Important Plant Areas have been identified in Kenya as of yet.

UNESCO NATURAL AND MIXED WORLD HERITAGE SITES

There are seven World Heritage Sites in Kenya, of which three are Natural World Heritage Sites. The only site to be within the project's AoA is the Kenya Lake System in the Great Rift Valley. This World Heritage Site (WHS) incorporates Lake Elmentaita and Lake Nakuru, both of which are within the study area's regional assessment area and both of which should be considered as critical habitat. The lake system is considered a World Heritage Site as it incorporates Criterion vii (presenting exceptional ranges of geological and biological processes of exceptional beauty), Criterion ix (illustrating ongoing ecological and biological processes) and Criterion x (being the single most important foraging site for the Lesser Flamingo (*Phoeniconaias minor*) in the world). No physical encroachment of the project in the Kenya Lake System in the Great Rift Valley WHS will occur.

SITES THAT FIT THE DESIGNATION CRITERIA OF THE ALLIANCE FOR ZERO EXTINCTION (AZE)

No Alliance for Zero Extinction sites are located in the project RAA. The closest Alliance for Zero Extinction (AZE) site to the project's RAA is Mount Kenya, which is located at least 90km away from the planned road upgrade site.

6.3.9.3 CRITICAL HABITAT OVERVIEW

Based on the above analysis, the following biodiversity features qualify as critical habitat according to IFC PS 6:

- the Critically Endangered Nubian Giraffe (*Giraffa camelopardalis Ssp camelopardalis*);
- the Endangered Basra Reed Warbler (Acrocephalus griseldis);
- the Endangered Malagasy Pond Heron (*Ardeola idea*);
- the Endangered Sharpe’s Longclaw (*Macronyx sharpei*);
- the Endangered Abbot's Starling (*Poeoptera femoralis*);
- the Endangered *Lagarosiphon hydrilloides*;
- the Endangered *Ethulia schefflera*;
- the restricted range Aberdare mole shrew (*Surdisorex norae*);
- the restricted range reptiles and amphibians : Kenya River Frog (*Phrynobatrachus keniensis*), Mountain Reed Frog (*Hyperolius montanus*), Lönnberg's Toad (*Mertensophryne lonnbergi*), Tigoni Reed Frog (Hyperolius cystocandicans), Kinangop River Frog (Phrynobatrachus kinangopensis), Jackson's Three-horned Chameleon (T*rioceros jacksonii*), Kenya Horned Viper (*Bitis worthingtoni)* and P*otamonautes jeannelli*;
- The migratory bird species: Common Ringed Plover (*Charadrius hiaticula*), Madagascan Cuckoo (C*uculus rochii*), Lesser Black-backed Gull (*Larus fuscus*) Red-throated Pipit (*Anthus cervinus*), Semicollared Flycatcher (*Ficedula semitorquata*);.
- High biodiversity sensitivity areas within the East to West/Plateau-Escarpment-Lowland landscape;
- Endangered ecosystems, Protected areas, KBAs and WHS.

CH exists independently of a project and can be identified without reference to a project (Stefan et *al.* 2013). Although part of the Project’s AoA qualifies as critical habitat, in some cases the Project will have little to no impacts on the qualifying biodiversity features. Table 6-51 describes the potential interactions the Project may have with the critical habitat qualifying features.

Figure 6-67 provides an overview of the critical habitat features identified. Detailed maps of each qualifying biodiversity features can be found in the CHA Report in Appendix 6-23.

Table 6-51 Potential interaction of critical habitat qualifying biodiversity features with the project

Biodiversity Feature	Rationale for CH	Potential interaction with the project
Nubian giraffe (*Giraffa camelopardalis camelopardalis*) (CR)	This giraffe is encountered in Soysambu Conservancy. There are currently only 800 individuals of this species in Kenya out of a global population of 3000, the majority of which are resident extra-limitedly in Kenya due to reintroduction efforts. Across sub-saharan Africa, giraffe species have been particularly negatively affected by habitat degradation, land transformation and human-wildlife conflict. Nubian giraffe populations specifically have been negatively affected by habitat fragmentation. Based on its key importance for Nubian giraffes, the Soysambu Conservancy can be considered as 'critical habitat'	The key potential interaction with the Nubian giraffe is the barrier effect of the road, and mortality from attempted road crossings. The baseline studies suggest that the existing road and fencing in Soysambu Conservancy is already a major barrier that prevents giraffe from crossing. In fact, fences are present on both sides of the road to keep wildlife and livestock away from the road, including a 6 ½ feet electrified fence on the western side of the road. This is corroborated by results of the camera-trap campaign conducted for the completed ESIA (WSP, 2021), where no giraffe was observed by the 15 camera traps placed near the road, and by the results of the biannual wildlife census conducted since 1996-2020 in the Soysambu Conservancy. Soysambu management also declared no giraffe cross the road on their property and that giraffes are generally found far from the road in the eastern section of their conservancy. Furthermore, Soysambu management confirmed they do not want endangered wildlife they are protecting within their land on the western side of the road to cross to the eastern side. Although part of Soysambu property, the eastern side of the road is characterized by a more important number of human settlements which represents a greater risk of poaching for the giraffes. These observations lead to the conclusion that the road upgrade will have no significant impact on the Nubian Giraffe.
Basra Reed Warbler (*Acrocephalus griseldis*) (EN)	The Basra reed warbler is classified as endangered by the IUCN's Red List based on population declines resulting from habitat drainage, poor water management and drought. The species breeds in the middle east but migrates to eastern Africa for winter (BirdLife International, 2017). The southern half of the study area, extending from Naivasha to Nairobi is considered a site of residence for the species during winter. A total of 4.56% of the EOO for the species in Kenya is situated within the CH AoA, which represents 1.80% of the species EOO globally.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main indirect potential impact on this wetland species is hydrological change to wetlands. Assuming potential pollution of watercourses is avoided through good management, no project impacts are likely on this species.
Malagasy Pond Heron (*Ardeola idae*) (EN)	This species has a declining population. Its main breeding range covers Madagascar, Réunion and the Seychelles, however individuals have been recorded as present (yet non-breeding) in Kenya. The species was not observed during the study period, although previous records indicated its presence particularly around Soysambu Conservancy. The portion of the species' EOO within the CH AoA is greater than 0.5% of the global scale EOO,	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main indirect potential impact on this wetland species is hydrological change to wetlands. Assuming potential pollution of watercourses is avoided through good management, no project impacts are likely on this species.

Biodiversity Feature	Rationale for CH	Potential interaction with the project
Sharpe's Longclaw (*Macronyx sharpei*) (EN)	The endangered Sharpe's longclaw was not observed in the study period yet was expected. It has a significantly limited range and is endemic to Kenya. The species is particularly dependent on grasslands, a habitat type which has reduced greatly due to land transformation for agricultural purposes. It thus appears that the eastern side of the study area, reaching into the Aberdare Mountain range is of global importance to this species.	The road passes along the very edge of the range on Kinangop Plateau. The grassland habitat along the road is degraded and fragmented, and probably does not hold this species. It is unlikely the road will lead to significant impacts on this species, unless there is a new footprint on montane grassland in range or indirect impacts from human relocation.
Abbot's Starling (*Poeoptera femoralis*) (EN)	The Abbot's starling is generally common in Kikuyu Escarpment Forest in the southern Aberdare Mountains. The Kikuyu Escarpment Forest, of which the Kinale Forest block is part of, forms the core distribution of the globally species. It was not identified during surveys but is expected to be observed. As the portion of the EOO within the CH AoA is 2.23% of the global scale EOO, one threshold is met, while the requirement for at least 5 reproductive units appears also highly likely to be met considering the biology of the species.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated and no significant impacts are foreseen.
Lagarosiphon hydrilloides (EN)	Lagarosiphon hydrilloides was not recorded during the study but is considered to be present in the CH AoA based on previous records for the area (Beentjie, 2017). The species is freshwater dependent with habitat requirements of still or slow-moving water between 1,650 to 3,000 m asl. Given the species distribution and endangered status it is believed that its habitat would be classified as critical on the basis of the IFC PS6's criterion 1	No direct habitat loss for this species is anticipated. Potential interaction with the project could arise from pollution, sedimentation or hydrological change to wetlands.
Ethulia schefflera (EN)	The species was not recorded during the study but is considered present in the CH AoA based on previous records for the area. This species' habitat requirements are swampy sites found along streams and marshy grassland areas which feature black cotton soils. All sites with species presence are located between 1,500 and 2,000 m asl. Studies have also suggested that the species may be present in rock crevices and in poorly drained sites which support populations of Ethulia bicostata Based on its characteristics, the habitat which this species occupies could be classified as critical habitat (IFC 2019).	No direct habitat loss for this species is anticipated as it is not thought to be found near the road alignment. Potential interaction with the project could arise from pollution, sedimentation or hydrological change to wetlands.
Aberdare mole shrew (*Surdisorex norae*) (RR)	The species distribution which overlapped with the CH AoA and had an EOO small enough to meet the threshold for criteria 2. This species has an EOO of 3,065 km2, 974 km2 of which are located within the CH AoA. Assuming a relatively even distribution of this species, over 30% of the species distribution is located within the CH AoA, which can be assumed to encompass more than 10 reproductive units.	This species is endemic to the east side of the Aberdare Mountain Range. The distribution of this species probably follows the top of this mountain range hence it is unlikely to be found in the LAA, close the road and no impats are foreseen.

Biodiversity Feature	Rationale for CH	Potential interaction with the project
Kenya River Frog (*Phrynobatrachus keniensis*) (RR)	This is a species of montane grassland and montane rainforest. It is often associated with the edge of water bodies such as swamps and streams, where it breeds. The CH AoA represents 73.54% of the global EOO for the species, this highlights that it is most likely that at least 10% of the species global population will feature within the CH AoA and the species therefore meets one of the qualifying levels for criteria 2 of the IFC PS6.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main potential impact of the road upgrade on this species will be the potential increase in barrier effect. However, it is important to note that the existing road is already a significant barrier for this species.
Mountain Reed Frog (*Hyperolius montanus*) (RR)	The Mountain Reed Frog is adaptable species of montane grassland and farmland (potato, tea, coffee and maize fields), montane rainforest and moor land. It apparently breeds in open water bodies (permanent and temporary) in marshes in savannah or very open farmed areas. The CH AoA represents 46.94% of the global EOO for the species, this highlights that it is most likely that at least 10% of the species global population will feature within the CH AoA and the species therefore meets one of the qualifying levels for criteria 2 of the IFC PS6.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main potential impact of the road upgrade on this species will be the potential increase in barrier effect. However, it is important to note that the existing road is already a significant barrier for this species.
Lönnberg's Toad (*Mertensophryne lonnbergi)* (RR)	This is a species of montane grassland, moorland and forest patches, and it survives in agricultural land. It breeds by larval development in small, shallow permanent and semi-permanent pools in open areas. The CH AoA represents 24.86% of the global EOO for the species, this highlights that it is most likely that at least 10% of the species global population will feature within the CH AoA and the species therefore meets one of the qualifying levels for criteria 2 of the IFC PS6.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main potential impact of the road upgrade on this species will be the potential increase in barrier effect. However, it is important to note that the existing road is already a significant barrier for this species.
Tigoni Reed Frog (*Hyperolius cystocandicans*) (RR)	The species is associated with rain-filled temporary pools in montane grassland and forest, where it presumably breeds by larval development similar to congeners. The CH AoA represents 31.30% of the global EOO for the species, this highlights that it is most likely that at least 10% of the species global population will feature within the CH AoA and the species therefore meets one of the qualifying levels for criteria 2 of the IFC PS6.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main potential impact of the road upgrade on this species will be the potential increase in barrier effect. However, it is important to note that the existing road is already a significant barrier for this species.
Kinangop River Frog (*Phrynobatrachus kinangopensis*) (RR)	This frog is associated with rain-filled temporary pools in montane grassland and forest, where it presumably breeds by larval development similar to congeners. The CH AoA represents 31.30% of the global EOO for the species, this highlights that it is most likely that at least 10% of the species global population will feature within the CH AoA and the species therefore meets one of the qualifying levels for criteria 2 of the IFC PS6.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main potential impact of the road upgrade on this species will be the potential increase in barrier effect. However, it is important to note that the existing road is already a significant barrier for this species.

Biodiversity Feature	Rationale for CH	Potential interaction with the project
Jackson's Three-horned Chameleon *(Trioceros jacksonii*) (RR)	The species' distribution corresponds with the recent historic extent of moist and dry montane forest types, however it appears to tolerate anthropogenic landscapes that have replaced this natural habitat. The CH AoA represents 15.22% of the global EOO for the species, this highlights that it is most likely that at least 10% of the species' global population will feature within the CH AoA and the species therefore meets one of the qualifying levels for criteria 2 of the IFC PS6.	This is an adaptable species that can survive in transformed habitats. Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main potential impact of the road upgrade on this species will be the potential increase in barrier effect and increased mortality from road crossings. However, it is important to note that the existing road is already a significant barrier for this species.
Kenya Horned Viper (*Bitis worthingtoni*) (RR)	This is a terrestrial species found in high grassland and scrub, where it favours broken rocky country and scrub-covered hills along the edge of the escarpment, up to the edge of forest. It has also been found on the valley floor, and at the edges of Acacia woodland. It can survive in areas converted to cattle ranching but will be lost from areas subject to intensive farming. The CH AoA represents 45.85% of the global EOO for the species, this highlights that it is most likely that at least 10% of the species global population will feature within the CH AoA and the species therefore meets one of the qualifying levels for criteria 2 of the IFC PS6.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main potential impact of the road upgrade on this species will be the potential increase in barrier effect and increase mortality from road crossings. However, it is important to note that the existing road is already a significant barrier for this species.
Common Ringed Plover (*Charadrius hiaticula*) (Migratory)	3.76% of the global EOO of this migratory species is located within the CH AoA.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main indirect potential impact on this wetland species is hydrological change to wetlands. Assuming potential pollution of watercourses is avoided through good management, no project impacts are likely on this species.
Madagascan Cuckoo (*Cuculus rochii*) (Migratory)	2.31% of the global EOO of this migratory species is located within the CH AoA.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated and no significant impacts are foreseen.
Lesser Black-backed Gull (*Larus fuscus*) (Migratory)	4.56% of the global EOO of this migratory species is located within the CH AoA.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main indirect potential impact on this wetland species is hydrological change to wetlands. Assuming potential pollution of watercourses is avoided through good management, no project impacts are likely on this species.
Red-throated Pipit (*Anthus cervinus*) (Migratory)	2.89% of the global EOO of this migratory species is located within the CH AoA	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated. The main indirect potential impact on this wetland species is hydrological change to wetlands. Assuming potential pollution of watercourses is avoided through good management, no project impacts are likely on this species.

Biodiversity Feature	**Rationale for CH**	**Potential interaction with the project**
Semicollared Flycatcher (*Ficedula semitorquata*) (Migratory)	1.07% of the global EOO of this migratory species is located within the CH AoA.	Because the amount of habitat being cleared for this project is very small, no direct loss of habitat for this species is anticipated and no significant impacts are foreseen.
The east to west/plateau-escarpment-lowland landscape	This escarpment zone is characterized by a transition in the landscape from upland, high moisture, to lowland which creates two ecotones between the different ecological systems. According to expert reviews, this meets the 'environmental gradient' key evolutionary process and the 'connectivity' key evolutionary process. High and very high biodiversity sensitivity areas within the RAA were determined to qualify as critical habitats under key evolutionary process.	No direct impact of these critical habitats is anticipated during project construction and operation. The main impact of the road upgrade on this landscape will be the potential increase in barrier effect for the wildlife this landscape support and overall decrease in connectivity. However, it is important to note that the existing road is already a significant barrier for many species. Furthermore, connectivity within and among these habitats is also currently significantly affected by existing fences and other infrastructure.
Endangered ecosystems, Protected areas, KBAs and WHS	Based on the high biodiversity value of the endangered ecosystems, protected areas, KBAs and WHS within the RAA, these should be considered as Critical Habitat	No direct impacts on these areas are anticipated during project construction and operation. In fact, no physical encroachment of the project in endangered ecosystems, protected areas, KBAs or WHS will occur. The main impact of the road upgrade on the protected areas and KBAs located near the road, or which the road traverses, is the potential increase in barrier effect for the wildlife these areas support and overall decrease in connectivity could. However, it is important to note that the existing road is already a significant barrier for many species. Furthermore, connectivity within and among these habitats is also currently significantly affected by existing fences and other infrastructure.

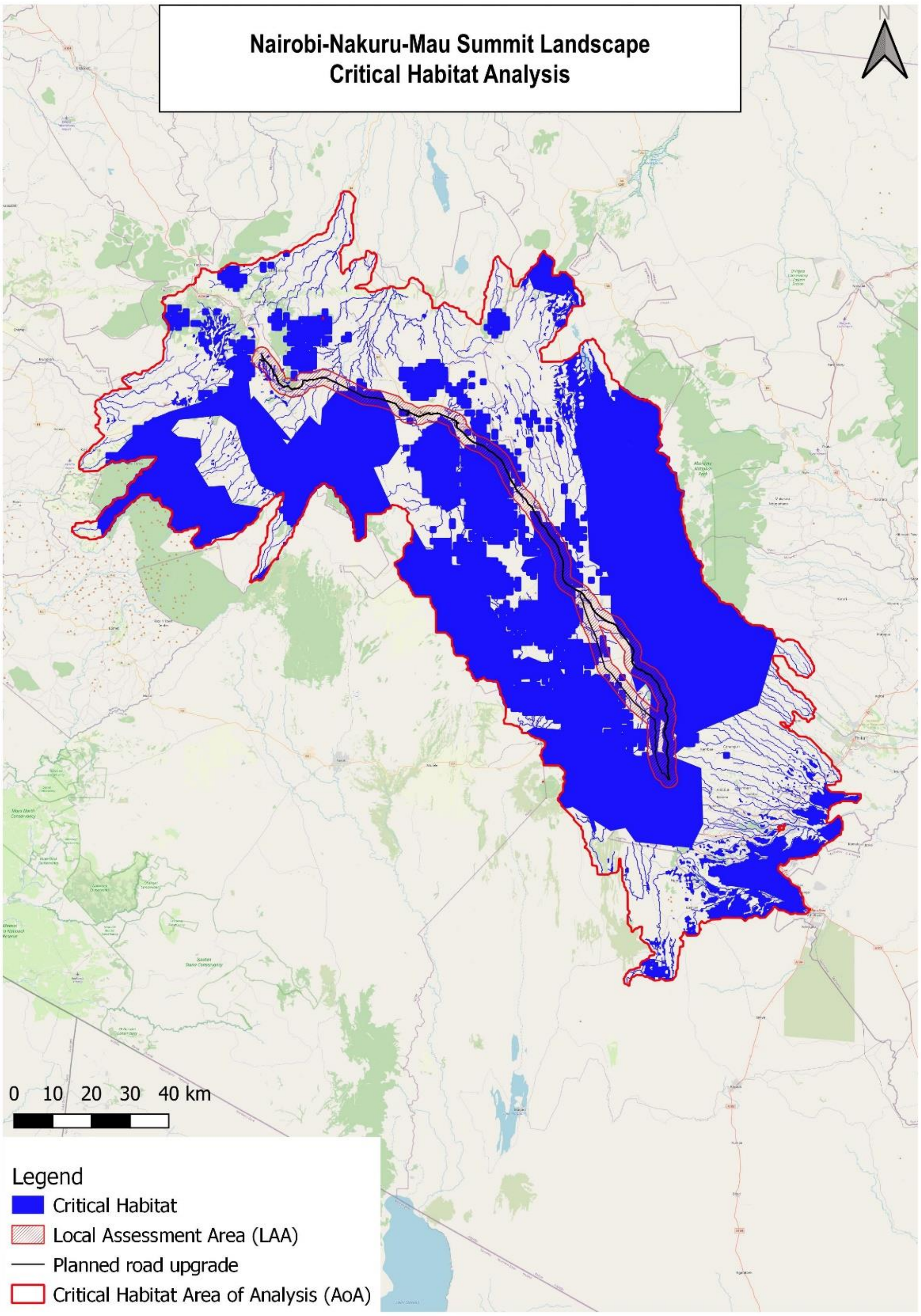


Figure 6-67 Representation of habitat classification in the Nairobi-Nakuru-Mau Summit study area as per IFC PS6 guidelines

6.3.10 ECOSYSTEM SERVICES

An ecosystem is defined as a dynamic complex of plants, animals, micro-organisms and non-living components interacting as a functional unit (MEA, 2005). Human communities are an integral part of ecosystems and are beneficiaries of many goods and services they provide. These benefits are recognised as Ecosystem Services (ES).

The concept of ES has grown in importance over the last decade, particularly following the Millennium Ecosystem Assessment (MEA). The definition of this concept comes from the evaluation report, which states that such services are the benefits people obtain from ecosystems (MEA, 2005; IFC, 2019). ES could be considered as the direct and indirect contributions of ecosystems to human well-being (Kumar, 2010).

ES are grouped into four categories that have been studied:

- Supply services: which refer directly to products people obtain from ecosystems (e.g. agricultural products, plants to eat, games, medicinal plants, fresh water, biofuel, timber, etc.);
- Regulating services: which are the benefits humans obtain from the regulation of ecosystem processes (e.g. climate regulation, waste decomposition, purification of water and air, etc.);
- Cultural services: which refer to the non-material benefits people obtain from ecosystems (e.g. sacred and spiritual sites, ecotourism, education, etc.);
- Supporting services: which are the natural processes that maintain the other services (e.g. nutrient cycling, genetic production and genetic exchange channels, etc.).

ES are also divided into two types according to IFC's PS 6:

- Type I: Provisioning, regulating, cultural and supporting ecosystem services, over which the promoter (RVH) has direct management control or significant influence, and where impacts on such services may adversely affect communities.
- Type II: Provisioning, regulating, cultural and supporting ecosystem services, over which the promoter (RVH) has direct management control or significant influence, and on which the project directly depends for its operations.

An Ecosystem Services Analysis was carried out to identify ES provided within the Project's Regional Assessment Area (RAA), and to determine the Priority Ecosystem Services (PES) as prescribed in IFC's PS6. The detailed Ecosystem Services analysis is available in Appendix 6-24.

The ES Analysis is based on various information coming from the baseline characterisation of different physical, biological and social components and on literature review. In order to obtain more information and to properly characterise the PES, specific consultations with local community representatives have been undertaken. The PES identification process is then supported by the application of prioritization criteria. The main finding of the ES Analysis is presented below.

A list of the main ES provided inside the RAA has been developed based on a literature review on ES, the natural and modified habitats identified within the RAA and the consultations held with the communities crossed by the Nairobi-Nakuru-Mau Summit Highway. Natural and modified habitats have multiple vocations associated with a range of uses by local communities:

- Provisioning ES are mainly associated with specific species found inside the RAA;
- Cultural ES are mainly associated with specific habitats inside the RAA, notably for tourism;
- Regulation and support ES are related to interaction between bio-physical and social components at a wider scale;
- Due to their complexity and overarching quality, support ES have not been specifically assessed inside the RAA but are known to contribute to all types of ES.

The main ES provided in the RAA are described in Table 6-52, as well as the description of their use by local communities.

Table 6-52 Main ES provided inside the LSA

Ecosystem services	Definition	Description of their use within the RAA
Provisioning services		
Agricultural potential and production	Areas with agricultural potential, including all crops and agricultural products grown by local communities for human and livestock consumption.	Many people in the project area live from the harvest of their agricultural activities. From information gathered during community meetings, about 27 different crops are cultivated in the sub-counties crossed by the proposed highway. Most of the crops are grown for subsistence use and only sold when there is surplus. Crops which are mostly grown for subsistence are maize and beans: The majority of these crops depend on rainfall through their growth stages. The shamba system, a form of agroforestry, is practiced in the Kinale and Koibatek forests. In this system, the farmers are encouraged to cultivate primary crops (maize, beans) on previously clear-cut public forest land on the condition that they replant trees.
Livestock and forage resources	Forage resources, water and others supporting livestock and animals owned for consumption, domestic or commercial uses	Livestock largely sustains the livelihoods of the populations living along the Highway. There are five common and distinct types of livestock reared by local residents, starting with the more common ones: cattle, sheep, goats, followed by donkeys and pigs. Poultry is also present, especially chicken and ducks. Livestock is mostly reared for economic income, and less for household food. Livestock product consumed on a daily basis in most households is milk, which excess is sold for income earning. Livestock mostly grazes on farms, roadsides and forests. The growing of forage resources is not widespread.
Fishing and fisheries resources	Fishing stock caught in lakes and rivers or from aquaculture	Two types of fisheries occur along the proposed highway project: inland freshwater fisheries, which is practised in rivers, dams and lakes, and aquaculture, which is limitedly practised. Fishing activities in rivers is predominant in Njabini, Molo, Malewa and Njoro rivers and are mostly for subsistence. Lake Naivasha is a freshwater lake with well-established commercial fisheries. Fish is sold in various fish market, but also on the highway roadside. Fish species caught in rivers are not well known by residents but in the lake common species caught are Tilapia, Common Carps, Catfish and Large Mouthbash.
Hunting and bush meat	Animal species trapped or hunted for consumption, including insects, mammals, birds, amphibians and reptiles	Hunting being illegal, it is not an important activity within the RAA. Only a few in a few sub-counties hunting was mentioned as being practiced by a limited number of people, mostly for antelopes, African hare and porcupine.
Wild food products	Products collected in the wild for food, other than animal proteins (vegetal products, mushrooms or honey)	Many households in the project area supplement their diets with wild food products. The wildly gathered foods are mostly vegetables and fruits that have been traditionally used by the communities. Some wild vegetable species have been adopted into home gardens where they are produced in large quantities. During consultations with communities, six plant species used as a food product were identified.
Traditional medicine	Mineral, plant or animal used in order to maintain people's health as well as to prevent, diagnose, treat or care for physical and mental diseases.	A total of 51 species of plants were recorded as medicinal plants during consultations. The species most frequently mentioned for its medicinal use is *Prunus africana. Warburgia ugandensis, Azadirachta indica*. Sources of the medicinal plants are mostly in the protected forests and in riverine forests traversing farmlands. The plants are used as treatments for various symptoms and diseases. Most communities mentioned the use of traditional vs modern medicine is about 50/50. Traditional medicine is often more easily accessible and consumed first as an alternative whenever they are unable to buy conventional medicines.

Ecosystem services	Definition	Description of their use within the RAA
Building. carpentry and craft materials	Mineral or vegetal material (ligneous or non-ligneous) used for construction purposes, to construct furniture and to make craft objects	Building materials occurring along the proposed highway road are timber, poles and mineral construction materials. Some of the timber in the section comes from farms while most of it is purchased from timber yards (sawmills). Mineral construction materials are also exploited, including stones and sands for building, and gravels for road construction. These resources are obtained from Kikuyu escarpment in the Kinangop area. Craft works is very limited in the area. For instance, bead work among Maasai community in Gilgil section uses synthetic raw materials which are purchased.
Biofuel	Animal or vegetal products used as energy sources	Biofuel resources along the proposed highway are mainly firewood. Charcoal is used mainly in urban areas. In most areas, local residents access forests for firewood, including Kinale, Kijabe, Kuresoi and Molo forests. Charcoal is obtained by local residents by purchasing from the local vendors. Collection of firewood in the forest is done by both men and women, especially for trade in the local market.
Water Resources	Groundwater and surface water used as tap water or for domestic, commercial or agricultural means. Comprises all the natural processes that regulate its quality or quantity	Water resources mentioned by the community representatives were rivers/streams, springs, swamps, water pans, dams, lakes, rainwater collection facilities, boreholes and water supply infrastructures (pipes). These change from one sub-county to another and constitute sources of water for domestic use, as well as for agriculture and livestock. In some areas where water resources are scarcer, water is bought from vendors. Water thus also represents a source of income for some water vendors which will transport and sell water. The most common source of water along the highway is rainwater which is harvested from roof catchments.
Regulation services		
Air quality control	Ecosystems influence in terms of gases exchange or filtration of physical or chemical particles in the air (ex : dust, O_2 CO2)	Baseline studies demonstrated standards for particulate matter already exceeded criteria, especially in dense urban settings. Considering the degraded nature of vegetation along the highway, air quality control by ecosystems is considered limited.
Climate regulation	<u>Global :</u> Ecosystems influence the absorption or emission of green gases and in the regulation of air masses	The contribution to global climate regulation is considered low because of the state of vegetation in the RAA, which is fairly degraded flooding and droughts was mentioned as being an important recurring problem for agriculture in some areas, which shows the importance of climate regulation issues within the project area.
	<u>Regional and local :</u> Ecosystems influence on regional and local temperatures, rainfalls or on other climatic parameters	
Water regulation and erosion control	Ecosystems influence on the amplitude and period of water flow, water storage, aquifer filling and flood prevention. They also have a role of ecosystems in preventing erosion by retaining soil by intercepting rainfall, reducing the speed of runoff, etc.	Vegetation, especially forested habitats, plays a significant role in soil erosion control. Their role is increased in areas with strong slope. Riverine forests also play an important role for the control of erosion from water action. Flooding and droughts were mentioned as being an important recurring problem for agriculture in some areas, which shows the importance of water regulation services amongst the communities.

Ecosystem services	Definition	Description of their use within the RAA
Cultural Services		
Sacred components	Cultural or religious value that population attaches to an ecosystem, a place or a species	Local communities have regarded places and environmental entities sacred in their daily lives. This is more pronounced among the Kikuyu community where some trees are sacred due to their beliefs. Knowledge of sacred trees is vivid among the Kikuyu community along the highway sections, but they hardly perform rituals or pray under the tree. No sacred site was cited by the residents to occur the project area, except for the caves in Menengai crater, where offerings are done by religious leaders. Nakuru residents mentioned the Jacaranda trees in the city had significant cultural importance for the city.
Recreation and Tourism	Nature, particularly protected areas and wildlife, plays an important role in supporting tourism. Ecosystems and biodiversity are therefore an important source of employment and income generation.	The natural sites within the project area attract a significant number of tourists to the area. Nakuru County attracts a large inflow of tourists from within and outside Kenya with its diverse flora and fauna. National Parks and private wildlife conservancies within the RAA attract tourists. In general, tourism provides work for local residents in different hotels and restaurants, which also purchase local food produce.
Support Services		
Primary production	Production of organic matter by plants through photosynthesis and nutrient input. It forms the basis of the food chain	Due to their complexity and overarching quality, support ES have not been specifically assessed inside the RAA but are known to contribute to all types of ES
Nutrients cycle	Nutrients cycle in the ecosystems (phosphorus, nitrogen, carbon, sulfur, etc.)	
Habitat	Natural or modified areas which support flora and fauna communities	
Water cycle	Water transition through different receptors (atmosphere, terrestrial and aquatic habitats) in all its phases (solid, liquid and gaseous)	

6.4 HUMAN ENVIRONMENT

This section describes the baseline conditions for the valued environmental components (VEC) of the human environment selected for the Project (See Section 5.3).

6.4.1 METHODOLOGICAL CONSIDERATIONS

The human environment baseline description is based on primary and secondary sources. Primary sources were collected through social surveys undertaken by the consultant from February 5 to March 11, 2021 following the methodology presented in Section 5.4.2.7, the socio-economic protocol included in Appendix 5-1, and using tools included in Appendix 5-2. Map 5-2 shows the region and the A8-A8 South Road, as well as the social survey area.

The survey targeted 6 stakeholder groups:

- key informants and chiefs (n=20; 3 females, 17 males);
- livestock owners/caretakers (n=33; 3 females, 30 males);
- households close to the RoW (n=62; 36 females, 26 males);
- shop owners/keepers with physical infrastructures (in a building) located close to the RoW (n=68, 35 females, 33 males);
- street vendors in or around well demarcated markets, with stalls in the RoW, or at transport junctions (n=71; 39 females, 32 males), and
- Maasai pastoralists (n=4 males).

Details about survey participants are found in Section 5.2.4.7 in Tables 5-12 and 5-13 and in Figures 5-14 and 5-15. In summary, 258 persons in total completed the survey. The gender distribution of participants is slightly biased towards males with approximately 55% of male participants versus 45% female. The age distribution of survey participants closely reflects that of the adult population in the three counties traversed by the Project with a slight under-representation of the 18-24 age group and a slight over-representation of the 40-54 age group. However, these differences are to be expected as 4 out 6 questionnaires targeted specific occupations and that youth are the most affected by unemployment (see Section 6.4.6) and that key informants and chiefs were all 40 years old or above.

The ESIA social survey has been useful in providing local-level information that was not available at this scale. This is particularly the case for livelihoods that will most likely be affected by the Project, but for which little information is available in secondary sources – namely street vendors and shops in the vicinity of the highways, and livestock owners/caretakers using the RoW for grazing. While the social surveys targeted people living or using the right of way (RoW) for livelihood activities, it should be noted that this section does not address topics related to the resettlement program or the advancement of the compensation and resettlement program. These aspects were covered in the existing and approved resettlement action plan (KeNHA, 2018).

Secondary sources were examined to complete the socio-economic portrait of the population concerned by the project. These include publications from government agencies such as the Kenya National Bureau of Statistics (KNBS), UN agencies, NGOs, and scientific literature. Previous Environmental and Social Impact Assessments (ESIA) conducted in 2016 and 2018 as well as the 2018 Resettlement Action Plan were consulted.

6.4.2 POPULATION

6.4.2.1 ADMINISTRATIVE STRUCTURE

A new governance structure was created in 2010 by the Kenyan Constitution. This new structure devolves responsibilities to the counties. This devolution of power aims to achieve self-governance by the people and enhance their participation in the State's exercise of power, and in making decisions affecting them. County governors are elected by voters registered in the county. Elections take place on the same day as the general elections, which is every five years on the second Tuesday of August.

Among the devolved functions, county governments manage environmental aspects, as described in Chapter 2, and they are partly responsible for land acquisition, especially communal land. From this new structure, Kenya is composed of 47 counties, which are divided in 295 sub-counties and 1,450 wards. Even if the location and sub-locations are no longer recognized by the Constitution, they remain significant for the population and they constitute a landmark among local governance.

Three counties are directly concerned by the Project: Nakuru, Nyandarua and Kiambu. It should be noted that the right of way runs parallel to the Baringo County for a few kilometers without formally infringing it. Nakuru County is divided into 11 sub-counties which are further divided into 55 wards. Nyandarua County is divided into 5 sub-counties and 25 wards, and Kiambu County is divided into 12 sub-counties and 60 wards. The list of sub-counties and wards concerned by the Project are presented in Table 6-53.

Table 6-53 Counties, sub-counties, and wards in the vicinity of the Project

County	Sub-county	Ward	Highway
Nakuru	Gilgil	Gilgil	A8
		Mbaruk/Eburu	A8
		Malewa West	A8
		Murindat	A8
	Kuresoi North	Kamara	A8
	Molo	Molo	A8
	Naivasha	Biashara	A8 / A8 South
		Hells Gate	A8 / A8 South
		Lake View	A8 / A8 South
		Mai Mahiu	A8 / A8 South
		Naivasha East	A8 / A8 South
		Viwandani	A8 / A8 South
	Nakuru East	Biashara	A8
		Kivumbini	A8
		Menengai	A8
		Nakuru East	A8
	Nakuru West	Kaptembwo	A8
		Kapkures	A8
		Shaabab	A8
		Barut	A8
		London	A8
	Rongai	Menengai West	A8
		Visoi	A8
		Mosio	A8
Kiambu	Lari	Kinale	A8 / A8 South
		Lari/Kirenga	A8 / A8 South
		Kijabe	A8 / A8 South
	Limuru	Bibirioni	A8 / A8 South
		Limuru Central	A8 / A8 South
		Ndeiya	A8 South
		Ngecha Tigoni	A8
Nyandarua	Kinangop	Githabai	A8
		Magumu	A8

6.4.2.2 DEMOGRAPHIC AND SOCIO-ECONOMIC CONDITIONS

DEMOGRAPHY AND LIFE EXPECTANCY

According to the recent census data from 2019, the national population was approximately 47.6 million inhabitants. Population living in rural areas represented two thirds of the total, while those living in urban areas represented the other third. Nationwide, the population density average is 82 persons per square kilometer. The distribution of the population among the counties is highly variable. The core population is distributed in the Central and in the Western part of the country, bordering Uganda.

Kiambu County has a population of 2.4 million and has the highest density of the four counties with 952 people/km^2. Nakuru County has a population of 2.1 million with 290 people/km^2. Nyandarua County is less populated, with 638,289 inhabitants and a density of 194 people/km^2. Baringo County has a population of 666,763 inhabitants and a density of 61 people/km^2. The gender distribution is balanced. The population in Kiambu, Nakuru and Nyandarua counties consists of approximately 50.6% women and 49.4% men.

Table 6-54 Demographic Data for the Counties concerned by the Project

County	Number of households	Men	Women	Total	Land Area (km^2)	Density (people/km^2)
Kiambu	795,241	1,187,146	1,230,454	2,417,735	2,538.6	952
Nakuru	616,046	1,077,272	1,084,835	2,162,202	7,462.4	290
Nyandarua	179,686	315,022	323,247	638,289	3,285.7	194
Kenya	12,143,913	23,548,056	24,014,716	47,564,296	580,876.3	82

Source: Kenya National Bureau of Statistics, 2019.

The Project crosses many towns and settlements. Table 6-55 presents the population figures of the main urban centers along the A8 and A8 South for which data is available.

Table 6-55 Population of Main Urban Centers along the Project

County/ Sub-county	Urban Center	Status	Male	Female	Total	Highway
Nakuru/ Naivasha	Mai Mahiu	Other Center	5,617	5,613	11,230	A8 South
Kiambu/ Limuru	Limuru	Other Center	52,111	52,171	104,282	A8
Nakuru/ Naivasha	Naivasha	Municipality	91,371	90,595	181,966	A8
Nakuru/ Gilgil	Gilgil	Other Center	18,570	16,723	35,293	A8
Nakuru/ Nakuru North	Nakuru	Municipality	155,881	152,109	307,990	A8

Source: Kenya National Bureau of Statistics, 2009.

Interviews conducted with the targeted groups also document the demographic portrait of the Project area. The distribution of respondents shows a slight underrepresentation of women compared to the demographic data. Women represent 45% of the surveyed persons among the targeted groups. They are especially underrepresented among the key informants and chiefs categories, and the herders which is an occupation mainly practiced by men.

In 2018, life expectancy was estimated at 67 years old (UNESCO, UIS, 2020). Kenya has a relatively young population. People aged 0 to 14 years old represent 39% of the population, while those aged 15 to 24 years old represent 20%.

This tendency is also observed in the counties concerned by the Project, although Kiambu County has a higher rate of people aged 25 to 39 years old. Table 6-56 shows the distribution and the proportion of the population by age group for the counties concerned by the Project and the national level.

Table 6-56 Distribution of the population by age group

Age group	County						Kenya	
	Kiambu		Nakuru		Nyandarua			
	n	%	n	%	n	%	n	%
0-14	747,271	31	815,315	38	227,764	36	18,541,982	39
15-24	480,014	20	447,714	21	124,031	19	9,733,531	20
25-39	664,885	28	481,772	22	120,181	19	7,425,274	16
40-54	338,369	14	253,215	12	94,057	15	5,354,097	11
55-69	61,991	3	111,092	5	47,627	7	2,646,294	6
70 +	56,062	2	46,958	2	24,604	4	1,184,309	2
Total	**2,417,600**	**100**	**2,162,107**	**100**	**638,269**	**100**	**47,564,296**	**100**

Source: Kenya National Bureau of Statistics, 2019.

HOUSEHOLD CHARACTERISTICS

In 2019, the national average household size was 3.9 persons. The average household size in the counties concerned by the Project was smaller than the national average household size. Average household sizes in Nyandarua and Nakuru counties were 3.5 persons, and Kiambu's average size was 3.0 persons (KNBS, 2019). The average size of households who are living close to the road (n=62) according to the ESIA social survey is 4.1 persons.

According to the Housing Survey Report 2012-2013 (KNBS, 2013), 72% of the households in Kenya were headed by males, while 28% were headed by females. This proportion was roughly the same in counties concerned by the Project, whereas households headed by females accounted for 24% to 30% of total households (KNBS, 2013). However, the average age of household headship differs in rural and urban areas which is 35-39 years old in rural and peri-urban areas, and 25-29 years old in urban areas (KNBS, 2013). Results from the ESIA social survey show a similar sex distribution than that reported in the Housing Survey Report: 77.4% of surveyed households located close to the highway are headed by males and 22.6% by females. However, the average household headship age is higher at 46.9 years old.

The Housing Survey Report 2012-2013 conducted by KNBS reveals substantial information regarding household characteristics. As presented in Table 6-57, there were more households owning their residence in rural area than in urban spaces. On the other hand, tenants were more populous in urban areas.

Results from the social survey show that 29 of 62 households surveyed own their home, and 28 also own their land. There are also 28 of 68 shops that are owned by their managers, but only four of them are also owners of their business land area.

Table 6-57 Number of Households by Area of Residence

Household	Rural Area	Urban Area	Total
Owner	4,810,531	1,090,189	5,960,507
Renter	680,836	2,599,161	2,807,447
Total	**5,491,367**	**3,689,349**	**8,767,954**

Source: Housing Survey Report 2012-2013, conducted by Kenya National Bureau of Statistics.

ECONOMIC WELL-BEING

The Basic Report on Well-being in Kenya (KNBS, 2018) estimates that 36% of the Kenyan population is living below the overall national poverty line[8]. A gap is observed between rural, peri-urban and core-urban areas. Poverty rates are higher in rural areas. For example, it is estimated that 40% of rural individuals live below the overall national poverty line, and 11% live below the extreme poverty line[9]. These rates are estimated to be respectively 29% and 3% for the core-urban individuals. The accessibility to better employment opportunities and conditions in urban areas can explain this difference. The Housing Survey Report 2012-2013 also highlighted the fact that households living in urban areas have higher monthly incomes, expenditures and savings than rural households, which contributes to improving their global well-being.

Data from the social survey shows that many households living close to the road experiment financial difficulties. Only one of 62 respondents mentioned being financially comfortable all year. Business fluctuation, health issues, and high expenses are the reasons that cause financial difficulties. The period from January to April is identified as the most restrictive. The weather is also mentioned as a contributing factor to financial issues.

EDUCATION

Poverty and education are closely linked. Children evolving in poor conditions have fewer opportunities to attend school, especially in rural areas where distances from the village to the school can be an obstacle. Education leads to better life conditions and can help to pull families and communities out of the cycle of poverty by offering better job opportunities, reducing gender inequalities, or improving their standard of living.

Kenya's national education system is mandatory for children aged 6 to 17 years old. Free primary education was implemented in 2003 by the National Government, and free secondary education is yet to be implemented. This was a matter of debate in the last election in 2017.

The national education system is based on the model 8-4-4; i.e., eight years of primary school, four years of secondary school and four years of higher education. Nevertheless, an education reform has been ongoing since 2015. The new structure will be referred to as a competency-based curriculum (CBC) 2-6-3-3 (KICD, 2021). Under the CBC system, the learners will be undergoing: 2 years in pre-primary (PP1 and PP2); 6 years in primary school (Grades 1 to 6); 3 years in junior secondary school (Grades 7 to 9); 3 years in senior secondary school; and 3 years in university.

An important proportion of the population (60%) aged 15 years old and above attend or have completed their schooling (KNBS, 2019). Table 6-58 presents data from the Kenya Bureau of Statistics on the distribution of the population aged 15 years old and above by school attendance status.

While literacy rate of people aged 15 and above is estimated at 82% at the national level in 2019 (UNESCO UIS, 2020), there remains a gender disparity among adults aged 15 years old and above. In 2018, illiteracy among adults in that age group affected 3,428,491 women and 2,285,968 men. However, this disparity was not observed for the age group from 15 to 24 years old, while 659,401 men and 631,237 women were considered as illiterate (UNESCO UIS, 2020). This tends to show that efforts made by the Kenyan government has encouraged equal school access for men and women.

---

[8] Overall poverty line refers to households and individuals whose monthly adult equivalent total consumption expenditure per person is less than KSh 3,252 in rural and peri-urban areas and less than KSh 5,995 in core-urban areas (KSBN, 2018).

[9] Extreme poverty (or hardcore poverty) line refers to households and individuals whose monthly adult equivalent total consumption expenditure per person is less than KSh 1,954 in rural and peri-urban areas and less than KSh 2,551 in core-urban areas (KSBN, 2018).

Table 6-58 Distribution of Population Age 14 and above by School Attendance Status

County	Art education		Abandoned education *after* completion		Abandoned education *before* completion		Never attended school		Do not know/ Not stated	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Kiambu	150,654	150,224	503,525	507,544	150,671	175,461	15,342	35,277	7,054	5,608
	300,887 (18.01%)		1,011,121 (60.53%)		326,165 (19.53%)		50,624 (3.03%)		12,662 (0.76%)	
Nyandarua	50,500	45,996	98,456	100,036	50,028	54,893	7,164	17,332	988	740
	96,501 (23.51%)		198,494 (48.35%)		104,927 (25.56%)		24,497 (5.97%)		1,728 (0.42%)	
Nakuru	164,008	150,225	328,638	320,615	149,510	171,517	30,483	53,806	8,564	6,328
	314,244 (23.33%)		649,279 (48.21%)		321,048 (28.84%)		84,290 (6.26%)		14,894 (1.11%)	
Kenya	3,511,688	3,200,218	5,880,733	5,626,802	3,154,572	3,666,609	1,890,066	2,655,002	183,229	147,775
	6,712,086(23.13%)		11,507,846 (39.65%)		6,821,427 (23.50%)		4,545,254 (15.66%)		331,028 (1.14%)	

Source: Kenya National Bureau of Statistics, 2019

The education level of the ESIA social survey participants is similar to that of the population in the counties traversed by the Project (Figure 6-68) with approximately 60% of respondents having attended high school or a higher level. Participants were also asked about their literacy and 92% indicated that they could read.

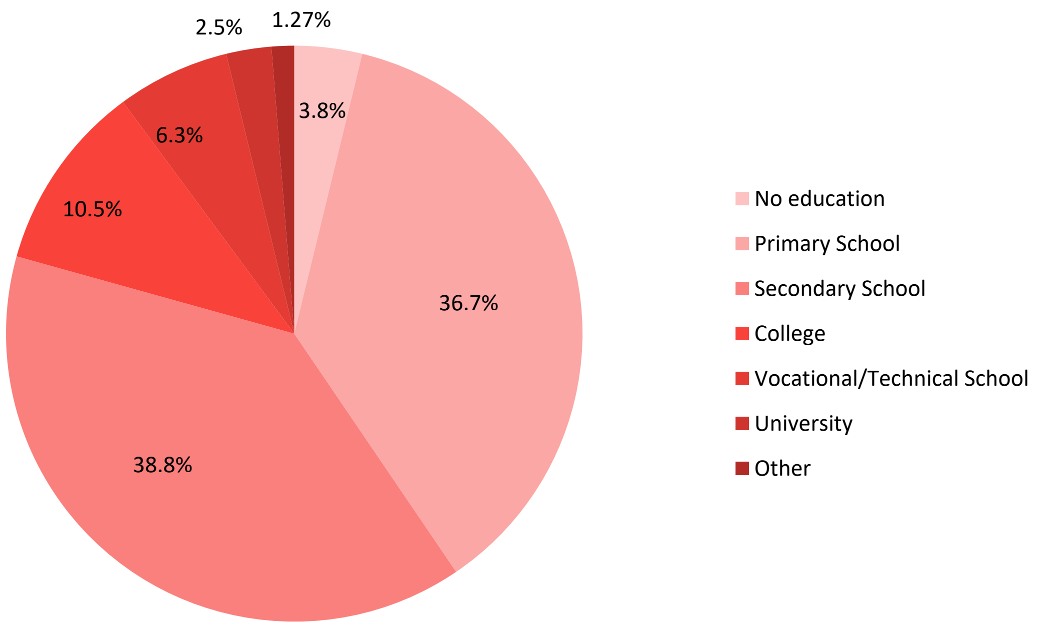


Figure 6-68 Education level of ESIA survey participants (n=238). Key informants and chiefs (n=20) were not asked about their education level, which is why the number of respondents is lower than the total previously reported.

6.4.2.3 ETHNICITY

The only available statistics on ethnicity distribution in Kenya are at the National level. The five most populous ethnic groups in the country are Kikuyu, Luhya, Kalenjin, Luo and Kamba (KNBS, 2019).

According to the ESIA conducted in 2017 (KeNHA 2017), Kiambu and Nyandarua County inhabitants in the Project area belong mostly to Kikuyu ethnic groups while Nakuru County stands out for its multi-ethnic background and its cultural diversity. The results from the ESIA socioeconomic surveys carried out in February and March 2021 paint a similar picture. As illustrated in Figure 6-69, the majority of respondents belong to the Kikuyu ethnic group with a proportion of 71% (169 respondents out of 238[10]). Table 6-59 presents the distribution of respondents by ethnic groups and county of affiliation.

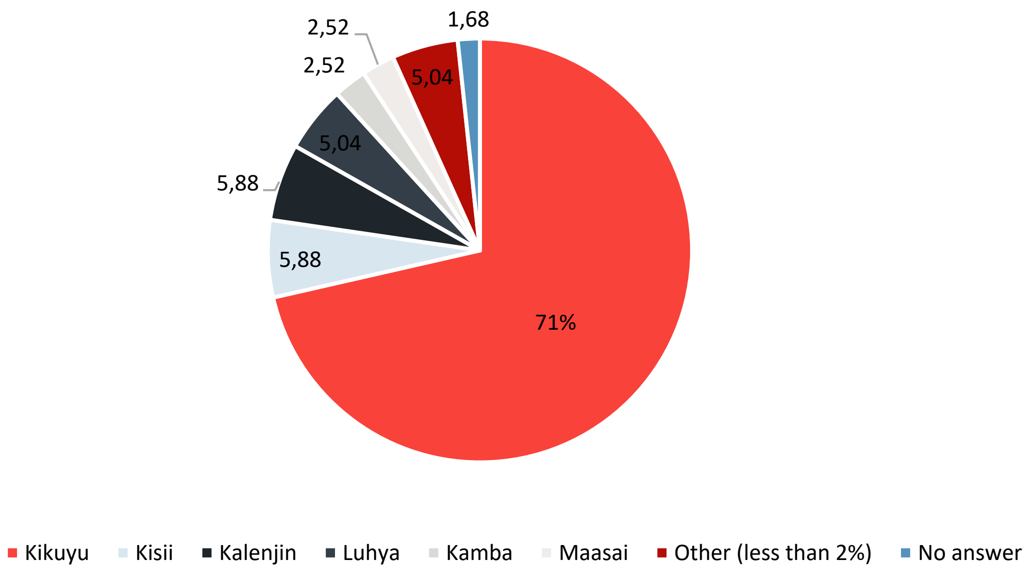


Figure 6-69 Distribution of ESIA social survey participants according to their ethnic group (n=238). Key informants and chiefs (n=20) were not asked about their ethnicity which is why the number of respondents is lower than the total previously reported.

[10] This number of respondents excludes the surveys completed with Key informants or Chiefs which is why this number differs from the total previously presented.

Table 6-59 **Distribution of ESIA social survey participants according to their ethnic group and the county of affiliation (n=238). Key informants and chiefs (n=20) were not asked about their ethnicity which is why the number of respondents is lower than the total previously reported.**

Ethnic Group	COUNTY			Total
	Kiambu	Nakuru	Nyandarua	
Kikuyu	38	122	10	**170**
Kisii/Gusii/Abagusii	1	13	-	**14**
Luhya	-	11	1	**12**
Kalenjin	-	14	-	**14**
Maasai	-	6	-	**6**
Kamba	-	6	-	**6**
Luo	-	4	-	**4**
Meru	-	3	1	**4**
Other (Turkana, Borana, Indian/Arab)	1	3	-	**4**
Prefer not to answer	-	4	-	**4**

6.4.2.4 RELIGION

Christianity is the most practiced religion among Kenyans. Islam is also present, especially in the eastern, northeastern, and coastal part of the country (Cultural Atlas, 2018). A small proportion of Kenyans practice traditional religion based on traditional and indigenous beliefs.

Table 6-60 presents the distribution of the population by religious affiliation. Kiambu, Nyandarua, and Nakuru counties present similar distribution of the population by religion affiliation. Protestantism, Evangelicalism and Catholicism are the three branches of Christianity that are the most practiced in the three counties crossed by the Project.

Table 6-60 **Distribution of population by religious affiliation**

County	Christianity[1]	Islam	Hindu	Traditionists	Other religions	No religion / Atheists	Do not know / Not stated
Kiambu	2,322,520	21,311	1,311	3,117	19,515	30,770	4,290
Nyandarua	610,187	969	33	719	8,766	14,722	606
Nakuru	2,007,377	25,479	1,660	4,568	30,739	67,640	5,204
Kenya (national level)	40,379,079	5,152,194	60,287	318,727	467,083	755,750	80,162

Source: Kenya National Bureau of Statistic, 2019.
Note: 1 Are included in this category: Catholic, Protestant, Evangelical Churches, African Instituted Churches, Orthodox and Other Christian groups.

6.4.3 LAND DEVELOPMENT, USE, AND OCCUPATION

PREAMBLE

In recent decades, Kenya has given limited attention to spatial and physical planning. This has resulted in uncoordinated development and has led to unbalanced development between regions. In order to become a "newly industrializing, middle income country", the Government of Kenya adopted in 2008 a long-term development plan called Kenya Vision 2030. This plan is based on three pillars: economic and macro, social, and political. The first medium-term plan covered the years 2008-2012, and the second the years 2013-2017. The third medium-term plan is currently underway, and it includes four priorities called the Big Four: food security, affordable housing, manufacturing, and affordable healthcare for all.

Some objectives of Kenya Vision 2030 pertain to land use and land tenure. For example, land reforms are planned to address landlessness caused by the 2007 election crisis[11] by providing landowners with compensation and documentation legitimizing land occupation and ownership. Agriculture is also a priority and the Government of Kenya aims to shift from subsistence agriculture to a market-oriented strategy. An Agriculture Land Use Master Plan is part of the strategy to enable efforts and ensure an efficient use of all forms of land. The Kenya Vision 2030 plan has guided the counties to set their priorities for land management and administration.

As part of the biodiversity assessment, a land use and land use change analysis (LULUCA) spanning three reference years (the years 2000, 2010 and 2020) was undertaken (FFMES, 2021a). This analysis provides an overview of the current land use and land cover for the regional assessment area as well as the grounding of the current situation within the context of the land use and land cover since the year 2000. Images were analyzed in 10-year increments to provide a broad outline of the evolution of the landscape over the past 20 years. Figure 6-32 highlights the changes in land use considered to have occurred between 2000 and 2020. The complete LULUCA Report is available in Appendix 6-13.

A brief overview of the land considerations associated with the three counties traversed by the Project is presented hereafter.

KIAMBU COUNTY

Kiambu County is highly densified and there are several urban settlements/centers concentrated along the road, Rironi, Limuru, and Uplands. Although the project road passes mostly through rural/open country land use, it also connects various major towns between Nairobi and Nakuru through to Mau Summit. Agriculture also plays an important role in the county. With an objective to ensure food security, the Kiambu County Government has prepared a County Spatial Plan, which aims to ensure zoning and free land for agriculture. The County Spatial Plan aims to also densify urban areas. This Spatial Plan is a 10-year development plan, and it provides a framework for the level of resource utilization and its potential. It provides guidelines on urban, peri-urban and rural development in the 12 Sub Counties under its jurisdiction (County Government of Kiambu, 2017).

According to the Kiambu County Integrated Development Plan (County Government of Kiambu, 2018), 85% of landowners have official land title deeds. An important number of registered land parcels have, however, been subdivided leading to fragmented pieces of land without land registration.

---

[11] The 2007 general election results were disputed and led to violent protests and confrontation. The post-election violence, which took place from December 2007 to February 2008, resulted in approximately 1,300 dead and caused the displacement of 600,000 people called the Post-Election Victims. Part of the violent events took place in the study area (Nakuru, Naivasha, Central Region) affecting both rural and urban areas. Increased crime (e.g., sexual violence, riot, and burning down properties) occurred due to the lack of order. Violence had an ethnic dimension, due to political allegiances. The Kikuyu were against the Luos, Luhyas and Kalenjins and expelled them from their homes and businesses. Kalenjin groups from the North Rift also attacked and drove out the Kikuyus living there (Commission of Inquiry into Post-Election Violence, 2008; Center for Strategic and International Studies, 2009).

NAKURU COUNTY

Nakuru County counts two major urban centres: Nakuru City and Naivasha. There is also a local university based in Njoro, Egerton University, approximately 20 km away from Nakuru City. Agriculture is predominant in the county and land use is mostly for subsistence farming. There are also some large-scale establishments (horticultural and wheat), livestock (beef and dairy) rearing, and settlements.

A development project, named Soysambu Kingdom City Development is ongoing to the south of the city of Nakuru. A 500-acre parcel of land has been sold to the project proponents adjacent to the eastern side of the A8 Highway at the level of the Soysambu Conservancy. Figure 6-70 shows the proposed master layout of the project. This photo was taken during the second round of consultations, on June 3, 2021 (See Cartographic Atlas for location). Further details about this project are given in Section 6.4.13 – Known and relatively foreseen projects and in Section 8.5 – Cumulative impacts.

Figure 6-70 Photographs of the Soysambu Kingdom City Development Plan

According to the Nakuru County Integrated Development Plan (County Government of Nakuru, 2018), 72.5% of landowners have official land title deeds, and 20% are landless people which include slum dwellers or informal settlers and Internally Displaced Persons (IDPs). The latter are people victims of forced migration resulting from cultural inter-clan conflicts, social/communal tensions, politically influenced violence, and Government evictions (iDMC, 2012). Nakuru County was especially affected by violent clashes following the contested 2007-2008 elections. Over 30,000 IDPs were settled in 43 government-established "transit camps" and, unfortunately, the majority are still living in such camps (iDMC, 2012; 2020). These camps are located in Molo, Gilgil, Naivasha and Rongai sub-counties (iDMC, 2020) which are all traversed by the Project. Another important cause of displacement in Nakuru was the forced evictions of forest dwellers (mostly Ogiek People – see Section 6.4.8.2) from the Mau Forest (County Government of Nakuru, 2018). The lack of reliable data on IDPs and their location, including those who have returned to their places of origin or resettled elsewhere, remains a major challenge in Kenya (iDMC, 2012). Anecdotal data, including EISIA surveys conducted in a locality of IDPs, suggest there may be several IDP camps in the Project area, but their exact number and locations are difficult to ascertain. With this being said, because the Project will not require additional resettlement, IDPs will experience the same impacts as the general population.

NYANDARUA COUNTY

Nyandarua County is characterised by its agricultural productivity. Subsistence farming is the principal activity practiced by the households. The county is facing challenges such as road network efficiency and adequate distribution of electricity and water (Wikipedia, 2021). Several road projects were announced by Nyandarua County, such as the Ongoing County Rural Roads Construction Programme, and addressing road network issues faced among the county (Nyandarua County Government, 2021).

The Magumu Ward Market and Logistic Center (Residential and Commercial) is a development project initiated by UN-Habitats and Cities Alliance aiming to upgrade Nyandarua's agroeconomy. The space dedicated to this project is approximately 70.38 acres. It is located at CH 29+900 to 30+100, but no construction schedule is currently available. Additional information about this project is available in Section 6.4.13 – Known and relatively foreseen projects and in Section 8.5 – Cumulative impacts.

According to the Nyandarua County Integrated Development Plan (County Government of Nyandarua, 2018), 90% of landowners have official land title deeds. Landless people are present, including Post Election Victims that have settled in camps for IDPs. As previously mentioned, there is a dearth of reliable data on the number and location of IDPs in the country. However, if IDPs are directly affected by the Project, the impacts will not differ from those experienced by the general population.

6.4.4 COMMUNITY WELLBEING AND SAFETY

PREAMBLE

Well-being is an overarching concept that encompasses physical (e.g., food and shelter, health and safety), relational (e.g., community relations and cohesion, ability to participate in decision-making), and subjective aspects (e.g., the degree of choice in one's situation, sense of identity, culture) (McGregor, 2008). As such, it overlaps to a variable degree with all other human environment VECs. In this section, we focus on mobility and health and safety considerations as living conditions are covered in Section 6.4.5 and livelihoods and economic activities are covered in Section 6.4.6.

MOBILITY

The implementation of highways A8 and A8 South have improved the mobility of the local population as well as general interregional access. They have also given local communities a national and a global advantage by linking them to various cities and towns, facilitating access to goods and services and facilitating commutes to work in the area and to major cities and towns such as Nairobi and Nakuru. The highways have stimulated the economy by attracting large companies such as Simba Cement who benefits from proximity to a highway. Local businesses also benefit from a reliable road system which improved the flow of manufactured goods and services, access to energy and raw materials, and employee transportation and movement. In short, local communities and businesses have come to depend on the highways for their transportation needs.

Markets have developed at road junctions and peri-urban areas, where people can stop and purchase food and goods. This leads to important traffic congestion. Truck stops are also present, with shops, hotels, bars and restaurants. Street vendors sell goods such as vegetables, live geese, furniture, animal products and plants. In these areas, the RoW is less demarcated and more likely to be encroached. The first houses are often built right at the edge of the RoW.

In urban areas, the highway is usually an important feature. Motorcycles and cars add to the traffic created by trucks and pedestrians that are using the side of the roads. Nuisances from the traffic are noticeable. Nakuru City is the largest city in the social study area, and a sensitive area given that the road crosses the city center. Traffic jams are common. During the day, people residing outside Nakuru City come to either offer labour services or access services in the city.

A number of informal roads run parallel to the highways, mainly located along villages crossed by the highways (see Project Atlas for location and patterns). These are particularly important for pedestrians, non-motorised transport and for community members at large. These roads play a significant role in local mobility as household members participating in the ESIA social survey largely depend on non-motorised transport (74.19%, n=62) as illustrated in Figure 6-71.

Figure 6-71 Means of transportation used by household members close to the RoW participating in the ESIA social survey (n=62)

HEALTH AND SAFETY

The presence of the A8 and A8 South is vital for communities in the vicinity of the Project. The highways have stimulated the economy and improved local communities' quality of life. In addition to improving the flow of and access to goods and services, the highways contribute to local livelihoods by offering an outlet to sell products along the road or pasture for livestock. On the other hand, highways are also leading to nuisance and safety risks for communities.

The Route Hazard Mapping Driver's Handbook (2017), published by the National Transport and Safety Authority (NTSA), identified black spots and sections of the road with a high number of accidents. In this handbook, project segments where low visibility are identified as an accident factor. These sections of A8 and A8-South highways are listed in Table 6-61. Other main road hazards listed are due to inadequate or non-existent road signs, poor visibility (wet season, bends, trees, etc.), careless driving or overtaking, excessive speed, and drunk driving. Also undesignated bus stops, heavy pedestrian crossings or pedestrians crossing in an unsafe manner contributed to road accidents. These hazards harm and cause death to road users and pedestrians.

Table 6-61 Project segments where low visibility is identified as an accident factor in NTSA Handbook

Section	Black Spot Name	Chainage (approx.)	Accident Causes	Accident Occurrences	NTSA Recommendations
1	Kimende Forest	20+300 - 21	– no road signs. – foggy conditions in wet season. – speeding motorists – poor visibility during wet season	throughout the week but mostly during the night and during wet season	Install appropriate road signage
2	Delamare B (Near KCC market)	64+300 - 65	– speeding motorists – poor visibility at the bend caused by the tall acacia trees on the roadside	throughout the week, during the day and night, and also mostly during wet seasons	– Mark the road. – Repair the damaged road section
4	Ngata Bridge - Sobea	131+400 - 140+200	– speeding motorists – careless overtaking on sharp bends – poor visibility due to misty conditions in the wet season	throughout the week but mostly at night and during wet seasons	Install appropriate signage for hazards and speed limit.
4	Salgaa - GSU Cam	152+300 – 173+300	– Speeding motorists – careless overtaking – poor visibility due to misty conditions	throughout the week but mostly night and during both wet and dry seasons	– Install appropriate signage showing hazards and speed limit. – Mark the speed bumps with reflectors for visibility at night and in wet seasons. – Repaint the speed bumps. – Designate pedestrian crossing points
4	Jogoo Area - Mau Summit	173+200 – 174+200	– unsafe pedestrian crossing speeding motorists careless overtaking poor visibility	throughout the week but mostly at night and equally during wet and dry seasons	– Install appropriate signage for hazards and speed limit. – Designate pedestrian crossing points.

During the second round of consultations held in May 2021, stakeholders also identified accident black spots for the A8 and A8 South highways. These safety hazards are listed in the meeting minutes presented in the Appendix 7-4.

Field observations conducted in 2019 revealed that pedestrians regularly use cattle underpasses, vehicle underpasses, and box culverts along the road (see Figure 6-72a and b). Conversely, where safe crossing locations are unavailable or are not near key sites (i.e., shopping centres, bus stops, etc.), pedestrians were often observed crossing the highways at non-designated crossing locations, in many cases at risk of serious injury or death. The ESIA social survey confirmed these observations (Figure 6-73). The great majority of participating household members living close to the highways (98,39%, n=62) indicated that they will cross the road without using specific infrastructure or crossing, with only two individuals reporting also using dedicated crossings when available. Only one individual reported crossing the road by only using dedicated crossings. The main reason given by surveyed household members to cross the road is to access town services (Figure 6-74).

a) b)

Source: WSP, 2019. Chainage approx. 35+300

Figure 6-72 Overview of Existing Underpasses

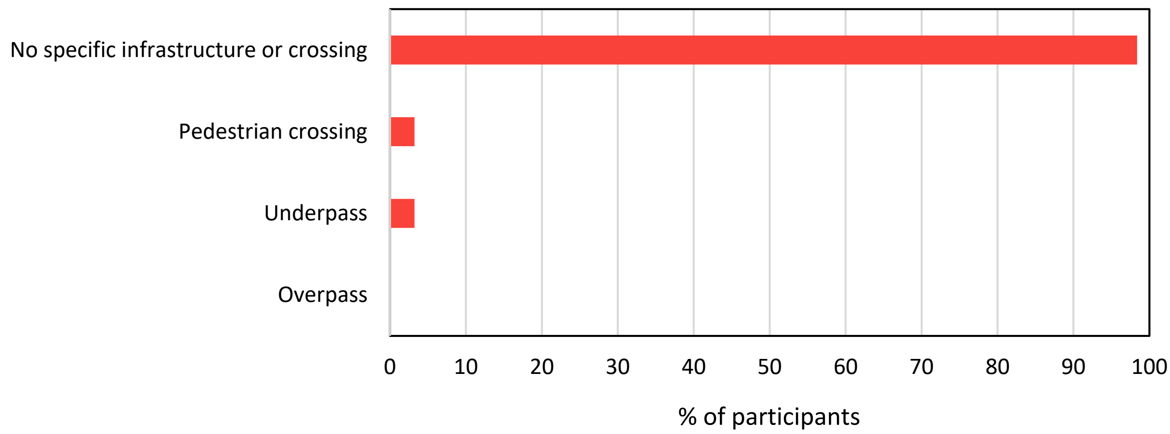


Figure 6-73 Means used to cross the highways by household members close to the RoW participating in the ESIA social survey (n = 62; multiple answers allowed).

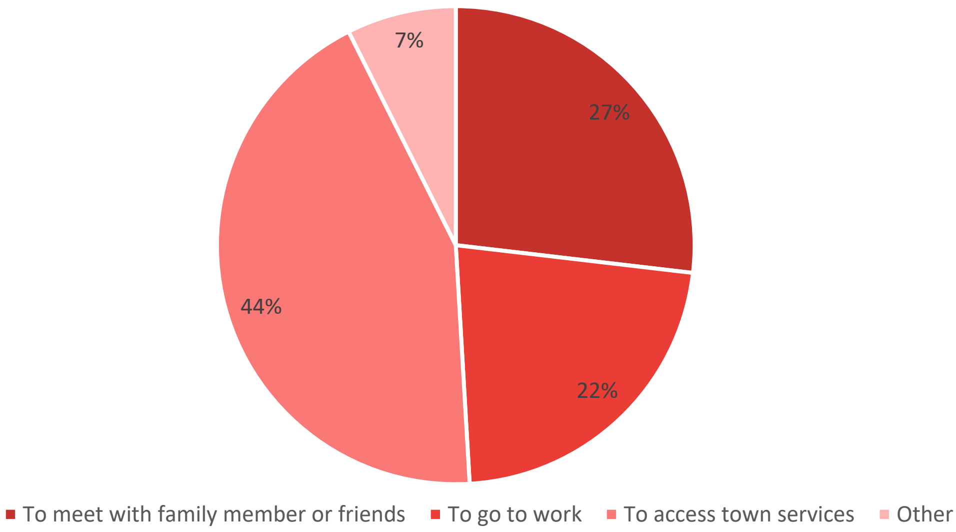


Figure 6-74 **Reasons to cross the highways of household members close to the RoW participating in the ESIA social survey (n = 62; multiple answers allowed).**

Livestock owners and pastoralists use the land adjacent to the highway for grazing on both sides of the road for most of the Project's extent (see Figure 6-77a and b). Herders have been observed using all crossing types with livestock. In areas without livestock crossings, crossing is done during periods of reduced traffic. Although the majority of herders reported rarely or never crossing the highways with their herds, over a third indicated doing so often (16%) or always (19%) (Figure 6-75). The risk of accidents posed by this situation was observed during the mission held in 2019 and was confirmed by the ESIA social survey as 28% of participating livestock owners reported loss of at least one animal due to vehicle collision (Figure 6-76). Road safety hazard remains important, especially as 56% of herders surveyed depend on their livestock for income (see Section 6.4.6 for more details on livelihoods).

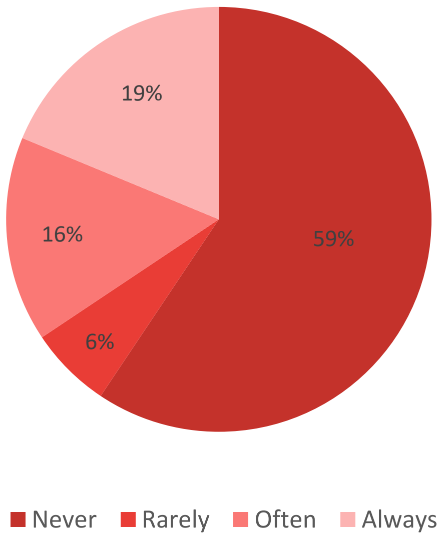


Figure 6-75 **Frequency of highway crossing with livestock of herders participating in the ESIA social survey (n = 32)**

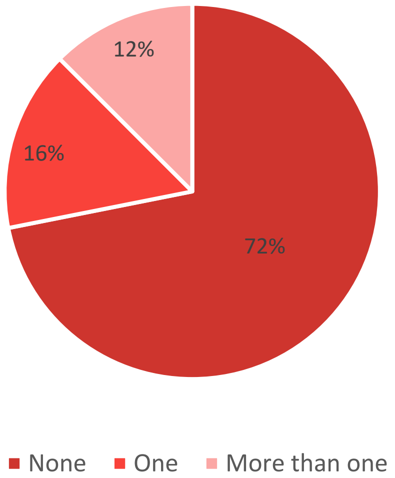


Figure 6-76 Loss of livestock due to a vehicle collision of herders participating in the ESIA social survey (n = 32)

a) b)

Source: WSP, 2019. Chainage approx. 153+800

Figure 6-77 Grazing of land adjacent to the A8 and A8 South highways

Street vendors are taking advantage of the passage of the highways for their business. The ESIA social survey reached 71 street vendors, of which 15 (21%) are moving vendors (i.e., they follow the pace of traffic to sell their goods) and 56 (79%) use stalls to sell their products. Details on the significance of this livelihood are provided in Section 6.4.6. The majority of surveyed street vendors were settled at the entrance or the exit of a town (50.70%), or directly in town (43.66%) (Figure 6-78). Approximately 42% of the surveyed street vendors reported crossing the highways to sell their products (Figure 6-79) and the majority (88.73%) stated that traffic is a safety hazard. In fact, 17 respondents (23.94%) personally know an individual who died or was injured in a collision with a vehicle.

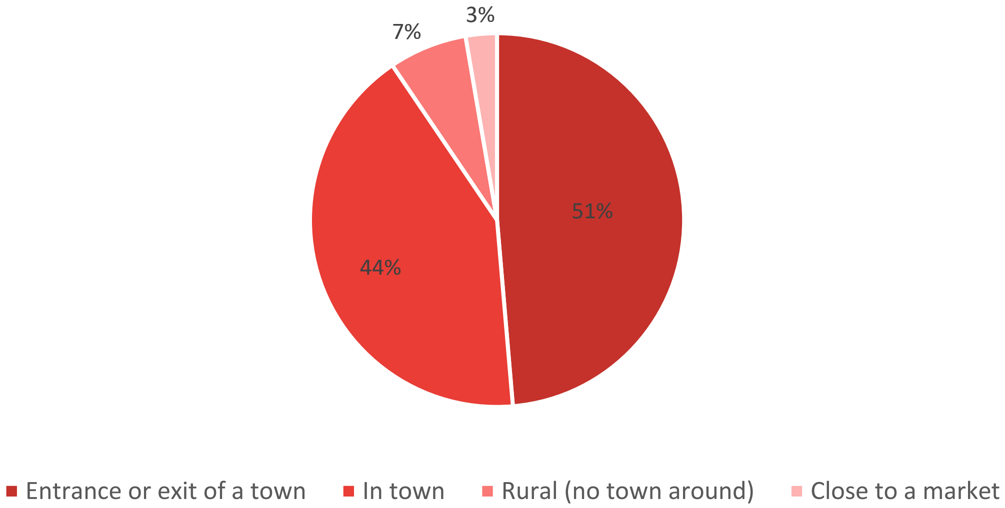


Figure 6-78 **Location of street vendors participating in the ESIA social survey (n = 71)**

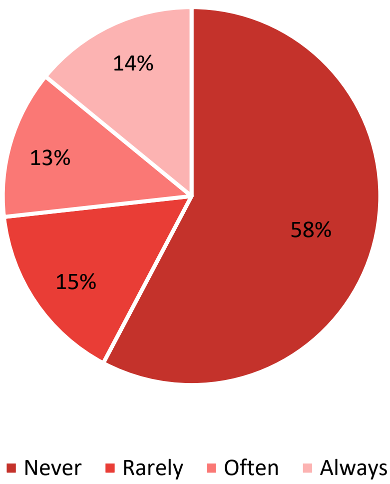


Figure 6-79 **Frequency of highway crossing of street vendors participating in the ESIA social survey (n = 71)**

6.4.5 LIVING CONDITIONS, SOCIAL AMENITIES AND COMMUNITY ASSETS

LIVING CONDITIONS

The Kenya Population and Housing Census published in 2019 by the Kenya National Bureau of Statistics (KNBS) reports statistics at the national level about housing / living conditions and amenities:

- 61.3% of total households own the main dwelling unit they occupy;
- Iron sheet is the main roofing material, walls are mainly built with mud and cow dung, concrete/cement is the predominant material used for the floor;
- Piped water is the main source of drinking water for 34.2% of households;
- Covered pit latrines are used by 51.2% of households as a sanitation facility;
- Burning in the open is used by 27.1% of households to dispose of solid waste. It is the most common method of waste disposal;
- Firewood is the most common type of cooking fuel (55.1% of households) while electricity is used most for lighting (50.4% of households).

In the Project's right-of-way, the settlement pattern is mainly linear, following roads. At important market locations and truck stops, settlements are more nucleated, with houses clustered around the markets or truck stops.

According to key informants and chiefs participating in the ESIA social survey, all 20 locations and sub-locations surveyed are connected to the electrical network. Sewage connection is implemented only in a few locations. Access to clean water is provided in most of the locations and sub-locations surveyed. Domestic waste collection system is implemented in 13 of the 20 locations. Table 6-62 shows the distribution according to the counties and the services mentioned above.

Table 6-62 Accessibility to public services in locations covered by the ESIA social survey by County according to key informants and chiefs

County	Connected to the electrical network	Connected to sewage	Access to clean water	Domestic waste collection system
Kiambu	5	2	5	3
Nakuru	14	7	12	9
Nyandarua	1	0	1	1
Total	**20**	**9**	**18**	**13**

Source: WSP, 2021

Information gathered during the ESIA social survey provides a portrait of the surveyed households' living conditions (n=62):

- The majority of households surveyed are connected to the electrical grid (87.1%). Four households use solar energy for lighting, two use candles and two others use kerosene;
- City water (pipes) is the principal source of water for 31 households. Other means used by the households interviewed to get water are wells, bottled water purchases, purchasing it from a neighbour or a vendor, rainwater collection, or from a Community Based Organization (see Figure 6-80);.
- The majority of respondents have personal latrines for toilets (57 respondents of 62);
- Masonry is the main material used for walls of the surveyed households' residence (43 respondents of 62). Iron sheet (8 of 62), wood (6 of 62), and mud (4 of 62) are other materials used for walls. Corrugated iron sheet is the most common material used for the roof of the surveyed households' residence (60 respondents of 62);
- The average dimension of the surveyed households' residence is 9.3 metres long and 7.7 meters wide;
- A total of 29 surveyed households own their house and their land. Among the other respondents, 27 are renting their house and their land, 4 of them are not paying any rent and 2 abstained from responding.

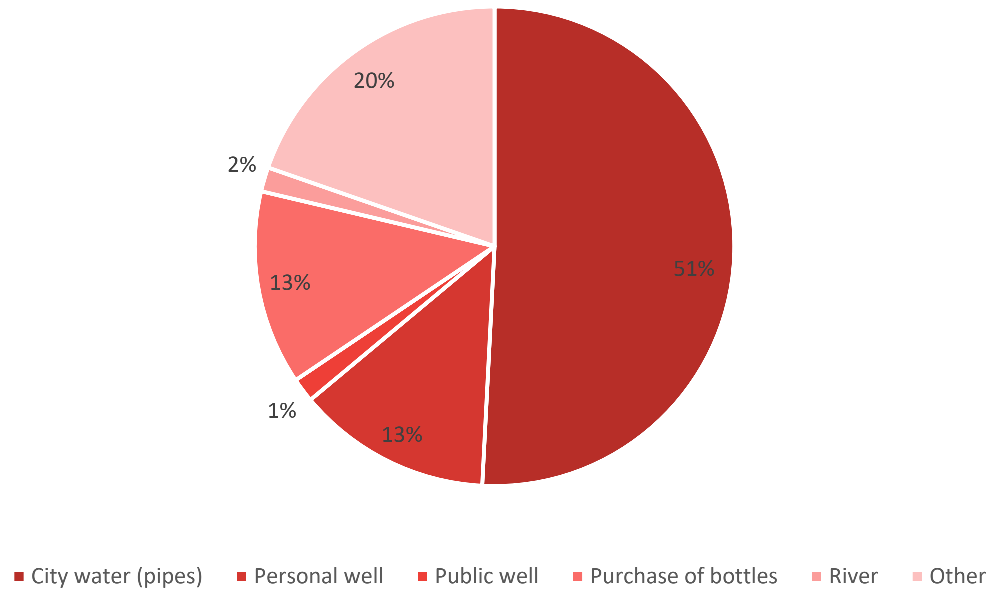


Figure 6-80 Primary source of drinking water for household members close to the ROW participating in the ESIA social survey (n=62)

SOCIAL AMENITIES AND COMMUNITY ASSETS

Key informants and chiefs participating in the ESIA social survey listed some assets available in their communities. Location of social amenities and community assets are identified in the Project Cartographic Atlas.

Among the 20 locations surveyed, only 2 schools (10%) are located right beside the RoW (one in Mai Mahiu and the other in Ngata location). Schools are mostly located near the RoW (around 200 meters) (65%), whereas 5 locations (25%) have a school far from the RoW (500 meters). Out of the 20 locations visited during the ESIA social survey, there was only one health center located right beside the RoW in Mai Mahiu. The majority is far from the RoW (60%). Other sensitive areas such as churches, places of worship and public places are mostly located near the RoW (around 200 meters) (70%). Almost all locations benefit from a bus stop along the road (80%).

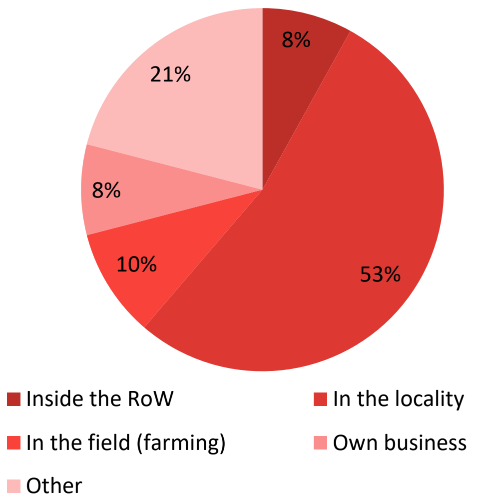
6.4.6 LIVELIHOOD STRATEGIES AND ECONOMIC ACTIVITIES

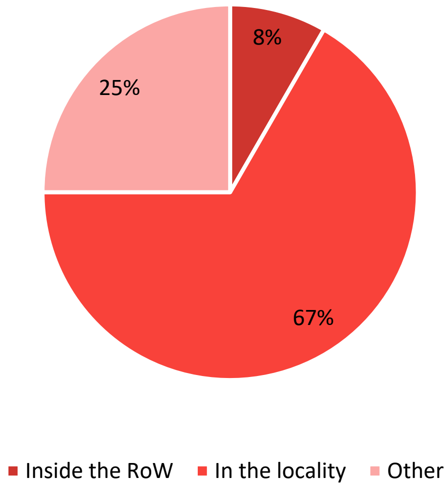
ECONOMY AND EMPLOYMENT

The economy and employment rates in Kenya have dramatically increased in recent years (Nicolle & Guillaume, 2017). In the study area, the highways have stimulated growth and development, allowed people to develop local skills and labour, and facilitated movements of goods and services. Nakuru City also has a big wholesale market which attracts traders from all over the country. However, the increase in available jobs has not been sufficient to accommodate the number of Kenyans that enter the labour force each year and unemployment remains a major issue, especially among the youth (Nicolle & Guillaume, 2017). Unemployment rates are estimated at 60% in Kiambu County (County Government of Kiambu, 2018), 22.9% in Nakuru County (County Government of Nakuru, 2018), and 11.4% in Nyandarua (County Government of Nyandarua, 2018). Population and (un)employment statistics must be interpreted with caution as their general reliability and accuracy have been questioned (Nicolle & Guillaume, 2017).

Unemployment is more prevalent among 18 to 25 year old’s who have significantly higher unemployment rates than adults throughout the country (Nicolle & Guillaume, 2017). Gender and location also play a role. Young women are more affected by unemployment than young men, and youth unemployment rates are higher in urban areas than rural areas (however, the absolute number of unemployed youths is higher in rural areas) (Nicolle & Guillaume, 2017). The information provided by key information and chiefs during the ESIA social survey (n=20) confirm these trends. All participants considered youth unemployment to be an issue except for two participants from Navaisha, Nyandarua County and one from Kimende Township in Kiambu County.

People living along the highways have different livelihood strategies depending on their location. In rural areas, livelihoods are mainly land-based while in peri-urban and urban settings, casual labour and business-based livelihoods are more common. Diversified livelihoods are common and 19% of household members near the highways participating in the ESIA social survey also indicated engaging in a secondary livelihood activity. While most households surveyed reported working in the locality or at their own business, the use of the RoW as a place of work for herders and street vendors is a salient socioeconomic feature of the study area (Figure 6-81) (discussed in more detail below).





a) Main livelihood activity

b) Secondary livelihood activity

Figure 6-81 Location of livelihood activities of household members close to the RoW participating in the ESIA social survey (n = 62)

LAND-BASED LIVELIHOOD ACTIVITIES

AGRICULTURE

Agriculture is a central element of peoples' livelihoods in the counties and sub-counties concerned by the Project. It is key in achieving food security in the region as both the land area and the number of households dedicated to subsistence farming surpasses that of commercial farming (with the exception of two sub-counties, Kinangop and Gilgil, where the land area for commercial farming is slightly greater) (Table 6-63). Indeed, nearly 75% of agricultural land is dedicated to subsistence in both the counties and the sub-counties directly concerned by the project (KNBS, 2019).

Agriculture in the study area consists mainly of two subsectors: Industrial (cash) crops and horticulture crops (food and flower). The distribution of the type of crops grown by households in the counties and sub-counties directly concerned by the Project are presented in Tables 6-64 and 6-65. The main cash crops in the three concerned counties are tea, coffee and avocado. Households in the sub-counties concerned by the project also farm a wide range of other food crops, the most important ones being maize, potatoes, beans, cabbages, and kale (KNBS, 2019).

Commercial agriculture is the leading economic sector in terms of employment and income for the counties of Kiambu and Nyandarua, contributing about 17% and 73% to household incomes respectively (County Government of Kiambu, 2018; County Government of Nyandarua, 2018).

- In Nakuru County, the majority of wage earners are mainly in the flower, tea and coffee farms (County Government of Nakuru, 2018);
- In Kiambu County, coffee and tea are grown especially in the upper and lower highlands of the county. They are the leading sectors hiring labour force, with each estate employing between 100 and 500 workers (County Government of Kiambu, 2018). There are 21 co-operative societies which assist in marketing coffee and macadamia which is an upcoming crop in the county (County Government of Kiambu, 2018);
- In Nyandarua County, agriculture employs about 50% of the population with most people employed in the family agricultural holding (County Government of Nyandarua, 2018). The main cash crops produced are wheat (112,400MT), coffee (15,900 MT), tea (11,495MT), and pyrethrum (260MT).

Flower culture is also a common agricultural product in Kiambu, Nakuru and Nyandarua (County Government of Kiambu, 2018; County Government of Nakuru, 2018; County Government of Nyandarua, 2018). From 1960 to the late 1990s, Kenya was the world's leading producer of pyrethrum (dried flowers), supplying over 90% of the world's demand (Monda, 2014). Production then drastically declined, and Kenya currently produces less than 2% of world pyrethrum (Monda, 2014). However, this industrial crop is now the focus of major revival programs, especially in Nakuru and Nyandarua counties (County Government of Nakuru, 2018; County Government of Nyandarua, 2018). Production of pyrethrum is low in Kiambu County after farmers shifted to other crops, but there are still 3 co-operative societies which assist in marketing pyrethrum (County Government of Kiambu, 2018). In the past, floriculture in Kiambu County was practiced in Lari and Limuru sub-counties, but farmers from other sub-counties including Thika, Juja and Ruiru are now growing summer flowers for export (County Government of Kiambu, 2018). Cut flower farming is also practised in Nyandarua County with flower farms in Ol'Joro Orok, Ol'Kalou and Kipipiri (County Government of Nyandarua, 2018).

Table 6-63 Agriculture in counties and sub-counties concerned by the Project

County subcounty	Agricultural Land					Farming Households				
	Subsistence		Commercial		Total	Subsistence		Commercial		Total
	Hectare	%	Hectare	%	Hectare	Number	%	Number	%	Number
Kiambu	**66,642**	**73.87**	**22,247**	**24.66**	**90,218**	**173,960**	**81.27**	**35,169**	**16.43**	**214,052**
Kikuyu	4,545	83.56	809	14.87	5,439	15,864	89.66	1,551	8.77	17,693
Lari	7,006	64.85	3,711	34.35	10,803	18,033	70.44	7,069	27.61	25,602
Limuru	5,814	71.93	2,169	26.83	8,083	16,560	86.24	2,201	11.46	19,202
Nyandarua	**69,496**	**71.46**	**27,102**	**27.87**	**97,254**	**107,997**	**76.67**	**31,613**	**22.44**	**140,854**
Kinangop	6,134	47.59	6,630	51.44	12,888	13,116	55.49	10,220	43.24	23,636
Nakuru	**270,779**	**75.64**	**83,022**	**23.19**	**357,968**	**241,174**	**85.02**	**37,725**	**13.30**	**283,652**
Gilgil	17,495	38.97	27,162	60.50	44,897	23,996	87.98	2,821	10.34	27,273
Naivasha	20,669	74.12	6,817	24.45	27,884	26,981	81.61	5,336	16.14	33,061
Nakuru East	10,851	62.91	5,044	29.24	17,248	6,504	73.28	1,979	22.30	8,876
Nakuru West	9,274	70.78	3,754	28.65	13,103	7,053	80.59	1,474	16.84	8,752
Rongai	21,641	80.99	4,804	17.98	26,720	26,934	91.09	2,230	7.54	29,568
Kuresoi North	23611	74.70	7,622	24.11	31,609	27,360	82.43	5,389	16.24	33,190
Total Counties	**406,917**	**74.60**	**132,371**	**24.27**	**545,440**	**523,131**	**81.92**	**104,507**	**16.37**	**638,558**
Total Sub-Counties	127,040	63.94	68,522	34.49	198,674	182,401	80.40	40,270	17.75	226,853

Source: Kenya National Bureau of Statistic, 2019.

Table 6-64 Number of households growing permanent crops by type in the counties concerned by the Project

County	Total farming	Tea	Coffee	Avocado	Citrus	Mango	Macadamia
Kiambu	214,052	20,958	31,152	31,392	2,160	9,855	11,748
Nyandarua	140,854	-	-	2,892	1,580	-	-
Nakuru	283,652	10,041	-	20,209	4,332	6,560	-

Source: Kenya National Bureau of Statistic, 2019.

Table 6-65 Number of households growing other crops by type in counties and sub-counties concerned by the Project

County Subcounty	**Total farming**	**Maize**	**Sorghum**	**Potato**	**Bean**	**Cassava**	**Sweet Potato**	**Wheat**	**Green gram**	**Banana**	**Cabbage**	**Tomato**	**Onion**	**Millet**	**Kale**	**Sugarcane**
Kiambu	**214,052**	**144,125**	**-**	**108,457**	**120,887**	**9,816**	**18,416**	**-**	**-**	**74,810**	**41,121**	**17,996**	**28,684**	**-**	**103,524**	**19,981**
Kikuyu	17,693	13,449	-	12,438	12,733	338	782	-	-	3,174	2,178	1,259	2,421	-	8,210	1,054
Lari	25,602	16,282	-	19,240	12,158	305	1,089	-	-	4,896	12,078	1,578	4,917	-	20,622	780
Limuru	19,202	14,312	-	14,217	13,413	179	540	-	-	1,617	4,908	1,344	3,755	-	11,999	567
Nyandarua	**140,854**	**114,595**	**1,793**	**119,679**	**59,481**	**1,038**	**3,788**	**2,719**	**4,241**	**3,956**	**64,651**	**3,099**	**43,964**	**-**	**74,358**	**3,636**
Kinangop	23,636	13,568	35	20,282	3,784	40	84	85	971	83	15,861	118	4,652	-	12,808	80
Nakuru	**283,652**	**243,535**	**9,613**	**140,998**	**168,112**	**6,953**	**16,130**	**6,021**	**7,919**	**32,257**	**41,413**	**14,871**	**65,022**	**13,563**	**114,162**	**11,097**
Gilgil	27,273	23,695	982	15,359	21,481	1,034	2,431	329	815	3,010	3,034	1,920	6,023	842	9,169	1,790
Molo	26,641	23,531	556	17,167	13,884	231	514	230	985	1,826	5,370	789	7,030	995	11,244	429
Naivasha	33,061	23,332	321	17,061	20,884	353	1,555	283	745	1,548	4,381	1,850	9,444	213	12,924	978
Nakuru East	8,876	5,637	157	2,520	4,448	167	411	171	210	653	739	690	1,023	102	2,640	277
Nakuru West	8,752	6,573	434	1,347	5,256	148	420	217	125	705	582	632	845	625	2,728	234
Rongai	29,568	26,386	3,207	4,022	21,725	1,250	2,671	445	427	4,627	1,533	2,292	3,777	3,271	9,197	1,043
Kuresoi North	33,190	30,713	455	23,145	10,963	80	349	1,679	1,224	1,441	7,513	1,006	10,380	1,608	16,861	269

Source: Kenya National Bureau of Statistic, 2019.

LIVESTOCK

Livestock rearing is an important activity in all counties and sub-counties concerned by the Project (Table 6-63) (Census 2019). The main livestock types in the Project area are dairy cattle, indigenous chicken, and sheep. Indigenous cattle are also an important livestock in Nakuru County (KNBS, 2019). While still a relatively marginal activity, apiculture (beekeeping) is becoming increasingly popular in rural areas, especially in Kiambu and Nakuru Counties (County Government of Kiambu, 2018; County Government of Nakuru, 2018).

The dairy industry is the leading enterprise in Kiambu County with nearly 70% of the farm families keeping an average of 2-3 cows under zero grazing systems. Milk is the major livestock product in Kiambu County and currently leading in Kenya (County Government of Kiambu, 2018). The presence of Wangige wholesale market and Gitaru market for eggs, and Ndumbu-ini slaughterhouse for pigs provide market outlets that favour local enterprises (County Government of Kiambu, 2018).

In Nyandarua, livestock farming is the second major employment sector after agriculture with approximately 65.1% of households rearing livestock, mostly cattle and sheep (County Government of Nyandarua, 2018). Cooling and pasteurizing facilities exist in Kinangop Sub-County and Ol'Kalou, though privately owned. Other existing facilities pertaining to livestock outputs are milk coolers owned by various dairy co-operative societies (County Government of Nyandarua, 2018).

Livestock production is one of the major economic activities undertaken in Nakuru County. Dairy and meat production are the main income earners. Milk production has been boosted by the availability of major milk processing companies that purchase milk directly from the farmers' co-operatives. Nakuru County is boosting this sector by constructing milk cooling plants for farmer groups across the county. Additionally, this continues to improve the quality of meat products through the construction of modern slaughter slabs, meat inspection, disease surveillance and control (County Government of Nakuru, 2018).

Ranching is limited in the study area. There are no ranches in Kiambu County. Nyandarua County holds only one ranch in Kipipiri sub-county which is run by the Kenyan Agricultural and Livestock Research Organization (KALRO); it occupies 300 ha and mainly rears sheep and cattle (County Government of Nyandarua, 2018). There are 17 ranches in Nakuru County. Five are company ranches while 12 are private. Most ranchers keep dairy and beef cattle, goats and sheep with milk, meat, hide and skin, wool and mutton as their main products (County Government of Nakuru, 2018).

As mentioned in Section 6.3.3.2 above, livestock herders will take advantage of the available pastureland in the RoW for grazing. They include owners and caretakers of mostly cattle and sheep, and other animals such as geese, goats, and donkeys. According to our survey (n=32), the great majority of herders are male (91%), and most are aged 18-35 (60% of respondents) or over 55 years old (34%). Herding is thus a significant economic activity for youth in rural areas who are generally more affected by unemployment. Surveyed herders also tend to live close to the highway (59% less than a kilometer and 38% 1-5 km from the highway). In most cases, they reported that livestock herding is their only or main source of income (66% of respondents). The RoW is significant for this activity as 47% of respondents rely solely on the RoW for grazing, and 69% reported using the RoW for grazing 6 hours or more per day. As mentioned in Section 6.4.4, loss of livestock due to vehicle collisions is common and thus significantly affects this livelihood.

Table 6-66 Number of households rearing livestock in counties and sub-counties concerned by the Project

County Subcounty	**Total Farming**	**Exotic Cattle - Dairy**	**Exotic Cattle - Beef**	**Indigenous Cattle**	**Sheep**	**Goat**	**Camel**	**Donkey**	**Pig**	**Indigenous Chicken**	**Exotic Chicken - Layer**	**Exotic Chicken - Broiler**	**Beehive**	**Rabbit**
Kiambu	214,052	67,014	9,559	10,511	30,251	21,854	-	3,891	9,731	92,248	14,138	4,156	1,535	7,577
Kikuyu	17,693	3,771	479	575	2,447	1,896	-	957	1,336	8,393	1,066	321	141	416
Lari	25,602	11,369	1,636	1,547	6,324	1,007	-	988	144	11,012	1,646	387	178	1,110
Limuru	19,202	5,747	745	648	3,982	1,168	-	1,106	536	7,653	1,238	247	127	471
Nyandarua	140,854	62,978	9,637	23,151	53,860	12,196	-	6,668	512	80,850	7,065	1,996	2,442	9,263
Kinangop	23,636	13,083	1,741	1,297	8,503	688	-	635	37	11,473	1,371	325	194	1,529
Nakuru	283,652	52,739	6,781	67,473	76,438	33,712	61	15,750	1,700	140,607	10,631	3,421	5,935	7,001
Gilgil	27,273	2,303	452	7,735	8,013	4,912	2	1,931	165	15,496	924	318	506	849
Naivasha	26,641	6,358	762	4,071	7,749	1,712	6	1,227	47	12,251	1,130	371	585	779
Nakuru East	33,061	5,273	1,022	6,839	10,321	4,740	11	2,891	250	16,707	1,347	485	399	1,118
Nakuru West	28,990	4,640	536	3,025	7,420	3,010	4	418	353	14,755	1,201	350	86	966
Rongai	41,771	6,560	643	10,479	11,983	5,171	11	4,012	241	20,570	1,246	346	963	1,262
Kuresoi North	33,190	8,714	991	9,862	8,937	2,244	2	2,737	28	14,337	1,202	360	1,211	504

Source: Kenya National Bureau of Statistic, 2019.

AGROFORESTRY AND FOREST

There are three main forest types that contribute to the livelihoods in the study area: natural, plantation, and private forests. The main characteristics of the gazetted forests in the three counties concerned by the Project are presented in Table 6-67.

Table 6-67 Gazetted forests by counties concerned by the Project

County	Number	Area cover (hectare)	Main products	Main gazetted forests
Kiambu	8	40,032.81	Timber (used for supporting the construction industry, power line transmission, and fuel wood) Water	Kieni forest, Kinale Forest
Nyandarua	5	4,991,620	Livestock fodder (grass) Timber Poles Fuel wood	Ndaragwa forest, Lake Ol'Bolosat, Geta Forest, North Kinangop Forest, South Kinangop Forest
Nakuru	8	69,663	Timber and timber products	Mau Complex, Bahati Forest, Dundori Forest, Eburru Forest, Menengai forest, part of Aberdare Forest, Sururu Forest, Bararget Forest

Source: Kiambu County Integrated Development Plan 2018-2022, Nyandarua County Integrated Development Plan 2018-2022, and Nakuru County Integrated Development Plan 2018-2022.

Private forestry in Kiambu plays a key role in substituting dominance in sourcing vital forest products and services from gazetted forests. The data on the specific size of private forests is not available, though plans to carry out a survey are underway (Kiambu CIDP). The main income generating activity in the county is commercial forestry for timber and poles. Non-gazetted forests in Nyandarua County include Muruai, Kirima, Kaimbaga Extension, Mawingu, Salient and Malewa Tree Nursery as well as two presidential tree parks within Ol'Kalou urban centre. The main products from these forests are the same as from the gazetted forests, namely livestock fodder, timber, poles and fuel wood (County Government of Nyandarua, 2018). In Nakuru County, a number of companies have been registered with Kenya Forest Service to harvest mature trees from plantation forests for commercial use. The natural forests provide a wide range of non-wood products ranging from medicinal herbs, honey, food (meat) from trapped animals, fish (trout), fruits, vegetables, fibres, nuts and tubers which form an important source of food to forest-adjacent households (County Government of Nakuru, 2018).

In terms of agroforestry, small-scale to large-scale woodland establishments on farms is evident in Kiambu and farmers have majored on timber production, fodder production, medicinal herbs, riparian rehabilitation, apiculture, aquaculture, and fruit tree production (County Government of Kiambu, 2018). This sector is becoming interesting and playing a major role in livelihood empowerment and finance resource mobilization. The communities downstream directly depend on the water resource in the forest where abstraction is being embraced. This results in the increase of farm production that upscale food security levels within Kiambu and adjacent counties. It also further promotes communities' health, resulting in increased productivity (County Government of Kiambu, 2018). In Nyandarua County, several farmers and institutions have been able to establish woodlots in their farms (County Government of Nyandarua, 2018). The total area under farm forestry is estimated to be 97,360 ha and is increasing. Most of the trees planted on farms provide a source of income when they are sold to saw millers. Some trees from plantations are sold to the Kenya Power and Lighting Company (County Government of Nyandarua, 2018). Nakuru County, through its agricultural extension officers, is encouraging farmers to practice agroforestry to increase forest cover and to control soil erosion and enhance diversity (County Government of Nakuru, 2018). There are very low levels of value addition among groups and individual farmers producing timber and non-wood products. Most of the trees sold by farmers are sold in raw form as trees or rough timber (County Government of Nakuru, 2018).

SELF-EMPLOYED AND BUSINESS-BASED LIVELIHOOD

MICRO, SMALL, AND MEDIUM ENTERPRISES (MSMES)

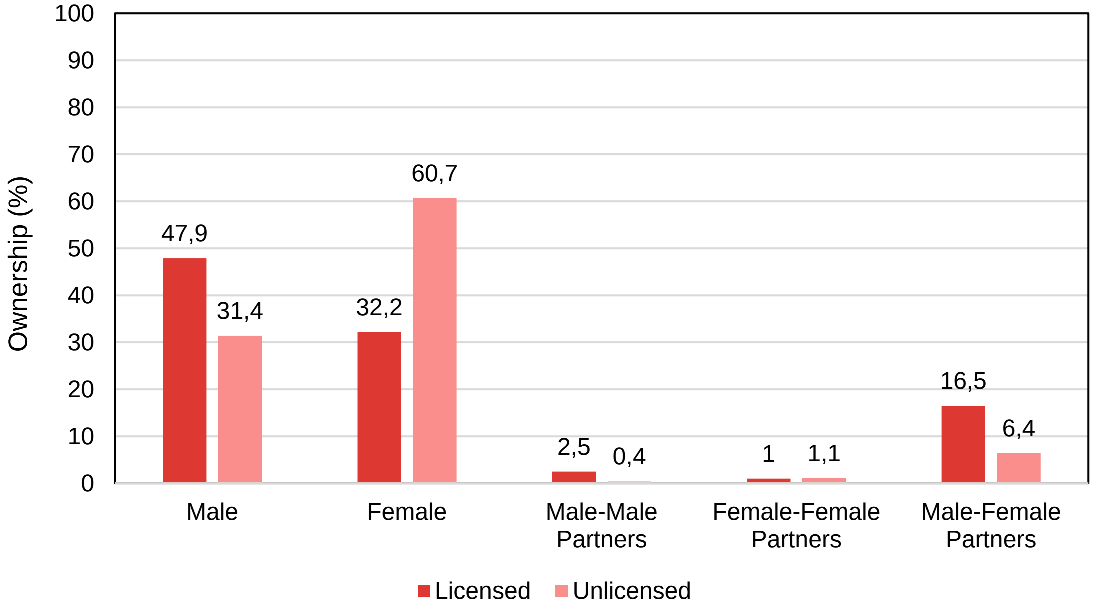
Micro, Small, and Medium Enterprises (MSMEs) play a crucial role in job and wealth creation in Kenya. They cover a range of establishments in almost all sectors of the economy and sustain the majority of households. MSMEs operate formally or informally, seasonally or year-round and are located in a number of areas including markets, streets and households or are mobile (KNBS, 2016). MSMEs have been identified under the Kenya Vision 2030 as a key driver in the provision of goods and services enhancing competition, stimulating growth and innovation, generating employment, and hence alleviating poverty. The MSME sector has given rise to a pool of skilled and semi-skilled labour force, strengthened linkages among socially, economically and geographically diverse sectors of the economy. Moreover, it has increased the participation of Indigenous Peoples (referred to as Vulnerable Marginalised Groups in Kenya) in economic activities of the country, and created opportunities to cultivate and nurture entrepreneurial and managerial skills of the country (KNBS, 2016).

MSMEs are defined according to the following employment sizes:

- Micro: 1-9 employees
- Small: 10-49 employees
- Medium 50-99 employees

Use of the term "employment" refers to the total number of people working in the business whether they are partially, fully paid, or not. Thus, it includes any working owners/operator (including self-employed), fully paid employees (including casual workers), unpaid or partially paid family members, and apprentices (KNBS, 2016).

According to the MSME survey conducted by the KNBS in 2016, licensed establishments are mostly owned by males while unlicensed establishments are mostly owned by females. Figure 6-82 shows the distribution of MSME ownership by sex of owner and licensing status.



Source: Micro, small and medium establishment (MSME) survey 2016

Figure 6-82 MSME ownership by sex of owner and licensing status

The number of MSMEs and MSME employees by licensing status and by size of establishment in counties concerned by the Project are presented in Tables 6-68 and 6-69 respectively. MSMEs are particularly important in Nakuru County which holds the highest number of MSMEs in the country after Nairobi City County. Nakuru is also in second place for the proportion of employment in licensed MSMEs which accounts for 7.9% of employment in the county. Kiambu also has a significant proportion of employment in licensed MSMEs at 5.9% (KNBS, 2016).

Table 6-68 Number of Micro, Small, and Medium Establishments (MSMEs) by establishment size and licensing status in counties concerned by the Project

County	Licensed				Unlicensed	Total
	Total	Micro (%)	Small (%)	Medium (%)	Micro	
Kiambu	92,400	91.4	7.9	0.7	170,800	263,200
Nyandarua	17,600	96.1	3.2	0.7	83,600	101,200
Nakuru	118,200	92.6	6.6	0.8	257,900	376,100
Kenya	1,560,500	92.2	7.1	0.7	5,850,300	7,410,800

Source: Micro, small and medium establishment (MSME) survey 2016

Table 6-69 Number of employees by establishment size and licensing status in counties concerned by the Project

County	Licensed				Unlicensed	Total
	Total licensed	Micro	Small	Medium	Micro	
Kiambu	368,000	180,800	138,900	48,300	276,800	644,800
Nyandarua	49,400	30,500	8,500	10,500	114,300	163,800
Nakuru	495,000	270,100	143,700	81,200	261,700	756,700
Kenya	6,280,500	3,456,100	2,027,800	787,600	8,617,800	14,898,300

Source: Micro, small and medium establishment (MSME) survey 2016

As shown in Table 6-68, the great majority of MSMEs in Kenya are unlicensed, indicating that there is a high number of undocumented businesses operating informally in the country. While establishments that are licensed register higher net worth than most unlicensed establishments, the latter account for the majority of new jobs created (KNBS, 2016).

Micro establishment is by far the most common establishment size. They represent 92.2% of licensed and 100% of unlicensed enterprises. Micro establishments are mostly operated by own account workers with few or no employees engaged. Self-employment is prevalent in the three counties concerned by the Project. Estimates from the 2009 Population and Housing Census indicate that on average, 14 per cent of the Nakuru county population (12 per cent urban and 16 per cent rural) are self-employed. Most of Nyandarua's population, about 46.2%, is self-employed (County Government of Nyandarua, 2018).

Data for the number of employees disaggregated by sex and county are only available for licensed MSMEs. These figures for the counties concerned by the Project are presented in Table 6-70. We remind the reader that women are more prevalent in the unlicensed sector which also accounts for the greatest numbers of establishments and of employees.

Table 6-70 **Distribution of employees in licensed MSMEs by sex in counties concerned by the Project**

County	Total licensed	Male (%)	Female (%)
Kiambu	368,000	52.9	47.1
Nyandarua	49,400	58.2	48.8
Nakuru	495,000	55.8	44.2
Kenya	6,280,500	57.5	42.5

Source: Micro, small and medium establishment (MSME) survey 2016

As shown in Table 6-71, the wholesale and retail trade sector accounts for the greatest number of licensed businesses in Nyandarua and Nakuru counties. The Kiambu County Integrated Development Plan (2018) reports that self-employment comprises mainly of construction companies, supermarkets, *jua kali*, manufacturing, hotels and bars.

Table 6-71 **Number of licensed business establishments by category in counties concerned by the Project**

Category of Business	County		
	Kiambu	Nyandarua	Nakuru
Wholesale and retail trade	5,411	23,554	22,773
Informal sector/hawkers	*	117	2,549
Transport, storage and communication	*	968	625
Agriculture, forestry and mining	*	4,164	1,440
Hotels and restaurants	*	7,427	4,326
Financial services	> 560	--	4,480
Professional and technical services	*	1,049	--
Education, health and entertainment	*	3,590	1,393
Manufacturing and industry	*	3,011	2,572
TOTAL	72,000	43,880	40,158

Note: * Data not available at this scale.
Source: Nakuru County Statistical Abstract 2015, Nyandarua County Statistical Abstract 2015, Kiambu County Integrated Development Plan 2018-2022.

Data for the number of employees disaggregated by sex and by category of business are only available at the National level. These figures are presented in Table 6-72 for both licensed and unlicensed MSMEs. Males are predominant in most business categories. Notable exceptions where females represent the majority of employees are the education sector for both licensed (55.1%) and unlicensed (68.2%) MSMEs, other service activities for both licensed (66.8%) and unlicensed (52.4%) MSMEs, wholesale and retail trade; repair of motor vehicles and motorcycles for unlicensed MSMEs (62.0%), accommodation and food service activities for unlicensed MSMEs (71.8%), agriculture, forestry and fishing for licensed MSMEs (50.1%).

Table 6-72 Distribution of MSME employees by sex and business category

Category of Business	Licensed			Unlicensed		
	Number	Male (%)	Female (%)	Number	Male (%)	Female (%)
Agriculture, forestry and fishing	13,100	49.9	50.1	383,000	65.7	34.3
Mining and quarrying	22,400	81.8	18.2	32,000	100.0	0.0
Manufacturing	666,100	68.8	31.2	1,094,300	50.7	49.3
Electricity, gas, steam and air conditioning supply	9,500	79.3	20.7	--	--	--
Water supply, sewerage, waste management and remediation activities	19,000	72.3	27.7	11,600	100.0	0.0
Construction	81,600	70.0	30.0	16,000	70.7	29.3
Wholesale and retail trade; repair of motor vehicles and motorcycles	2,609,100	60.5	39.5	5,404,700	38.0	62.0
Transportation and storage	168,100	86.6	13.4	244,800	100.0	0.0
Accommodation and food service activities	870,000	50.3	49.7	779,700	28.2	71.8
Information and communication	88,900	70.8	29.2	--	--	--
Financial and insurance activities	255,300	48.9	51.1	--	--	--
Real estate activities	51,900	65.6	34.4	64,700	88.1	11.9
Professional, scientific and technical activities	154,900	60.9	39.1	2,800	100.0	0.0
Administrative and support service activities	120,200	60.1	39.9	--	--	--
Education	601,500	44.9	55.1	112,900	31.8	68.2
Human health and social work activities	115,800	60.2	39.8	6,500	100.0	0.0
Arts, entertainment and recreation	46,000	75.8	24.2	48,400	69.0	31.0
Other service activities	387,200	33.2	66.8	416,300	47.6	52.4
TOTAL	6,280,500	57.5	42.5	8,617,800	42.9	57.1

Source: Micro, small and medium establishment (MSME) survey 2016

STREET VENDORS & SHOPS WITH A PHYSICAL INFRASTRUCTURE IN THE VICINITY OF THE HIGHWAYS

In the study area, shops with a physical infrastructure and street vendors benefit from or take advantage of the traffic from the highways. Street vendors include both moving and non-moving vendors with stalls selling food, vegetables or various goods, as well as people selling plants from nurseries encroaching on the RoW (Figure 6-83).

In accordance with the general trend in the country, shop tenants and street vendors in the study area who were interviewed for the ESIA social survey are largely self-employed (89% of respondents identified as self-employed, n=71), and all respondents fall under the category of MSMEs. Most street vendors also reported working without any help from family members (85% of respondents, n=71). As opposed to the general trend where most MSMEs are unlicensed, approximately 60% of surveyed street vendors and 91% of surveyed shop tenants indicated holding a license. However, only 28% of street vendors and 19% of shop tenants are a member of an organization.

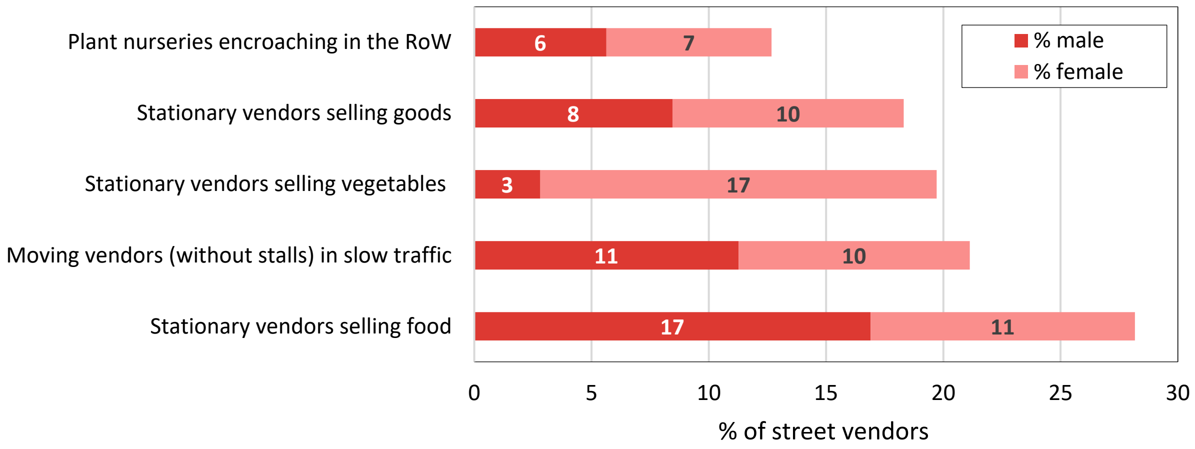


Figure 6-83 Type of street vendors participating in the ESIA social survey by sex (n=71)

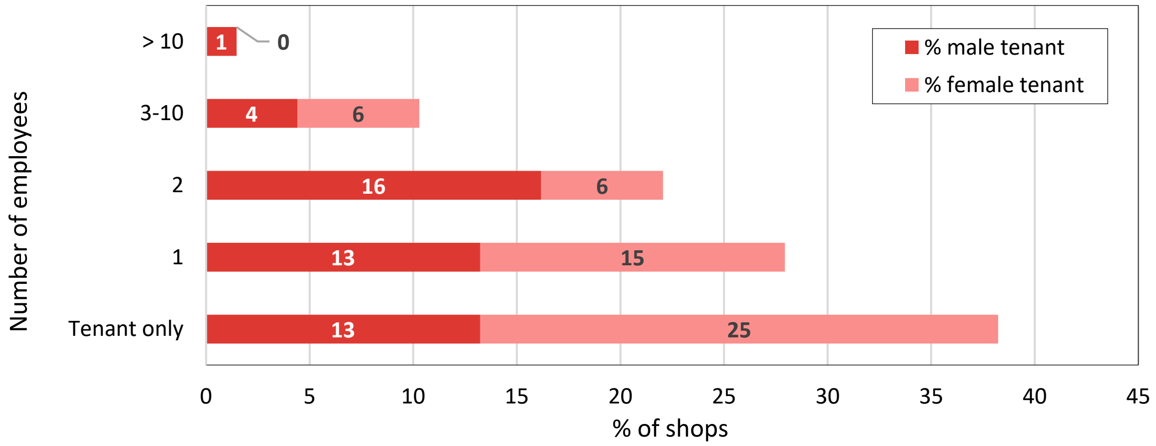


Figure 6-84 Ownership of shops by size and sex of owner in shop tenants participating in the ESIA social survey (n=68)

The great majority of surveyed street vendors (94%) were located either in town or at the entrance/exit of a town (Figure 6-84). Personal characteristics of street vendors are presented in Figure 6-84. According to our survey, approximately 55% of street vendors are female and 45% are male. The gender distribution varies for each type of street vendor, with females being more present as stationary vendors selling vegetables (85.7% of that vendor type) and goods (53.8% of that vendor type) and in plant nurseries encroaching in the RoW (55.5% of that vendor type) (Figure 6-83). Males are more prominent as moving vendors (60.0% of that vendor type) and stationary vendors selling food (53.3% of that vendor type) (Figure 6-83). Street vendors' age covers the whole adult range, but most are within the 18-35 years old category (Figure 6-86a). They also tend to sell close to their home (38% less than a kilometer and 52% 1-5 km away from their house) (Figure 6-86b)). Information pertaining to street vendors' revenue and labour are presented in Figure 6-87. The great majority of street vendors (93%) reported that trading is their only source of income. A large proportion of respondents (37%) were unable to estimate their monthly gross revenue, but most among those who responded, reported a monthly gross revenue of 10,000-50,000 Ksh. This type of trading is time intensive as most street vendors work 9-12 hours per day, 6-7 days per week (Figures 6-87c) and d)). Finally, most street vendors indicated never or rarely crossing the highway to sell goods, but over a quarter do so either often (13%) or always (14%) (Figure 6-88).

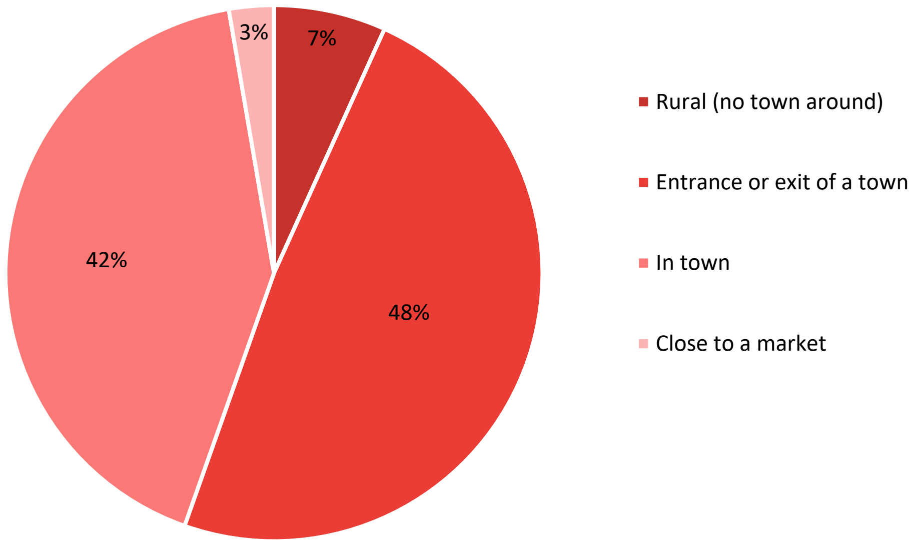
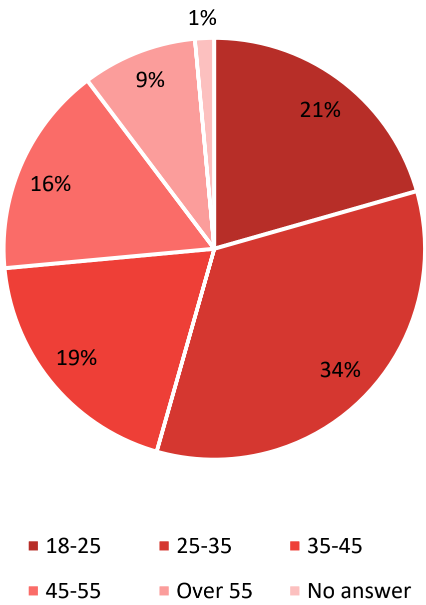
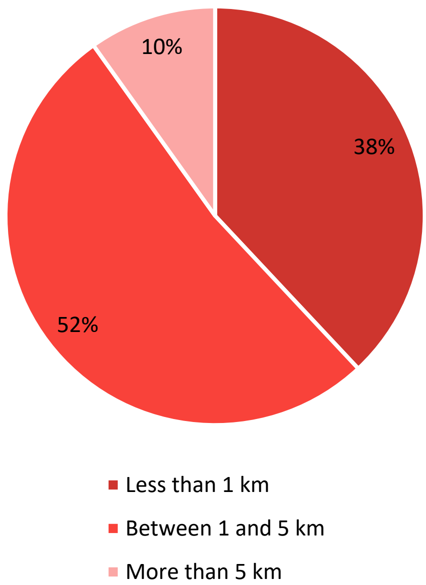


Figure 6-85 Location of street vendors participating in the ESIA social survey (n=71)

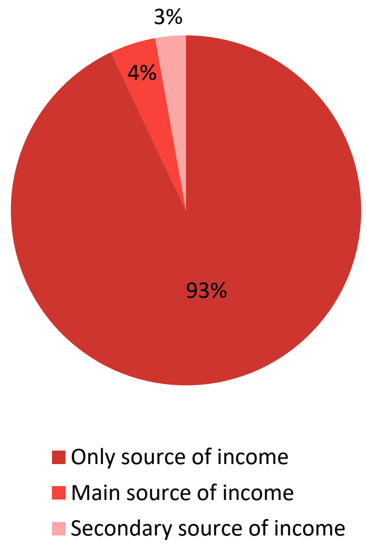


a) Age

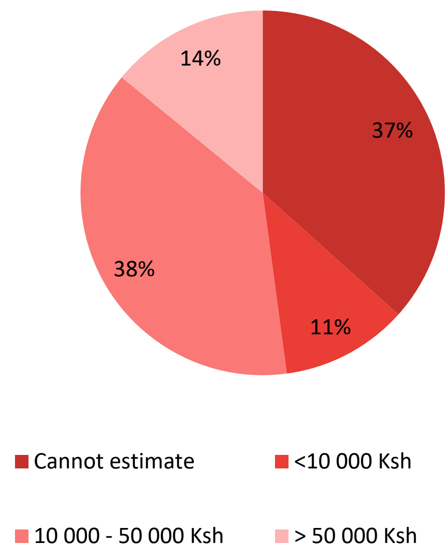


b) House distance from selling location

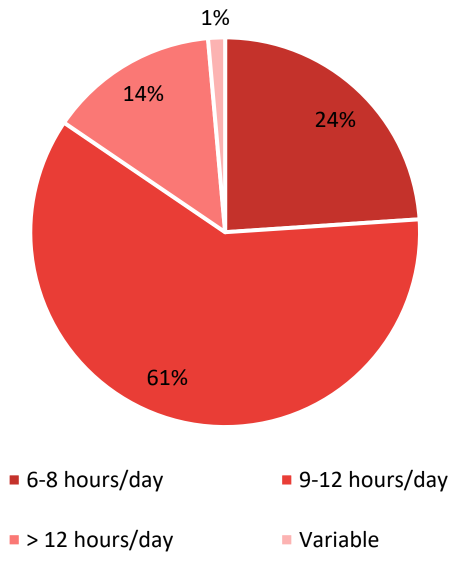
Figure 6-86 Characteristics of street vendors participating in the ESIA social survey (n=71)



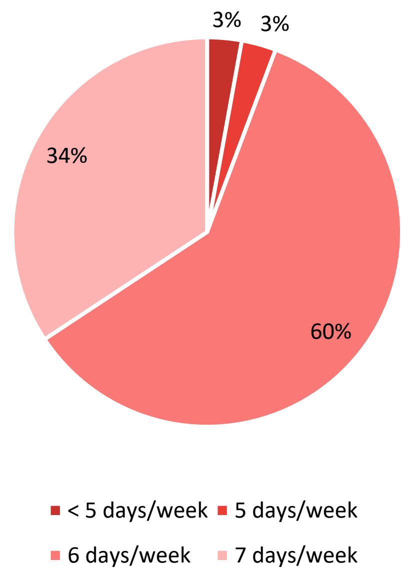
a) Contribution of trading to income



b) Estimated monthly gross revenue



c) Hours worked per day



d) Days worked per week

Figure 6-87 Economic significance of trading for street vendors participating in the ESIA social survey (n=71)

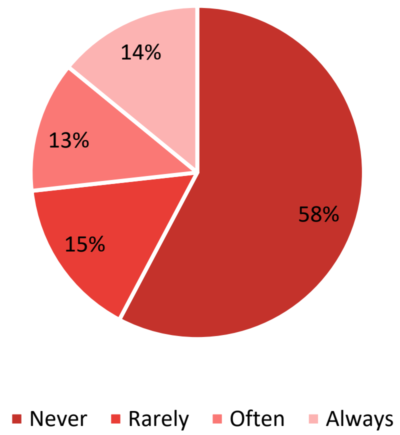
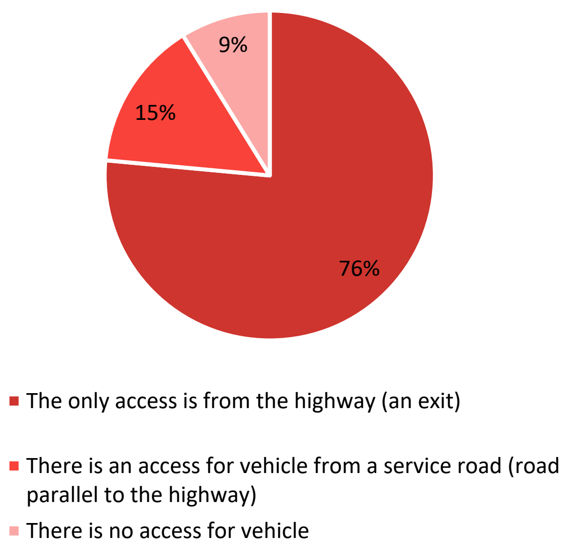
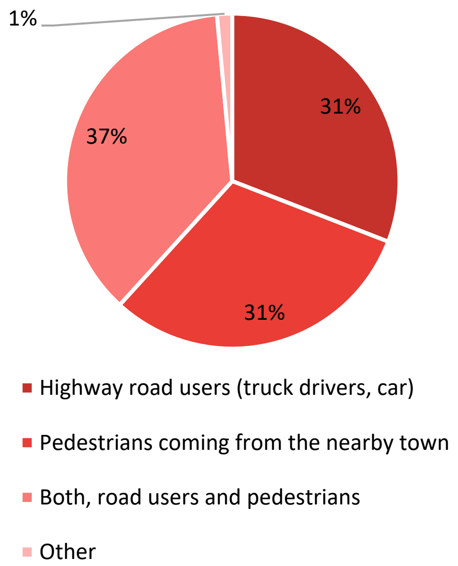


Figure 6-88 **Frequency of highway crossing by street vendors participating in the ESIA social survey (n=71)**

A large proportion (41%) of shop tenants participating in the ESIA social survey were unsure about the location of their shop in relation to the RoW, while approximately 29% indicated being inside the RoW and another approximately 29% indicated being outside the RoW. Sixty-six per cent of shop tenants participating in the ESIA social survey reported that they will not be displaced by the Project. Surveyed shop tenants heavily rely on the highways for their business (Figure 6-89 a) and b)). Seventy-seven percent reported that the only means for vehicles to access their business was by using an exit from the A8 or A8 South highway. Highway users also represent the main clients for 33% of surveyed shops, and the main clients along with pedestrians for an additional 39%. As a result of this dependence on the highways, 63% of surveyed shop owners stated that they will be negatively impacted during road construction. However, 44% expected positive impacts during the operation phase of the Project.



a) Vehicle access to shop

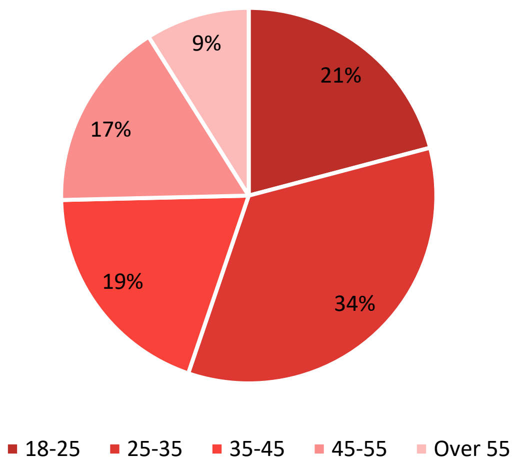


b) Shops' main clients

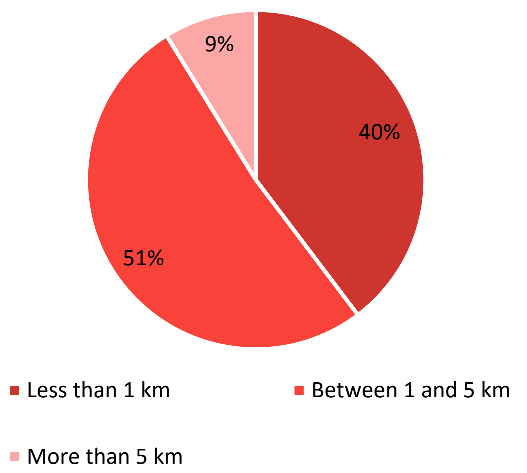
Figure 6-89 **Significance of the A8 and A8 South highways for shops participating in the ESIA social survey (n=68)**

Personal characteristics of surveyed shop tenants are presented in Figure 6-90. According to our survey, approximately 51.5% of shop tenants are female and 48.5% are male. Smaller shops tend to be mostly operated by females (Figure 6-84). Indeed, they are prominent for shop sizes of zero employee (tenant only) (65.4% of that size), 1 employee (52.6% of that size), and 3-10 employees (57.1% of that size). The only exception are shops of 2 employees where males hold the majority (73.3% of that size). All tenants of shops with more than 10 employees participating in the ESIA social survey were male. Shop tenants' ages are almost equally distributed between the following categories: 18-25, 25-35, 35-45, and over 45 years old. They also tend to live close to the shop's location (40% less than a kilometer and 52% 1-5 km away from their house).

A large proportion of shop tenants (38%) did not want to report their monthly gross revenue, but most among those who responded, reported a monthly gross revenue above 50,000 Ksh (Figure 6-91).



a) Age



b) House distance from shop location

Figure 6-90 Characteristics of shop tenants participating in the ESIA social survey

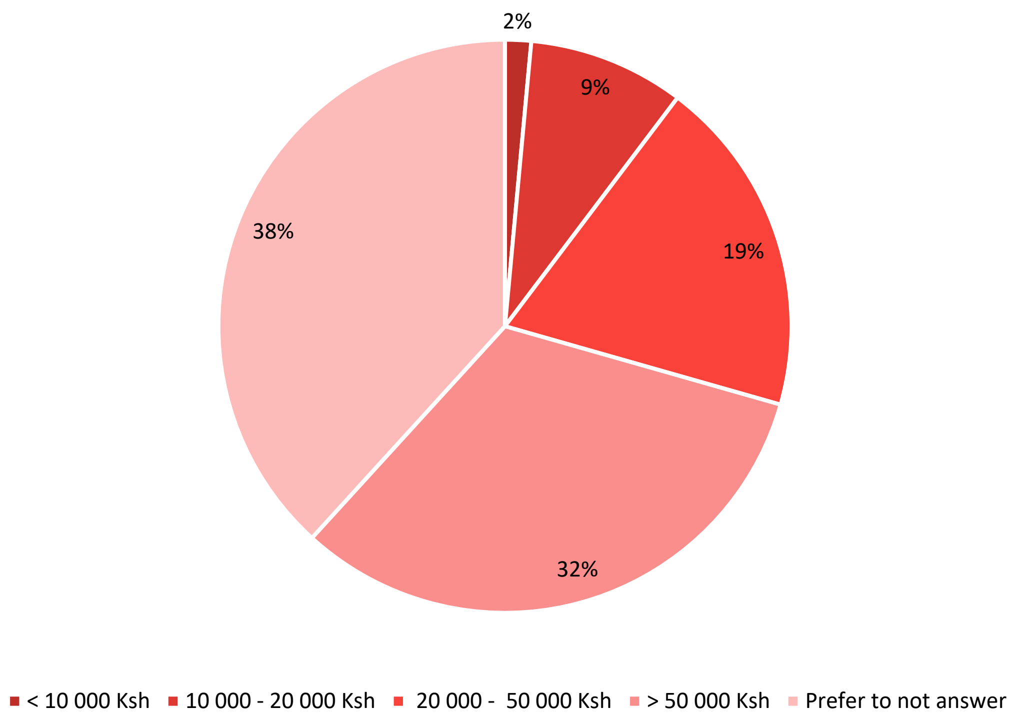


Figure 6-91 Estimated monthly gross revenue of shop tenants participating in the ESIA social survey

FISHERIES

Fisheries is a growing sector in the Project area. It is considered an important activity for enhancing the wellbeing and economy of the region. All three counties are actively promoting fishery development through measures aimed at increasing fish farming (aquaculture) productivity and fish catch, and improving the marketing, value chain, and selling of products (County Government of Kiambu, 2018; County Government of Nakuru, 2018; County Government of Nyandarua, 2018). The number of households engaged in aquaculture and capture fisheries in the counties and sub-counties concerned by the Project according to the latest Census (KNBS, 2019) are presented in Table 6-73.

Table 6-73 **Number of households engaged in aquaculture and fishing by counties and sub-counties concerned by the Project**

County Subcounty	**Total farming**	**Aquaculture**	**Fishing**
Kiambu	214,052	417	1,317
Kikuyu	17,693	26	70
Lari	25,602	40	72
Limuru	19,202	25	69
Nyandarua	140,854	250	603
Kinangop	23,636	28	50
Nakuru	283,652	565	2,494
Gilgil	27,273	47	113
Molo	26,641	26	58
Naivasha	33,061	65	1,624
Nakuru East	8,876	34	46
Nakuru West	8,752	20	59
Rongai	29,568	73	115
Kuresoi North	40,359	73	80

A brief overview of the primary considerations associated with the three counties traversed by the Project is presented hereafter

KIAMBU COUNTY

Fisheries in Kiambu County include aquaculture, as well as river line, dam and sport fishing (the latter conducted mainly at Gatamaiyu fishing camp in Lari Sub-county) (County Government of Kiambu, 2018). The main species farmed are tilapia and catfish which are warm-water species. The County also has potential for cold water species such as trout in Lari Sub-county. According to the Kiambu County Integrated Development Plan (2018), there were 580 farmers equipped with modern aquaculture technologies in 2018.

Kiambu County is investing 43.5 M Ksh in its Fisheries Development and Management Programme. It aims in 2018-2022 to improve aquaculture value chains, increase fishery productivity by 40%, develop market access, improve the adoption of ornamental and sport fishing, and strengthen fisheries policy, strategy and capacity building (County Government of Kiambu, 2018).

NYANDARUA COUNTY

Nyandarua County has identified Fisheries Development as one of its Flagship projects for 2018-2022 which is intended to spur economic growth and bring about transformative change to the lives and welfare of its people (County Government of Nyandarua, 2018). In 2018, there were 1,500 fishponds excavated and pond liners purchased, 65,781 fingerlings procured and distributed 370 fish farmers. While this sector is nascent, Nyandarua County's Fisheries Development Programme has set ambitious goals to significantly expand the sector in the coming years. It is investing 500M Ksh to promote aquaculture, capture and sport fishing, and improve quality control, value chains, and marketing (County Government of Nyandarua, 2018).

NAKURU COUNTY

Fisheries play an important role in the economy of Nakuru County by providing food security and employment (County Government of Nakuru, 2018). The major fishery activities include aquaculture and inland capture in Lake Naivasha, River Malewa, and public and privately-owned dams. Aquaculture in Nakuru County involves rearing in fishponds which are earthen, cemented or lined as well as fishing in Lake Naivasha. Some practice emerging technologies like raised ponds and aquaponics. In 2018, there were a total of 1,524 ponds constructed in the County of which 821 were operational. Lake Naivasha fishing activities support about 704 fishermen (holding about 176 boats, 1,760 fishing nets of 4 inches mesh size), and more than 3,000 people indirectly. The main species of fish caught are common carp and tilapia. Other species such as crayfish are harvested on a small scale. There are three landing sites along Lake Naivasha: Kamere, Central and Tarambeta landing sites (County Government of Nakuru, 2018).

Nakuru County is investing 234M Ksh in its Fisheries Development Programme to enhance food security and employment. This included an investment of 60M Ksh in 2018-2019 to reduce post-harvest losses through the development of a fish market along the Nakuru-Nairobi highway in Navaisha and the construction of a modern fresh fish auction facility with cold storage. Other initiatives include increased productivity through stocking of dams, setting up fish hatcheries and operationalizing fish feed pelletizers; rehabilitation of fishponds and dams; improved fish quality, marketing and value addition; training and capacity building; awareness campaigns to increase local fish consumption; and enhanced patrolling, extension services and emergency response (CIDP).

INDUSTRY

KIAMBU COUNTY

Kiambu County hosts major industries for all sectors of the economy, with a concentration in agro-processing and manufacturing. Industries act as a major source of employment and market outlets for agricultural and non-agricultural products both for domestic use and export. Agro-processing industries are spread across the county and include Farmers Choice Ltd, Kenchic Co. Ltd, Brookside Dairies, Githunguri Dairies, Ndumberi Dairies, Limuru Milk and Palmside Dairies, among others. Most industries are located in Thika and Ruiru sub-counties; i.e., not in the sub-counties traversed by the Project. Thika has more than 58 industries which include Bidco Oil Industries, Thika Motor Vehicle dealers, Thika Pharmaceutical Manufacturers Limited, Devki Steel Mills, Broadway Bakeries, Kenblest Industry, Kel Chemicals, Thika Rubber Industries Limited, Macadamia Nuts, Campwell Industry and Kenya Tanning Extracts Limited. In Ruiru sub-county, the major industries include Clay Works as well as Spinners and Spinners. The Bata Shoe Factory which is Kenya's major producer of leather products is in Limuru sub-county (County Government of Kiambu, 2018).

Kiambu has a gazetted and an established industrial park, Tatu City in Ruiru sub-county. The park is also a Special Economic Zone and many *Jua Kali* groups are present with approximately 30 officially registered. There are more than 200 bodaboda sheds for operators across the county (County Government of Nakuru, 2018).

The main mining activities in Kiambu include natural gas exploitation in Lari constituency by Carbacid Company Limited and extraction of ballast, hardcore, gravel, murram, sand and building stones in Juja, Gatundu South and Gatundu North Constituencies (County Government of Nakuru, 2018).

NYANDARUA COUNTY

Nyandarua County has an underdeveloped industrial sector. There are no large-scale industrial activities related to manufacturing and processing. A processing plant does not exist for milk or any other livestock product. There is thus great potential for agro-industrial processing in the dairy and livestock sector, horticulture, and food crop production. For example, the Midlands potato processing factory in Njambini has a contracted market in Nairobi. There is room to expand this factory and establish more to boost potato farming in the County and offer cold storage facilities for green peas and carrots. Moreover, the pyrethrum processing industries that have collapsed could also be revived. Finally, there is also potential for secondary manufacturing of forest, commercial use of water, and natural stone for quarrying (County Government of Nyandarua, 2018).

In the absence of a strong formal industrial base, the Jua Kali sector remains the most important economic activity in the urban and trading centres. The main activities include tailoring, carpentry and joinery, blacksmith, welding/ fabrication and motor vehicle repairs. This sector provides the bulk of farm implements. The County has a total of five Jua Kali associations with a combined membership of 1,023 people. Most of the Jua Kali artisans, however, operate in an uncoordinated manner in production and marketing (County Government of Nyandarua, 2018).

Nyandarua has numerous small-scale industrial activities such as saw-milling, and furniture and metal fabrication, concentrated mainly in the urban and market centres. Metal fabrication and wood crafts have now extended to the rural areas because of electricity supply. Cottage and small-scale industries are minor economic activities carried out in the market centres. The contribution of these cottage industries to the local economy cannot be estimated because most entrepreneurs are not willing to disclose information on the amount of money they earn. The role of the sawmill as a major source of employment has declined with a fall in available trees for lumber in Nyandarua County. Commercial tree production is now the only source of timber for the few sawmills that are still operational. Thread milling which is done on a small scale in Kinangop could be expanded and replicated in other areas as wool is readily available in Nyandarua (County Government of Nyandarua, 2018).

There are no minerals of any significant value in the Nyandarua and no exploration for minerals has ever been documented in the County. Small-scale quarrying is the only significant extraction activity. The most notable quarry sites are in Kibathi, Ol’Joro Orok (near Kangui), Kapten, Ndemi, Mumui, Ndunyu- Njeru and Tulaga which provide materials for building construction and road maintenance such as gravel and murram. Pumice for use in building is mined near Kinungi in small quantities although there are ample reserves (County Government of Nyandarua, 2018).

NAKURU COUNTY

There are various industries that drive the economy of Nakuru County and offer employment opportunities. They include animal feed production companies, agricultural inputs (e.g., Syngenta), engineering works, manufacturing industries (e.g., Keroche), Menengai Oil Refineries, canners, dairy products, bakeries, and the hotel industry. However, investment opportunities still exist in Nakuru County that includes revival of pyrethrum processing among other agro-based industries (County Government of Nakuru, 2018).

There is no industrial park in Nakuru County. However, there are proposals to put up an industrial park in Naivasha sub-county. The Kenya Vision 2030 has also proposed the establishment of the Small and Medium Enterprise (SME) Park in Rongai Sub-county (County Government of Nakuru, 2018).

The County mineral resources include kaolin, diatomite, sand and building stones, trona (soda ash), natural carbon dioxide. The major current mining activity in Nakuru County is that of diatomite at Kariandusi, located along the Nairobi-Nakuru highway Gilgil Sub-County about 2 km east of Lake Elmentaita. Further there are 15 stone quarries, 13 sand harvesting and 2 murram quarries which are licensed to carry out quarrying activities. These are mainly found in Bahati, Gilgil and Naivasha sub-counties. These quarries provide employment opportunities to the youth in the County as well as a source of revenue to the County as the transporters pay a tax to the County government. Kaolin deposits (found at Eburru sites and Olkaria) are used for pottery. The reserves of white clay present at Eburru site exceeds 69,000 tonnes. There is also harnessing of underground hot water for geothermal power generation (County Government of Nakuru, 2018).

TRANSPORTATION SECTOR

Mainly found in Nakuru County, in the subcounties of Naivasha, Gilgil, and Rongai, the transportation sector activities concern the long-distance carriage of goods. An important number of trucks are travelling on the extensive journey from Mombasa westwards to Uganda, South Sudan, Rwanda and the Democratic Republic of Congo, using both A8 and A8 South roads

Truck drivers stop to sleep, eat and rest, and many truck parking bays appeared along both roads. Major stopovers for truck drivers using the Northern Corridor are in the communities of Salgaa, Kikopey, Gilgil, Rongai, Sashangwan, Mai Mahiu, and Longonot.

Causing a lot of traffic and accidents, but also being the motor of those communities' economy, truck stopovers bring lucrative businesses for bars, restaurants and lodgings. They are often also associated with commercial sex work in those areas.

During the first and second round of public consultations for this ESIA, stakeholders mentioned the importance of truck stopovers (see Figure 6-92) for the local economy and requested to ensure that a space for truck bays and parking remain present in their communities inside the Nairobi-Nakuru-Mau Summit Highway project design.

Longonot truck stopover

Kikopey truck stopover

Salgaa truck stopover

Sashangwan truck stopover

Figure 6-92 Typical Truck Stopover along the Project Sections

TOURISM AND RECREATIONAL

Kiambu County has several tourist attraction sites which include:

- Kereita Forest and Great Rift Valley View Point in Lari sub-county;
- PCEA Church of Torch, Ondiri Swamp and Watson Memorial in Kikuyu sub-county;
- Chania Falls, Fourteen falls, Mugumo Gardens and Aramati Thigira Cultural Centre in Thika sub-county;
- Old Italian Church and Italian Prisoners of War in Juja sub-county;
- Paradise Lost in Kiambu sub-county; and
- Maumau Caves and Gatamaiyu Fish Camp in Gatundu and various historical sites in Gatundu and Githunguri sub-counties.

The main activities in these sites are sightseeing, boat riding, viewing of the Great Rift Valley, zip lining, hiking trails, and social activities. The County's attractions sites attract a large number of tourists annually, with most visitors being domestic tourists. The county's hospitality sector (hotels and bars) and golf clubs also benefits from their proximity to Nairobi (County Government of Kiambu, 2018).

Although Nyandarua County is within the Mount Kenya and Aberdare Ranges tourist circuits, tourism remains underdeveloped. The county has abundant game for tourist attractions. The main tourist attraction sites include:

- Aberdare National Park which has abundant wildlife and recreational activities including mountain climbing and nature trails;
- Lake Ol'Bolosat which is ideal for birds and hippopotamus watching, boating, water surfing activities and sport fishing;
- pre-colonial and colonial times settlements at the foot of the Aberdare forest where the colonialists lived;
- Mau caves at Geta and Kimathi which some community-based organizations have endeavoured to preserve; and
- other attractions including scenic terrains, waterfalls, rivers and forests (Nyandarua CIDP).

An estimated 6,000 visitors visit the Aberdare National Park and Lake Ol'Bolosat. These visitors are estimated to generate 100M Ksh in terms of revenue. It is projected that the County will receive 9,000 and 12,000 visitors annually by 2020 and 2022 respectively, generating revenues of 180M and 240M Ksh annually in 2020 and 2022 respectively (County Government of Nyandarua, 2018).

Nakuru County is among the counties with a large inflow of tourists from within and outside Kenya attracted by its diverse flora and fauna. The total number of tourists visiting attraction sites in 2014 was 426,548 (Nakuru County Statistical Abstract).

- The county's three national parks, Lake Nakuru National Park, Hells Gate National Park and Mount Longonot National Park, are the major tourist attractions;
- Other tourist sites include Menengai Crater, Subukia Shrine, Lord Egerton Castle, Lake Naivasha, Lake Elmentaita, Hyrax hill prehistoric site, Ol-doinyo Eburru volcano and Mau Forest. Private wildlife conservancies that attract tourists include Marura, Oserian and Kedong in Naivasha sub-county and Kigio and Soysambu in Gilgil sub-county (Nakuru CIDP);
- The main tourist activities include bird watching, hiking, picnics, excursions and game drives (Nakuru CIDP). Revival of the tourism sector in 2013-2017 has seen significant growth in Nakuru County's hospitality industry, particularly in conference tourism (County Government of Nakuru, 2018).

6.4.7 LABOUR CONDITIONS

While there is a high number of labour force available, Kenya is facing a shortage of skilled labour. This led multinational companies to employ foreign skilled labour to respond to their specific needs (Kereri, 2019; Mwangi, 2016). This is especially the case in the construction sector. A report from Kenya's National Construction Authority (2014) stated that 42% of construction workers were unskilled while the proportion on skilled workers was estimated at 25% (NCA, 2014). In their research paper, Keimi and al. (2015) identified the most common causes of construction site accidents, based on their case study in Nairobi. Among them, lack of training, lack of technical guidance, and lack of certified skill labour are listed as factors contributing to accidents. Recruiting skilled manpower has also been identified as a challenge on road construction projects by road contractors surveyed for research in the road construction sector (Mwangi, 2016).

Offering training to unskilled manpower can be an effective way to recruit labour. This strategy was raised during the first round of consultations held in February 2021. Stakeholders mentioned that local employment should be offered to skilled and unskilled workers. A consideration should be addressed as well to vulnerable groups such as people with disabilities, women and youths, as for Maasai communities.

6.4.7.1 KIAMBU COUNTY

WAGE EARNERS

According to the Kiambu County Integrated Development Plan 2018-2022, most of the wage earners are not permanently employed and are paid on a daily basis. Wage earners are mainly employed in the agricultural sector and their salaries are based on agricultural legal notice. The principal agricultural sub-sectors of employment are tea or coffee estates and horticulture. These subsectors employ many foreigners who do not hold their employment permits. There is also a large proportion of illiterate workers.

SELF-EMPLOYED

Very few formal jobs are available in the county, which leads the population to revert to self-employment. According to the Kiambu County Integrated Development Plan 2013-2017, self-employment contributed to 31% of households' income in the county. This statistic is unavailable for the 2018-2022 period. Those self-employed are mainly working in agricultural activities, businesses such as markets, hotels or bars, and small-scale industries.

LABOUR FORCE

The labour force is characterized by a high rate of unemployment. This is due to rapid and continued growth of the labour force with little or no employment opportunities and this remains a major challenge in the county. A considerable part of the county population is inactive due to their status (full-time students, home makers, retired), their conditions or their age. As a matter of fact, 31% of the county's population is aged 14 and younger. Table 6-74 shows the distribution of Kiambu County's population aged 5 years old and above by activity status. Lari and Limuru sub-counties present a lower rate of unemployed population than the one at the county level.

Table 6-74 Distribution of Kiambu County population aged from 5 years old and above by activity status

Sub-county	Gender	Working	Seeking work	Inactive population	Not stated	Total population
Lari	Total	67,954	4,574	47,305	8	119,841
	Male	33,413	2,974	22,981	3	59,371
	Female	34,541	1,600	24,323	5	60,469
Limuru	Total	74,553	9,335	56,242	22	140,152
	Male	38,873	5,469	25,727	14	70,083
	Female	35,680	3,866	30,515	8	70,069
Kiambu County	Total	1,116,365	165,846	842,577	528	2,125,316
	Male	578,378	89,806	370,435	267	1,038,886
	Female	537,923	76,022	472,110	261	1,086,316

Source: KNBS, 2019.

6.4.7.2 NAKURU COUNTY

WAGE EARNERS

The private sector employs the majority of wage earners in the county, and the main formal employment areas are concentrated in urban centres. Farming (flower, tea and coffee), construction, public transport, wholesale and retail trade are sectors among others that employs wage earners. Most of them do not have relevant or professional training, as these employees are younger aged.

SELF-EMPLOYED

The main self-employed sectors in Nakuru County are in formal wholesale and retail businesses, or informal businesses. From the 2009 Population and Housing Census, 14% of the county's population was self-employed. There was also a gap between rural areas (16 per cent) and urban areas (12 per cent).

LABOUR FORCE

Table 6-75 shows the distribution of Nakuru County's population aged 5 years old and above by activity status. Nakuru West, Nakuru East, Naivasha and Rongai sub-counties present a lower rate of unemployment than the one at the county level. According to the Nakuru County Integrated Development Plan 2018-2022, youths and women are overrepresented in the unemployed population. The County plans to adopt measures in order to create employment activities for these targeted groups.

Table 6-75 Distribution of Nakuru County population aged from 5 years old and above by activity status

Sub-county	Gender	Working	Seeking work	Inactive population	Not stated	Total population
Gilgil	Total	76,480	6,317	77,816	30	160,643
	Male	37,958	3,649	38,795	17	80,419
	Female	38,519	2,667	39,018	13	80,217
Kuresoi North	Total	73,139	3,367	74,352	18	150,876
	Male	35,521	2,053	37,572	9	75,155
	Female	37,617	1,314	36,778	9	75,718
Molo	Total	67,430	5,028	64,033	4	136,495
	Male	33,484	3,068	31,378	2	67,932
	Female	33,943	1,960	32,653	2	68,558
Naivasha	Total	156,874	19,321	129,293	66	305,554
	Male	82,451	10,734	59,142	34	152,361
	Female	74,409	8,584	70,142	32	153,167
Nakuru East	Total	78,274	11,886	76,849	56	167,065
	Male	39,960	6,025	32,921	31	78,937
	Female	38,310	5,861	43,924	25	88,120
Nakuru West	Total	78,472	16,137	75,216	6	169,831
	Male	45,338	8,386	32,721	3	86,448
	Female	33,130	7,749	42,491	3	83,373
Rongai	Total	82,714	9,713	81,691	23	174,141
	Male	41,556	5,890	39,413	11	86,870
	Female	41,157	3,823	42,275	12	87,267
Nakuru County	Total	909,666	94,842	865,402	312	1,870,222
	Male	460,598	53,315	412,433	162	926,508
	Female	449,029	41,519	452,931	150	943,629

Source: KNBS, 2019.

6.4.7.3 NYANDARUA COUNTY

WAGE EARNERS

Agriculture is a major sector of employment opportunities and it employs about 50% of the population (Nyandarua County CIDP 2018-2022, 2018). The *Jua Kali*[12] sector is an important economic activity, especially in urban and trading centres.

12 The Jua Kali term refers to labourers who work with wood or metal, typically performed outdoors (welding, carpentry, carving), employment requiring physical abilities, and are considered as an integral part of the informal economy. *Jua Kali* means in Swahili ‘’hot sun’’.

SELF-EMPLOYED

According to the Nyandarua County Integrated Development Plan 2018-2022, 46% of the county's population is self-employed.

LABOUR FORCE

Table 6-76 shows the distribution of Nyandarua County's population aged 5 years old and above by activity status. Kinangop sub-county presents a similar rate of unemployment than the one at the county level. According to the Nyandarua County Integrated Development Plan 2018-2022, youths are overrepresented in the unemployed population. Very few formal job opportunities are available in the county.

Table 6-76 Distribution of Nyandarua County population aged from 5 years old and above by activity status

Sub-county	Gender	Working	Seeking work	Inactive population	Not stated	Total population
Kinangop	Total	54,170	2,170	42,328	15	98,683
	Male	25,971	1,370	20,905	8	48,254
	Female	28,196	800	21,422	7	50,425
Nyandarua County	Total	318,818	9,880	237,397	63	566,158
	Male	153,553	6,232	118,623	29	278,437
	Female	165,256	3,648	118,767	33	287,704

Source: KNBS, 2019.

6.4.8 INDIGENOUS PEOPLES (VULNERABLE AND MARGINALIZED GROUPS - VMGS)

Kenya has ratified the International Convention on the Elimination of All Forms of Racial Discrimination (ICERD), the Convention on the Elimination of Discrimination against Women (CEDAW) and the Convention on the Rights of the Child (CRC). On the other hand, the country has no specific legislation on Indigenous Peoples and has not adopted the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) nor ratified the International Labour Organization (ILO) Convention 169. The term "Indigenous Peoples" is not used in Kenya, but the national legal framework rather recognizes particular concerns and rights of minorities and marginalized groups. The Constitution of Kenya adopted in 2010 requires the State to address the needs of vulnerable groups, including "minority or marginalized" and "particular ethnic, religious or cultural communities" (Article 21.3). The Constitution defines a marginalized community as:

- "A community that, because of its relatively small population or for any other reason, has been unable to fully participate in the integrated social and economic life of Kenya as a whole;
- A traditional community that, out of a need or desire to preserve its unique culture and identity from assimilation, has remained outside the integrated social and economic life of Kenya as a whole;
- An indigenous community that has retained and maintained a traditional lifestyle and livelihood based on a hunter or gatherer economy; or
- Pastoral persons and communities, whether they are (i) nomadic; or (ii) a settled community that, because of its relative geographic isolation, has experienced only marginal participation in the integrated social and economic life of Kenya as a whole" (Article 260).

The International Finance Corporation (IFC) Performance Standard 7 (PS7) defines Indigenous Peoples as “a distinct social and cultural group possessing the following characteristics in varying degrees:

- Self-identification as members of a distinct indigenous cultural group and recognition of this identity by others;
- Collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories;
- Customary cultural, economic, social, or political institutions that are separate from those of the mainstream society or culture; or
- A distinct language or dialect, often different from the official language or languages of the country or region in which they reside.”

There are different communities in the Project area that conform to both definitions above. It was determined in the RFP Stage ESIA Report (2018) that there are no significant gaps between PS7 and the various Kenyan national laws. We will therefore use the terms “Indigenous Peoples” and “Vulnerable and Marginalized Groups” interchangeably and refer to PS7 in the remainder of this section.

The objectives of PS7 are as follows:

- To ensure that the development process fosters full respect for the human rights, dignity, aspirations, culture, and natural resource-based livelihoods of Indigenous Peoples;
- To anticipate and avoid adverse impacts of projects on communities of Indigenous Peoples, or when avoidance is not possible, to minimize and/or compensate for such impacts;
- To promote sustainable development benefits and opportunities for Indigenous Peoples in a culturally appropriate manner;
- To establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project’s lifecycle;
- To ensure the Free, Prior, and Informed Consent (FPIC) of the Affected Communities of Indigenous Peoples when the following circumstances are present:
  - Impacts on lands and natural resources subject to traditional ownership or under customary use;
  - Relocation of Indigenous Peoples from lands and natural resources subject to traditional ownership or under customary use;
  - Significant impacts on critical cultural heritage.
- To respect and preserve the culture, knowledge, and practices of Indigenous Peoples.

Communities belonging to four distinct Indigenous Peoples have been identified in the Project area. The Maasai will be directly affected by the Project while the Ogiek, Turkana and Samburu are likely to be indirectly affected by the Project. To achieve the IFC PS7 objectives, we provide an overview of the culture, livelihoods, knowledge, and practices of the Maasai Peoples in communities directly affected by the Project, focusing on how these might be impacted. As the Project will impact lands and natural resources subject to traditional ownership or under customary use, a process to ensure the FPIC of the affected Maasai has been implemented. The process and its outcomes are presented in Section 7.3.2.4 of this document and in greater details in the Indigenous Peoples Plan. While not subjected to the same requirements (see Indigenous Peoples Plan), we also provide some information on Indigenous Peoples located in communities that are likely to be indirectly affected by the Project.

6.4.8.1 THE MAASAI PEOPLE

GENERAL CHARACTERISTICS

The Maasai People are semi-nomadic pastoralists speaking a Nilotic language (Maa). They are recognized as a Vulnerable and Marginalized Group (VMG) in Kenya, and they are recognized as Indigenous Peoples in various United Nations fora (e.g., UN Permanent Forum on Indigenous Issues) and by the African Development Bank (African Development Bank Group, 2016).

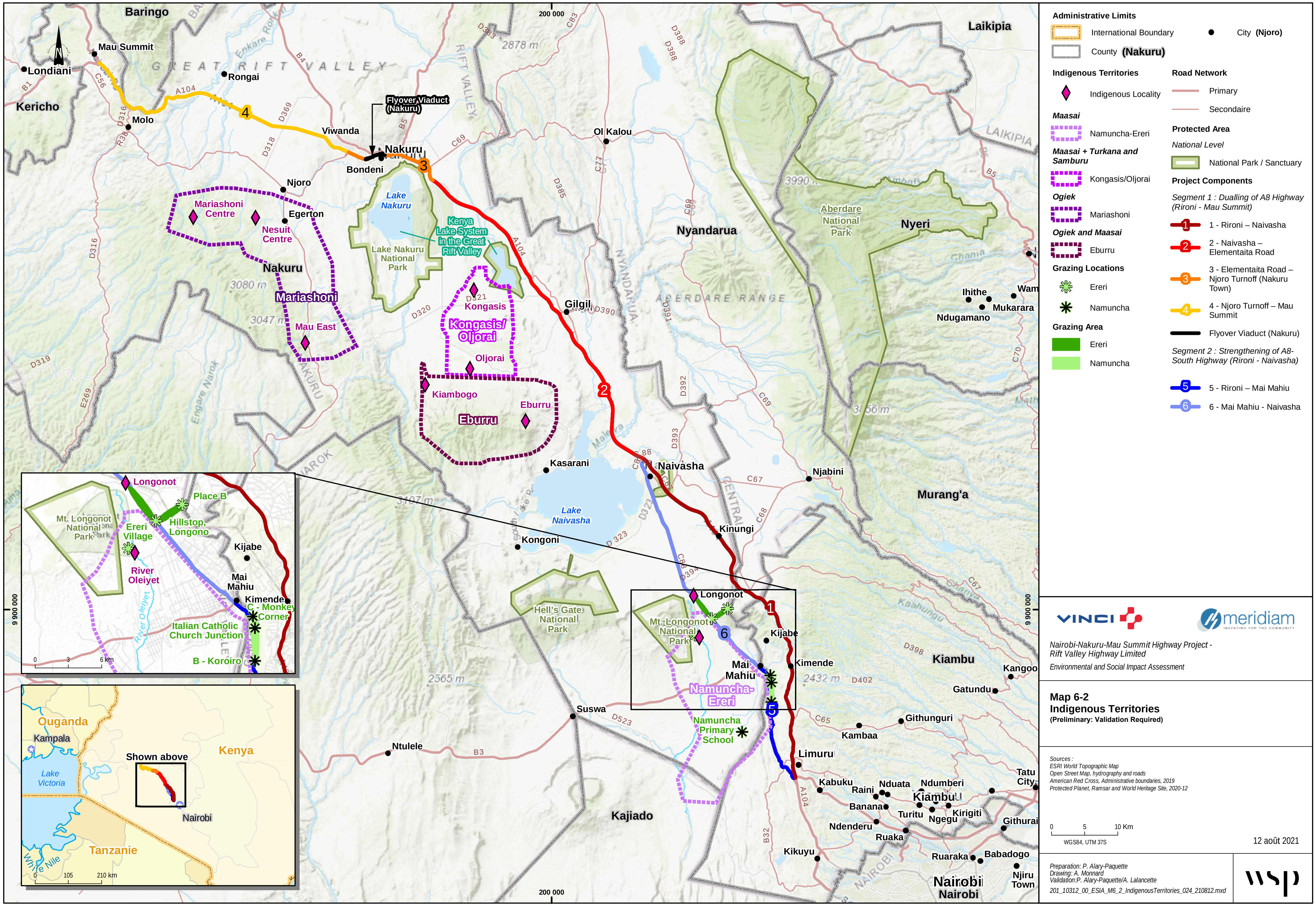
The Maasai population in Kenya is estimated at 1,189,522 (KNBS, 2019), representing 2.5% of the country's total population. However, it must be noted that most Maasai doubt these numbers. According to the Maasai Association (n.d.), many Maasai see the national census as government meddling and often miscount their numbers to census takers – some people want to be counted ten times while others refuse to be counted. Today, Maasailand comprises the arid and semi-arid rangelands spanning the border of southern Kenya and northern Tanzania (Figure 6-93) and covers a total land area of 160,000 square kilometers (Maasai Association, n.d.). Maasailand in Kenya is now roughly congruent with Narok and Kajiado Counties, although there are also some communities in neighbouring counties.

The Maasai are found along the Project corridor within the 15 km buffer in Nakuru, specifically in two settlements: one in Ereri village which is in the Nessuiet area, Longonot location, and another one in the Mai Mahiu location, in the Satellite sub-location which includes eight villages. The Maasai in the Longonot location are more remote and more traditional than those in the Mai Mahiu location, where the Maasai have more external exposure due to their proximity to Mai Mahiu Town.Two other communities including Maasai Peoples were identified in Nakuru close to the Project area: Eburru and Oljorai. These communities were consulted, and their concerns are outlined in Section 7.4. As these communities are located over 20 km away from the A8, they will not be directly affected by the Project. We therefore only provide specific information in this section on the communities in Longonot and Mai Mahiu.

The location of the four aforementioned Maasai communities, as well as Maasai territory subject to traditional ownership or under customary use are shown in Map 6-2. Note that the limits of the territory presented remains to be validated during the Round 3 Consultation scheduled with Indigenous People in January 2022. Population figures are a sensitive and politicized issue in Kenya. With that in mind, the estimated population provided by our informants is 3,000 for Mai Mahiu and 300 for Longonot (Ereri village).

Source: Ryan et al. (2009, p. 28)

Figure 6-93 Location and extent of contemporary Maasailand



Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.

The Maasai generally self-identify as “pure pastoralists”, despite engaging in agriculture and other livelihood diversification (Coast, 2002; Wijngaarden, 2012). Cattle and children are of the utmost importance to the Maasai and confer huge social, cultural and political prestige, encouraging them to have as many as possible (Maasai Association, n.d.; Parsitau, 2019).

The Maasai are monotheistic and worship a God named Enkai to whom they directly address daily prayers (Mollel, 2011). However, a growing number are now embracing Christianity, Pentecostalism in particular (Parsitau, 2019). This shift in religion is an important driver of cultural change in Maasai communities as the Maasai adopt certain aspects of Christianity and hybridize them with some of their traditional beliefs (Parsitau, 2019). In the Project area, Christianity has been embraced and there are numerous churches attended by the Maasai. Near Mai Mahiu location, the majority are from the African Inland Church, the Baptist Church and the Pentecostal Church. There is one church in Ereri village, Longonot, called Harvest which is attended by most of the practicing Christians.

HISTORICAL CAUSES OF MARGINALIZATION (OVERVIEW)

As is the case for many Indigenous Peoples worldwide, the Maasai have suffered through a history of dispossession and marginalization which continues to this day. Prior to the colonial period, the Maasai’s historical range extended much further than at the present day, especially in Kenya. In the nineteenth century, Maasailand stretched from northern Kenya down the broad plains and adjacent highlands of the Rift Valley to the Maasai Steppe in northern Tanzania (Spear & Waller, 1993).

During the colonial rule in Kenya, much land was appropriated from the Maasai through deception and use of force (Koissaba, 2016). Although almost every African community in the East African Protectorate lost land to the British, the Maasai lost the most due to the climatic and geographical conditions of the lands they occupied (Hughes, 2006). Following a series of successive moves, the Maasai were concentrated in the Southern Game Reserve in Narok and Kajiado Districts (Hughes 2006). As a result, several sections of Maasai pastoralists were alienated from their best dry season grazing land, losing prime water and grazing land around the Ngong Hills, and Lakes Nakuru and Naivasha (Hughes, 2006; Spear & Waller, 1993).

Further expropriation of land occurred for conservation through national park formation; first by the colonial government (e.g., Amboseli National Park and Maasai Mara National Reserve), and then continued post-independence up to this day (Bedelian, 2014). According to the Maasai Association (n.d.), national parks and reserves have been the greatest source of land loss, restricting Maasai access to critical water sources, pasture, and salt lick.

Livestock development and privatization policies caused further loss and alienation of Maasai pastoral land in Kenya (Koissaba, 2016). Customary land was transformed to private tenure and divided into Group Ranches and then further subdivided into individual titles. However, this process is more complex as both non-Maasai and Maasai elites have captured the benefits (Koissaba, 2016), creating tensions between wealthy and disadvantaged Maasai (Maasai Association, n.d.). In particular, women, youth, and other marginalized groups were left out of land allocations during subdivision and dispossessed of land altogether (Talle, 1988). Following subdivision, large tracts of land were acquired by non-Maasai leading to permanent loss of rights of access and restrictions on mobility for the Maasai as the new owners opt to fence or cultivate their land (Kimani & Pickard, 1998).

Tenure security has been an overriding concern of the Maasai both historically and currently (Bedelian, 2014). The transformation of Maasai land from customary to private and individual tenure alongside state alienation of land has resulted in Maasai displacement; growing loss of culture due to lack of land base; drastic increase in poverty; lack of, or poor, ineffective, political leadership; erosion of identity and self-determination; social problems; and heightened vulnerability to abuse and discrimination by the larger society (Koissaba, 2016; Olol-Dapash, 2001). The Maasai have actively attempted to defend their rights and seek redress, but challenges against unequal land allocations have generally been unsuccessful, in particular those against Group Ranches (Mwangi, 2007; Olol-Dapash, 2001).

POLITICAL AND SOCIAL ORGANIZATION

The economic and social conditions of the Maasai have changed throughout their history in response to a myriad of factors operating over a variety of spatial and temporal scales (Coast, 2002). And while they are undergoing tremendous social changes with colonization, modernity, monetization, education, globalization, and development, they have retained much of their culture and traditions. The Maasai aspire to protect their culture and identity which is intertwined with land issues (Koissaba, 2016) by embracing modernity on their own terms (Parsitau, 2019).

The Maasai are divided into different groups, clans and sub clans and their land consists of separate geographical sections (known in Maa as Iloshon). Each section is different politically and culturally with its own name, territory, dialect, ceremonies, ways of building houses and kraals, and leadership authority among others (Ole Saitoti, 1990).

Maasai society is heavily patriarchal and follows a system of social and political organization based on age sets without any centralized coercive authority (Parsitau, 2017, 2019). An age-set is a permanent unit formed by males of approximately the same age for the rest of their lives. They will move up through a hierarchy of three grades lasting approximately 15 years (i.e., boyhood, warriorhood, and elderhood), each of which requires them to perform certain duties and to follow certain behavioural norms (Kipuri, 2020; Parsitau, 2019). Each local age-set has its own political and ritual leaders who will remain in position for the entire age-set life (Kipuri, 2020). The age-set system continues to be the main social institution determining politics, religion, behaviours, and daily responsibilities in contemporary Maasai life (Mollel, 2011). Consideration of the different social stages is thus important in engaging with the Maasai and in evaluating social impacts.

Traditionally, uncircumcised boys (under 15 years old) provide the labour for routine herding activities while the main duty of warriors is to protect the community, their livestock and properties from both people and animal invaders (Mollel, 2011; Parsitau, 2019). During the dry season, warriors are also responsible for moving cattle to suitable grazing and watering locations. Traditionally, warriors organized cattle raids, but this is no longer the case due to Kenyan laws banning livestock theft (Mollel, 2011). Much of the time, they are needed for simple tasks like capturing a cow to be slaughtered, building a thorn fence to protect livestock and people from wildlife, or clearing sand from wells (Mollel, 2011). Finally, elders are directors and advisors for day-to-day activities for the Maasai tribe, and teach, direct, and supervise the younger generations (Kipuri, 2020; Maasai Association, n.d.). They are deeply respected and wield tremendous political and spiritual power (Mollel, 2011; Parsitau, 2019).

The age-set system has remained much the same except for a shortening of the time during which young men remain warriors to adapt to the schedule imposed by the school system (Kipuri, 2020). Since many boys were no longer able to participate in the age-set system, some sections have designed mechanisms to induct the youth and impart some lessons during school holidays. While some are managing this transition, others are facing some expected challenges (Kipuri, 2020).

LIVING ARRANGEMENTS AND COMMUNICATION TECHNOLOGY

The Maasai homestead consists of a circular enclosure surrounded by a thorn bush fence to protect people and livestock. The size of the camp and the number of gates it has depends on the number of families it comprises. The first wife will build her house on the right-hand side of her family's cattle entrance, the second wife on the left-hand side, the third on the right and so on. Traditionally, each of these camps or homesteads would hold many independent and not necessarily related families, but single-household homesteads are becoming the norm (Coast, 2002; Kipuri, 2020).

Maasai houses are rectangular with a slightly domed roof and are traditionally made from a mixture of dung and mud, smeared on a wooden frame, referred to as manyattas (Coast, 2002; Kipuri, 2020). New housing materials are increasingly being used, such as iron sheets as Maasai's level of transhumance decrease and their access to cash improves (Coast, 2002).

The Maasai in Mai Mahiu location have four organized group ranches, namely: Namuncha, Oiti, Elwai, and Osero Group Ranches. These ranches were subdivided in individual parcels. Members have shares in the group and ownership certificates. The livestock are kept in individual parcels, but Maasai owners can sell their land to interested buyers. Many Maasai have done so and, as a result, space is limited. Ereri village is located within Enkutoto Osinoni Group Ranch. This ranch was not subdivided into individual parcels and it is where the community lives. In both locations, the Maasai live in single-family households with most houses being manyattas. Houses with iron sheet roofs, but with thatched walls have started to appear, but there are very few.

The great majority of Maasai have access to basic mobile phones. In the Project area, consultation participants all had a phone with them. However, internet access is very limited, especially in the more remote areas. The latter is an important consideration for designing an appropriate Grievance Redress Mechanism that will allow for the plaintiff to remain anonymous.

GENDER DIVISION AND ISSUES

Women in Maasai society do not have formal age sets like men, although they also go through specific stages during their life (Kipuri, 2020). Females are commonly differentiated according to their circumcision status which marks the passage from girl to womanhood (Coast, 2002; Parsitau, 2017). Although significant work in Kenya has focused on the elimination of Female Genital Mutilation (FGM), also known as Female Genital Cutting (FGC), it continues to be prominent among the Maasai (Parsitau, 2017). Female circumcision is considered a prerequisite for marriage and Maasai girls are typically circumcised between ages 11-13 (Parsitau, 2017). Soon afterwards, they are married to a man chosen by the father (Koissaba, 2013; Parsitau, 2017). They then become associated with the age-set of their husband and, in effect, sexually become the wife of the whole age-set (Mollel, 2011). This practice is, however, fading in the wake of high HIV/AIDS infection rates as Maasai are becoming educated about reproductive health. Traditionally, the Maasai are polygamous. Men strive to marry many wives and have many children to increase their status in the community and to cope with labour demands (Parsitau, 2019). However, this is also changing with the rising adoption of Christianity which promotes monogamous ideals, impacting women and family dynamics (Parsitau, 2019).

In terms of labour, women are responsible for building and maintaining the house (by smearing a water and mud/dung mixture once the walls dry out or repairing the roof when it leaks). Other responsibilities include caring for children, fetching firewood and water, cooking for the family, and milking animals (Coast, 2002; Kelliher, 2018). Although grazing and watering livestock is normally associated with men, women will often contribute to these tasks (Kipuri, 2020). Maasai women are also responsible for milking and sometimes selling surplus (Coast, 2002). These chores are representative of those carried out by women in the Project area. Indeed, our informants in both Mai Mahiu location and Ereri, Longonot indicated that women build the house, herd cattle, fetch firewood and water and take care of all the household chores. In cases where new materials are used and specialized skills are required to build the house, women will remain in charge and oversee the work done by men.

At the level of the house, Maasai women possess relatively high levels of autonomy in terms of domestic affairs and the family economy (Coast, 2002). However, they lack access to political power as they tend to be excluded explicitly or implicitly from community decision-making (Parsitau, 2019).

Parsitau (2019) argues that Maasai women and girls are among the poorest and most marginalized groups in Kenya due to lack of property ownership rights (e.g., land, livestock and other productive assets), access to social services, and decision-making power such as marriage, number of children, education and access to healthcare services. They are submitted to harmful practices such as early marriage and FGM which are important contributing factors to Maasai girls' education in Kenya being extremely weak compared to the national average for girls in the country (Parsitau, 2017). Finally, women have very few opportunities to earn income and are far less integrated within the market economy than men. These tend to be limited to selling traditional clothing and beadwork for tourists (mostly through middlemen rather than directly), and small-scale shop keeping selling household essentials (Coast, 2002; Kelliher, 2018) (more details on women livelihoods below).

LIVELIHOODS AND LAND USE

Traditionally, the Maasai own and utilize natural resources within their land communally where each section (Iloshon) manages its own territory (Maasai Association, n.d.; Seno & Shaw, 2002). There were customary rules about the rights to use the land and no rules allowing an individual or corporate entity to own land (Koissaba, 2016). The movement of livestock and people is based on seasonal rotation: dry-season pastures are closed to all members of the community and guarded by the warriors until forage is no longer available elsewhere (Maasai Association, n.d.; Seno & Shaw, 2002). Under the collective customary tenure system, access to pastures and water is enforced through a council of senior elders and Maasai from different groups cannot enter another group's area without permission (Seno & Shaw, 2002). In principle, however, permission is always granted. For example, if the dry season becomes especially harsh, people graze animals throughout the land until the rainy season arrives (Maasai Association, n.d.). The Maasai recognize that by allowing others into their areas they create a reciprocal right, which is vital to their livestock production strategies (Seno & Shaw, 2002).

As pastoralists, livestock are of great subsistence, economic, social and cultural importance for the Maasai. Traditionally, they were reliant on livestock products of meat, milk and blood for subsistence. Cattle were, and still are, used in bride wealth, stock exchanges, and for gifts amongst friends and relatives (Kipuri, 2020). Despite the centrality of livestock in their diet, it is likely that most Maasai also relied on agricultural products for part of their subsistence during every dry season, or as a result of the loss of livestock due to disease, drought or raids (Berntsen, 1976). As economic or environmental conditions compelled them, individuals would shift between the subsistence modes of herding, farming and hunter-gathering, or rely on trade with neighbouring tribes to meet their needs (Berntsen 1976).

Maasai livestock population has steadily declined throughout the years due to overall loss of land, subdivision of land into parcels that cannot sustain livestock, restricted mobility (due to fences around individual land), and increasing dependence on the market economy (Coast, 2002; Maasai Association, n.d.). As a result, the Maasai had to diversify and engage in new livelihood strategies. The level of reliance on herding, transhumance, and diversification vary greatly among the Maasai and this is also seen between the two communities directly affected by the Project.

In Ereri, Longonot, pastoralism remains the main source of livelihood and cattle ownership is very significant. During the wet season (February-July), they will bring their animals to graze along the highway A8 South between Longonot Town and Hill Stop where they cross the road to access the forest (Map 6-2). During the dry season, families in groups of two to three will combine their herds together and hire a Maasai herdsman. The herdsman will leave with their livestock for grazing for 3-4 months (September-November), traveling hundreds of kilometers on foot and staying at other Maasai's houses along the way. Herdsmen will mainly graze along the two following trails:

- Naivasha – Nakuru – Njoro – Mau Narok – Narok – Ereri: a total of 320 km;
- Naivasha –30 km – Gilgil – 40 km – Kinangop –35 km- Naivasha – 25 km –Ereri: a total of 130 km.

During these travels, the herdsmen may cross the A8 Highway at one known location that is in the Kamandura area where they cross using an existing viaduct (to be maintained by the current Project) at the level of the junction between the A8 and A8 South Highways.

While the herd is gone, the remaining families will venture in other businesses. These include selling animals to Longonot and Suswa markets and to slaughterhouses in Mai Mahiu and Dagoretti, Nairobi area, and working as sand harvesters in Mai Mahiu. The latter is a significant activity for employing Maasai youth (18-35 years old). Even though Mai Mahiu is located approximately 20 km away from their village, Maasai from Ereri, Longonot, will walk to Mai Mahiu for income-generating activities and watering their animals during the dry season.

Maasai in Ereri, Longonot, practice small-scale agriculture where they plant maize and kale (vegetables) for subsistence and beans for commercial and subsistence purposes. Due to the seasonal status of the river Oleiyet, they practice rain-fed agriculture during the rainy seasons. There are no opportunities for them to directly participate or benefit from tourism, as all activities in the nearby Mount Longonot National Park are controlled by Kenya Wildlife Services (KWS). Women opportunities to generate income are limited to selling beads and artwork and traditional clothing (e.g., shukas) to tourists through middlemen.

Being located close to Mai Mahiu Town, there are more income diversification opportunities available to the Maasai in Mai Mahiu location. Pastoralism is no longer the primary source of livelihood but remains culturally important. Traditionally, cows were the preferred livestock and the one that brought prestige. However, in Mai Mahiu location, the number of cows is greatly reduced. The Maasai sold most of their land and have turned to goats (which are more adaptable to semi-arid conditions and require less land), and also to sheep. During the wet season, they will herd in the forest 2-3 times per week, traveling about 25 km moving back and forth (Map 6-2). Despite being a semi-arid area, they will also herd around Namuncha village in the Mai Mahiu location when not in the forest, and sometimes use the group ranches for grazing. Those who own cows will follow the same strategy as in Ereri, Longonot, during the dry season, i.e., hiring a herdsman to oversee grazing. The herdsmen will travel for around 5 months to Naivasha – Nakuru – Njoro – Mau Narok – Narok and back to Mai Mahiu, a total of 320 km. Agriculture is practiced for subsistence only and includes mainly vegetables.

The main source of livelihood in Mai Mahiu location is now the sand business. Quarries are controlled by business groups composed of landowners from a mix of different communities (i.e., not exclusively Maasai). Once land is open for quarry, it is no longer controlled by the Maasai elders, but by the business group as a whole. Middlemen connect sand buyers with the quarry group business. Employment as sand harvesters is very significant for the male Maasai youth in the village.

Other economic activities in Mai Mahiu location include supplying meat to the numerous hotels in Mai Mahiu Townand to the slaughterhouses in Mai Mahiu Town and Dagoretti. Selling beads and artwork and traditional clothing (e.g., shukas) in curio shops along the A8 South is another important source of income. Our survey with these shops has revealed that these are lucrative businesses. This is a mixed gender activity, but it is particularly significant for women. As one of the few and best opportunities for them to generate income, women are concerned that they will be displaced during the construction work and not be able to return. As such, they have requested stalls along the A8 South to secure the legality of this livelihood activity. In addition, some women have small shops in town where they sell household goods, but this is marginal compared to the economic importance of curio shops. Finally, the community chairs and is a member of the forest Community-based Organization (CBO) Ilparkuo which promotes conservation and offers ecotourism activities. They receive an average of 10 local tourists per month (mainly from Nairobi) to go hiking in the hills from the Italian Catholic Church junction to Kamirithu, charging 400 shillings per person for the 20 km hike. The collected fees support the CBO’s activities (e.g., training, planting trees, conservation) as well as the employment of Mai Mahiu Maasai tour guides.

6.4.8.2 THE OGIEK PEOPLE

GENERAL CHARACTERISTICS

The Ogiek are hunters-gatherers belonging to the Nilo-Saharan, Nilotic, Southern, Kalenjin group (Micheli, 2014a). The Ogiek were denied recognition as a tribe in Kenya until 2017. The African Court on Human Rights and Peoples’ Rights stated that the Ogiek’s were an Indigenous population that were a part of the people of Kenya having a particular status and deserving special protection derived from their vulnerability. They are recognized as an Indigenous People by various UN fora such as the UN Permanent Forum on Indigenous Issues, and by the African Development Bank (African Development Bank Group, 2016).

The Ogiek live in scattered enclaves between Kenya and Tanzania, where they are called the Akie. (Micheli, 2014b). The two groups live separately and have no connection with their counterpart in the other country (Micheli, 2014b).

The Ogiek in Kenya live in the Rift Valley Province, in Nakuru District and in the area of the East Mau Escarpment, in the Mau Forest and its surrounding area, and around Mount Elgon near the Ugandan border (Blackburn, 1982). According to the latest Census (KNBS, 2019), there are around 53,000 Ogiek in Kenya of which about 45,000 are from Mau and have the Mau Forest as their ancestral land (Kobei et al., 2020). The Mau Forest Complex is approximately 4,000 km^2 and is administered under 22 blocks including the Maasai Mau (Kobei et al., 2020). Currently, the majority of Ogiek are living in the Mariashoni District (Molo Sub County, Nakuru County), an area covering about 250 km^2 (Micheli, 2014a; Zocchi et al., 2020). Of the 12,000 people living in the Mariashoni area in 2014, (among them Kikuyu, Kipsigis and Nandi), 4,000 were Ogiek (Micheli, 2014a). The Ogiek of Mariashoni are distributed in small locations of about 20 to 30 people, located sometimes at the fringes of the forest or inside the forest itself (Micheli, 2014b).

The location of the Ogiek community in Mariashoni as well as their territory subject to traditional ownership or under customary use are shown in Map 6-2. Note that the limits of the territory presented remains to be validated during the Round 3 Consultation scheduled with Indigenous People in January 2022. Mariashoni is located approximately 18 km South from the A8 highway. Community members have confirmed that they will not be directly impacted by the Project. Nevertheless, we provide a brief baseline to facilitate impact evaluation since they are particularly vulnerable due to issues stemming from landlessness and have various court cases pending in relation to land dispossession and human rights violations (e.g., forced evictions).

The Ogiek customarily relied on the forest, practising mobile beekeeping and hunting as their main subsistence activities (Micheli, 2014b). Honey and beekeeping were central to their economic, social, cultural and religious life (Blackburn, 1982; Sang, 2001), and are core elements of their identity along with their hunting system (Micheli, 2014b). They are intimately related to the forest and uniquely specialized, holding deep knowledge of their ecosystem (Sang, 2001; Zocchi et al., 2020). In fact, Ogiek literally means “the caretaker of all plants and wild animals”. Ogiek adaptations to the forest and traditions have made them successful foresters and environmentalists. The survival of the Mau Forest and of the Ogiek Peoples are inextricably linked (Sang, 2001; Zocchi et al., 2020).

The Ogiek of Mariashoni call God Asista, the sun. Traditionally, they did not believe that human beings come from anywhere outside this world, nor in a soul that continues on after death (Micheli, 2014b). Nowadays, the great majority of Ogiek in Mariashoni declare to be Christian while also being initiated to and practicing traditional religion (Micheli, 2014a).

OVERVIEW OF HISTORICAL CAUSES OF MARGINALIZATION

Sang (2001) has argued that as the last remaining forest dwellers, the Ogiek are the most marginalized of all Indigenous Peoples and minorities in Kenya. Historically, hunter gatherers in East Africa, including the Ogiek, had lower prestige in terms of political, cultural and economic power than their pastoralist and farmer neighbours (e.g., the Maasai, Nandi, and Kipsigis) (Micheli, 2014b). This lower status led these powerful neighbours to define them as dorobo, which is a Maasai term meaning small and servant (Micheli, 2014b). In order to survive as a discrete group and to maintain intact with their ethnic identity, the Ogiek adopted an attitude of flexibility and adaptation. They were thus able to develop close relationships with neighbouring farmer and pastoralist communities, allowing them to barter basic goods in order to grant one another survival in a difficult habitat (Blackburn, 1982; Micheli, 2014b). Despite having their own distinct culture, the Ogiek’ adaptability has resulted in a flux, flexible, and uneasily describable identity (Micheli, 2014b), which may have contributed to their dismissal as a tribe by the British Protectorate.

The wide dispersal of the Ogiek split them into small defenceless groups prone to attack by other stronger close-knit tribes (Sang, 2001). However, the Ogiek of Mariashoni were able to live relatively undisturbed until the mid-1970s because their territory, the Mau Forest, was not interesting for their farmer and pastoralist neighbours and violence from these groups was usually limited to some very sporadic episodes (Micheli, 2014b).

Due to their small numbers, the Ogiek have historically been an easy target for those seeking land on which to farm or graze – both Indigenous and white settlers (Sang, 2001). When the British carved areas of Kenya into reserves for the various tribes, the Ogiek were excluded as they lived in small scattered groups over large areas and did not appear to have any property (Sang, 2001), rendering them landless on paper.

During their rule, the British colonial administration conducted several coercive evictions of the Ogiek from their ancestral lands, many of which were unsuccessful as the Ogiek managed to remain or return to the forest (Sang, 2001). They also attempted to disperse the Ogiek to various locations in order to have them assimilated by bigger tribes (Sang, 2001). The Ogiek endured significant harassment, violence, and dispossession.

During British colonial rule and later after Kenyan independence, the relationship between the Ogiek and the forest changed with the creation of natural reserves and the encroachment of economic and extractive activities, such as small-scale agriculture, tea cultivation, and exotic tree plantations (Sang, 2001). Following independence in 1963, the Kenyan government accused the Ogiek of being illegal squatters in the Mau Forest (Langat et al., 2016; Sang, 2001). The Ogiek were progressively evicted and resettled at mid-altitude (Kimaiyo, 2004). As many hectares of forest are turned into cultivated land each year, the traditional habitat of the Ogiek becomes poorer with the disappearance of game and of species key to the production of honey, rendering the issue of survival urgent and real (Micheli, 2014b). Since the beginning of the 1900s, the Ogiek have thus been forced to integrate farming and stock rearing to their traditional activities in order not to starve (Kimaiyo, 2004; Micheli, 2014b).

The Ogiek eventually filed a constitutional case against the Kenyan government in 1997, and in 2017, the African Court on Human Rights and Peoples' Rights recognized the Mau Forest as the ancestral home of the Ogiek and their role in safeguarding it. It also found seven separate violations of the African Charter on Human and Peoples' Rights, including the Ogiek's rights to non-discrimination, property, culture, religion, natural resources and development (Kobei et al., 2020).

Despite the Court's findings, Kenyan institutions have yet to remedy Ogiek rights (Mamo, 2021). The Ogiek are entitled to restitution of their ancestral land, compensation for the damage suffered, full recognition as an Indigenous People of Kenya, and the enacting of legislative and other measures to ensure their right to be effectively consulted on issues which concern them (Kobei et al., 2020). Implementation of the Court's recommendations have been extremely slow, and forcible evictions and repeated incidents of harassment have continued. For example, in 2020, the African Commission on Human and Peoples' rights (ACHPR) received reports of Ogieks having been forcibly evicted from their homes, which were also destroyed. The ACHPR was particularly concerned by the socio-economic impact of these evictions and destruction of property of people who rely on subsistence farming, especially amidst the ongoing Covid-19 pandemic, leaving some of the most vulnerable persons in society without shelter and access to sanitation, and further exposing them to arrest for not adhering to curfews (Mamo, 2021).

LIVELIHOODS AND LAND USE

The Ogiek have been living in Mau Forest since time immemorial on communally held pieces of land, which were administered through councils of Elders selected according to clan and family units (Sang, 2001). Each Ogiek clan had exclusive rights to its transects of land, which comprised ecological zones located at different altitudes in the forest (Blackburn, 1982). Customary land tenure was partially destroyed during the colonial administration, when the exotic tree plantations were introduced, weakening the Ogiek's direct control of the forest (Sang, 2001).

The Ogiek are traditionally honey gatherers, who survived mainly on wild fruits and roots, game hunting always with their dogs using bow and arrows and traps, and traditional beekeeping. Until around the 1990s, they used to live as seminomadic groups, following the migrations of bees from the Highlands to the Lowlands of the Mau Eastern Escarpment, spending more or less six months on each side (Micheli, 2014b). Thousands of log hives were spread across the forest, located high up in specific trees, and honey production relied on the spontaneous occupation of the hives by swarms of bees tracking flowering plants in different seasons, in different forest habitats (Blackburn, 1971).

Beekeeping was a male-dominated activity, with men in charge of the log hive construction and placement, as well as honey harvesting. Women helped to carry honey from the forest to the homestead and move the hives from one location to another inside the forest (Huntingford, 1955). Honey from specific plants was used for brewing honey mead, as a natural preservative for wild meat, and as an ingredient for medicinal preparations. Honey and its derivatives also played a central role in traditional rituals, e.g., in circumcision ceremonies and dowry payments, and as items of local exchange with neighbouring communities, such as the Maasai (Blackburn, 1982; Huntingford, 1955).

A century of displacement, replacement and negotiation of their relationship with the forest has led the Ogiek to a more sedentary life, thus reducing their reliance on the forest itself (Micheli, 2014a). At the same time, they shifted from a subsistence model based on hunting and gathering to a system that integrates traditional livelihood activities with cash crop farming.

While in the past honey was used for domestic consumption and informal exchanges, it has now become an important source of income for Ogiek families. Mariashoni village is one of the most important trade and business centres in the Eastern Mau Forest region. Honey is traded locally and in the nearest towns, from where it is then transported to major cities such as Nakuru and Nairobi (Zocchi et al., 2020).

The Ogiek of Mariashoni are involved in both an extensive beekeeping system based on traditional log hives and an intensive one based on modern beehives (Zocchi et al., 2020). Modern and traditional hives are not used interchangeably but rather their use depends on several variables such as differential accessibility to hives and/or the material and skills to build them, intended ecological location, primary purpose (e.g., home consumption, income generation) and social and cultural aspects (e.g., attachment to Ogiek cultural identity, food and medicinal properties of honey, etc.) (Zocchi et al., 2020). While beekeeping among the Ogiek remains a male-dominated activity, the introduction of modern hives has facilitated women's involvement in apiculture (Zocchi et al., 2020).

Because much of the spatial differentiation in the Mau landscape is vertical, with the agricultural frontier pushing into the forest from lower to higher altitudes, log hives predominate over modern hives at higher altitudes, and vice versa (Zocchi et al., 2020). Some beekeepers moved a part of their log hives from the forest to the lowlands, close to their homesteads. In doing so, they avoid travelling long distances to reach their hives in the forest and they have more time for crop farming and livestock rearing (Zocchi et al., 2020). Crops cultivated by the Ogiek of Mariashoni include cabbage, potato, pea, and kale.

There are three Ogiek Community-based Organizations (CBOs) working in Mariashoni, focusing among other things on supporting Ogiek honey businesses, forest conservation and youth employment. CBO officials have indicated that the transportation of honey and of perishable fresh produce to markets has been challenging due to poor transportation. The Project has thus the potential to significantly improve Ogiek livelihoods by improving access to external markets. However, while the Ogiek of Mariashoni is directly negatively affected due to their distance from the Project, they will not benefit from it either unless they are better connected to the highway.

6.4.8.3 THE TURKANA AND SAMBURU PEOPLES

The Turkana and Samburu Peoples are both Nilotic Peoples from Northern Kenya and pastoralists. They are also recognized as Indigenous Peoples by the UN Permanent Forum on Indigenous Issues and by the African Development Bank (African Development Bank Group, 2016). According to the 2019 Census (KNBS, 2019), the Turkana population number 1,016,174 and the Samburu 333,471. In the 1980s, some of them moved from their ancestral lands to the Project area and are found in Oljorai (which is approximately 29 km south of the A8) along with some Maasai people (see Map 6-2). As recent migrants to the area, they are not subject to the FPIC process since the territory in question is not their ancestral lands nor subject to customary occupation or use. However, as Indigenous Peoples, IFC PS7 requires that they are involved in a process of Informed Consultation and Participation (see Indigenous Peoples Plan). As such, their concerns are presented with those of the Maasai and Ogiek of the Eburru community in Section 7.4.5.

6.4.8.4 COVID-19 IMPACTS ON VMGS IN KENYA

The Covid-19 pandemic presents a new threat to the health and survival of Indigenous Peoples in Kenya. Due to the remoteness and vastness of the areas occupied by Indigenous Peoples, their access to health services are inadequate, making them the most vulnerable health category in the country (Mamo, 2021). The information presented above must thus be interpreted in the evolving context imposed by Covid-19.

The Ministry of Health developed a strategy to provide national statistics on Covid-19, but they do not disaggregate the data in a way that Indigenous Peoples can be identified. Due to the lack of mass testing equipment and the remoteness of the areas in which Indigenous Peoples live, relatively few COVID-19 cases were detected or reported among Indigenous Peoples (Mamo, 2021).

Indigenous Peoples who already face food insecurity as a result of the ongoing dispossession and loss of their traditional lands and territories also now face loss of their livelihoods, which form the main base for their subsistence. The interaction between Indigenous Peoples and other communities, and the exchange of goods and services were seriously and negatively impacted due to the closure of markets and the stringent Covid-19 curfew rules (Mamo, 2021). The income that Indigenous People predominantly depend on from livestock trading, sales of honey and other products declined rapidly (Mamo, 2021). For example, it is reported that the Maasai of Kenya had to close livestock markets and, as a result, the pastoral production system was stopped (Wight, 2020). The interruption in the movement of goods and services due to the lockdown increased the food insecurity of Indigenous Peoples since they could no longer purchase alternative foods such as cereals, which they normally purchase on market days (Mamo, 2021). Although inter-communal sale of livestock continued, the prices were lower than usual (Mamo, 2021). The pandemic also negatively impacted Indigenous youth engaged in formal employment within the tourism industry as travel restrictions and lockdowns has led to the closure of tourism facilities and businesses (Mamo, 2021). The pastoral tour guides who depend on this wildlife tourism industry have lost touch with their traditional livelihood systems and have therefore been left without a fallback option (Mamo, 2021).

On the one hand, the Covid-19 pandemic has offered some opportunities for reviving traditional medicine as a preventive measure and spark innovation among Indigenous communities (Mamo, 2021). On the other hand, Covid-19 containment measures are said to have led to Indigenous People human rights violations and brutality by security forces, and increases in crimes and homicides, gender-based violence, physical battering and sexual harassment and rapes, early pregnancies among school-going girls, school drop-outs among youth, together with a loss of economic livelihoods and increased unemployment (Mamo, 2021).

6.4.9 GENDER ASPECTS

Kenya is a patriarchal society. This model is dominant, especially in the rural areas. Roles and responsibilities are well defined between men and women. A man is expected to provide financial support to his family while expectations about a woman relate to household chores and raising the family.

Results from the social survey show a similar portrait of the division of roles and responsibilities among surveyed households. Figure 6-94 shows the distribution of the responsibilities by gender. Although men participate in household chores, women seem to assume the majority of these chores. Men are more present for house maintenance, educating their children, and doing groceries.

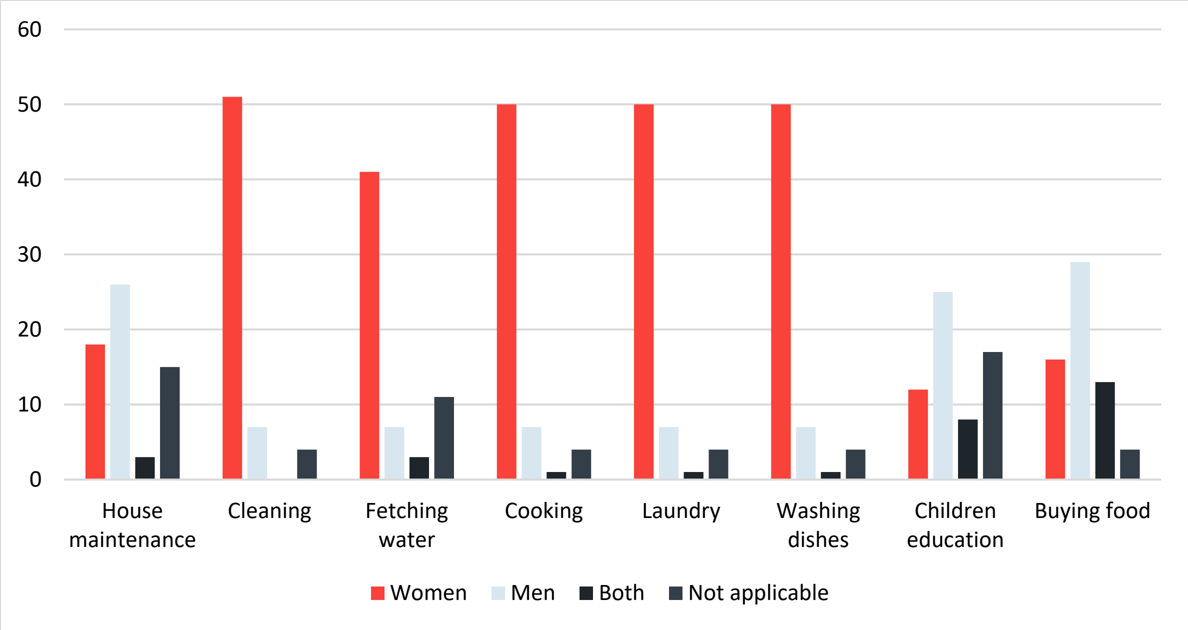


Figure 6-94 Distribution of chores performed by gender among surveyed households

This gender-based distribution of the roles leads to inequality. The responsibilities assigned to women limit their access to decision-making positions and restrict their involvement in areas such as socioeconomic development. Despite an improvement in recent years, especially for equal access to education, women are still facing challenges to access education at a higher level, land, and employment. These challenges are greater for women living in rural areas, where traditional roles are more entrenched compared to urban areas. Key informants and Chiefs interviewed during the social survey identified women as a vulnerable group, especially those who are single mothers or widows.

The Government of Kenya has made significant changes in recent years to promote girls' and women's rights. Among the actions undertaken, the new Constitution, promulgated in 2010, provides a framework to address gender equality. The Constitution of 2010 recognizes women's rights as human rights. The Bill of Rights included in the Constitution states: "Every person is equal before the law and has the rights to equal protection and benefit of the law. Women and men have the right to equal treatment, including the right to equal opportunities in political, economic, cultural and social spheres".

The creation of County Governments brought significant changes by bringing many women into public leadership positions (NGEC, 2017). Furthermore, women are able to gain recognition to equality in marriage, in parental responsibility, in employment, and in access to education. As a result, the proportion of women in politics increased from 8.1% in 2002 to 19.8% in 2013. The number of girls attending school has also increased (see Table 6-58, presented in Section 6.4.2.2).

6.4.9.1 GENDER BASED VIOLENCE (GBV)

According to the World Bank Guidance Good Practice Note on Gender-Based Violence (2020), GBV is an umbrella term for any harmful act that is perpetrated against a person's will and that is based on socially ascribed gender differences. GBV includes acts that inflict physical, sexual or mental harm or suffering, threats of such acts, coercion and other deprivations of liberty, whether occurring in public or private life. GBV arises when consent is not voluntarily and freely given. GBV can take different forms such as:

- Defilement, child pregnancies and early marriages, trafficking and child labour;
- Workplace sexual harassment;
- Physical violence, emotional abuse (humiliation, controlling behavior, insults, threats), economic abuse and denial of resources, services and opportunities (restricting access to financial, health, educational, or other resources with the purpose of controlling or subjugating a person).

KENYAN GOVERNMENT APPROACH AGAINST SEXUAL AND GENDER BASED VIOLENCE

Sexual and Gender Based Violence (SGBV) is a growing concern for lenders and the Kenyan government. SGBV was identified as a key priority following the National Commission of Gender and Development in 2010. Since then, SGBV became the centre of attention of many policies and country-wide strategies. Due to the presence of large work forces formed by men with paid wages, many projects, such as road projects, represent a risk that prevailing SGBV may worsen.

The Government of Kenya published several strategic and policy documents setting objectives reducing gender inequality and GBV, and to promote gender mainstreaming such as:

- *National Guidelines on the Management of Sexual Violence* (2014) : The guidelines provide essential information on management of sexual violence in a multidimensional manner. It gives medical and psychosocial practitioners information on procedures to be followed when treating a survivor of sexual violence;
- *National Monitoring and Evaluation Framework towards the Prevention of and Response to Sexual and Gender-Based Violence in Kenya* (2014): The framework aims to establish one integrated and functional SGBV multi-sectoral monitoring and evaluation system; to monitor and evaluate national efforts in the prevention and response to SGBV; and to contribute to evidence-informed funding, advocacy, decision-making and programming;
- *National Policy for Prevention and Response to Gender-Based Violence* (2014): The purpose of this policy is to put in place a framework to accelerate the implementation of laws, policies and programs for prevention and response to GBV by state and non-state actors;
- *County Government Policy on Sexual and Gender-Based Violence* (2017): The purpose of this policy is to put a framework in place to accelerate the implementation of laws, policies and programs that will prevent and respond to SGBV. The County government aims to work with National and international partners as well as other relevant stakeholders.

SGBV IN KENYA AND CONTRIBUTING FACTORS

According to the Kenyan Demographic Health Survey (2014), it is estimated that:

- 45% of women aged 15 to 49 have experienced either physical or sexual violence;
- 14% of women aged 15 to 49 report having experienced sexual violence at least once in their lifetime;
- Overall, 39% of ever-married women aged 15 to 49 report having experienced spousal violence (physical or sexual);
- 44% of women have sought assistance to stop the violence they have faced.

The main contributing factors to SGBV are:

- Unequal power relations between men and women, sociocultural norms that normalize and tolerate GBV. These sociocultural norms are early child marriages, forced marriages, widow inheritance, disinheritance, infanticide, virginity testing and ritual killings;
- Poverty, illiteracy, breakdown of the family unit and support systems, insecurity, alcohol and substance abuse;
- Strong economic dependency of women.

More specifically to the study area and along Kenya's road network, prostitution along roads is common. In fact, SGBV is increased by the presence of male truck drivers and truck stops with bars and hostels. SGBV also occurs regularly in public transportation (vehicles, bus stations) affecting female commuters (Flone Initiative, 2018).

According to the interviews led with Key informants and Chiefs from the study area, 55% of the respondents (11 respondents on 20) mentioned that the initial road construction brought GBV. The majority of them (70%) believe that the road brings social problems such as prostitution, human trafficking, sexual abuse and GBV. A proportion of 60% of the respondents expressed concern about an increase of GBV during the road upgrade.

Concerns were also raised during the first round of consultations. Stakeholders who met mentioned the alcohol and drug abuse (ADA) as an emerging problem in the area. They had concerns regarding the rise of ADA and a higher risk of gender-based violence occurrence. They recommended that mitigation measures be taken to prevent a rise of substance abuse, and also to address the risk of potential sexual harassment and gender-based violence by foreign workers during the construction phase.

This risk is acknowledged by KeNHA who commissioned a study in 2019, funded by the AfDB, to identify potential gender barriers and gender inequalities in road infrastructure projects. This study details several types of impacts on women such as gender-based violence (GBV) as a result of in road design and construction (KeNHA, 2019a).

RESULTS FROM THE SOCIAL SURVEY

Interviews conducted with Key informants and Chiefs reveal that cases of gender-based violence were reported when the road was first built. It has resulted in marital conflicts, sexual violence and abuse towards women, especially young ones. Cases of child abuse have also been reported. 14 respondents out of 20 believe that these roads create problems such as prostitution, human trafficking or GBV. According to them, it is mainly caused by poverty and lack of employment opportunities for young women, which lead them to turn to prostitution to earn money and sustain themselves. The ease of movement from the city to the locations created by the road also contributes to sexual exploitation. Concerns are also shared about the road upgrade and the risk of increasing GBV cases. They are concerned about substance abuse increasing, which could also lead to GBV.

Only one household surveyed mentioned that cases of GBV had occurred during the road construction. Two women street vendors have mentioned facing gender-based violence from men while they were working.

6.4.10 PUBLIC INFRASTRUCTURE AND SERVICES

6.4.10.1 ROADS

Considering its position in the Eastern region, Kenya plays a key role in the interconnectivity of the region. Neighboring countries, such as Uganda, Ethiopia and South Sudan, are highly dependent on the Kenyan road system, given their landlocked position. The Kenyan road network is about 177,800 km long, of which only 63,575 km is part of the classified road network (KeNHA, 2021). The classified road network is divided into six categories: Class A – International Trunk Roads; Class B – National Roads; Class C – Primary Roads; Class D – Secondary Roads; Class E – Minor Roads; and Special Purpose Roads.

The A8 and A8 South are classified as “Class A roads, International Trunk Roads” and part of the trans-African road network. Moreover, the highways connect with a significant number of other roads, making it a central artery for transportation in Kenya. As described in Section 4.4.6, the Project area includes 14 crossroads on the A8 and 9 crossroads on the A8 South with category A, B, C, and strategic class D roads. These numbers therefore do not include some class D roads of lesser importance and minor roads. Both highways are thus high-volume roads extensively used by trucks transporting goods for long distances. Tables 6-77 and 6-78 present the amount of light and heavy vehicles transiting on the highway per day by section. Due to the pandemic, data from 2020 were not representative and we therefore present data from 2017 (RVH, 2021).

A traffic survey undertaken on August 15-20, 2021 for the Roadside Stations Project along the Northern Corridor obtained similar figures for the traffic entering Kikopey, Gilgil sub-County, Nakuru County. They found that, on average, 7867 vehicles pass through from Nakuru to Nairobi and another 8084 in the other direction, and that, on average, 1,782 trucks (medium and heavy trucks) pass through from Nakuru to Nairobi and another 1,983 in the other direction (Roadside Stations & NCTTCA, 2021). This project will establish five roadside stations in the Project area at the following locations: Mai Mahiu, Naivasha, Nakuru, Salgaa, and Mau Summit (Roadside Stations & NCTTCA, 2021). These stations will offer rescue facilities as well as a range of amenities for motorists including among others parking spaces for trucks, service stations, washrooms and shops. The goal is to eliminate driver fatigue and improve the security and health for long distance passengers and cargo (Roadside Stations & NCTTCA, 2021).

The importance of the A8 and A8South highways is heightened by the generally poor conditions of roads in the counties traversed by the Project. Indeed, this is the case for more than 50% of Kiambu County’s road network (Kiambu County CIDP 2018-2022, 2018), 45% of Nakuru county’s road network (County Government of Nakuru, 2018), and most of Nyandarua County’s road network (78% are earth surface roads) (County Government of Nyandarua, 2018). During the first round of consultation, many stakeholders mentioned their interest toward the Project as they consider the A8 and A8 South Highways to be currently insufficient in serving traffic.

Table 6-77 Number of vehicles per day along the A8 South Highway (2017)

Homogeneous Section	City	Chainage (km)	Light vehicles (cars, pickup trucks)	Heavy vehicles (trucks)	Total
S6	Naivasha	54,6	3 300	3 588	6 888
S6		51,2	3 300	3 588	6 888
S6		36,9	3 300	3 600	6 900
S6		20,7	3 300	3 600	6 900
S5	Mai Mahiu	19,9	3 300	3 588	6 888
S5		15,9	6 313	4 788	11 100
S5		2,7	6 313	4 788	11 100
S5		1,5	6 200	4 738	10 938
S5	Rironi	0,0	6 200	4 738	10 938

Source : RVH, 2021

Table 6-78 Number of vehicles per day crossing the Nakuru viaduct (2017)

Homogenous Section	City	Chainage (km)	Light vehicles (cars, pickup trucks)	Heavy vehicles (trucks)	Total
S4	Mau Summit	174,5	5 925	3 250	9 175
S4		151,4	6 775	3 425	10 200
S4		140,0	8 100	3 525	11 625
S4		129,4	8 050	3 550	11 600
S3		127,6	16 825	3 600	20 425
S3	Nakuru	123,5	36 066	3 600	39 666
S3		121,4	30 875	4 650	35 525
S3		116,4	26 025	4 500	30 525
S3		114,1	16 050	4 550	20 600
S2		92,7	10 900	4 550	15 450
S2		89,4	10 900	4 550	15 450
S2		85,4	10 900	4 550	15 450
S2	Gilgil	81,9	9 575	4 225	13 800
S2		75,1	12 850	4 800	17 650
S2		68,4	12 850	4 800	17 650
S2		58,9	12 850	4 800	17 650
S1	Naivasha	53,6	9 150	1 650	10 800
S1		35,2	12 900	2 000	14 900
S1		30,6	12 188	1 800	13 988
S1		25,2	13 638	2 063	15 700
S1		22,3	13 638	2 063	15 700
S1	Mathore	16,8	13 625	2 075	15 700
S1		11,7	15 225	1 950	17 175
S1		9,0	15 225	1 950	17 175
S1		2,7	14 713	1 600	16 313
S1	Rironi	0,0	13 138	1 538	14 675

Source : RVH, 2021

6.4.10.2 RAILWAYS

The railway network plays an important role in the Kenyan economy. Kenya is part of the East African Railway Master Plan which aims to rejuvenate existing railway services and extend them to other countries among the region (Northern Corridor Transit and Transport Coordination Authority, 2021).

There are 131 km of railway that crosses Kiambu County. Four railway stations are available in Ruira, Thika, Kikuyu and Limuru towns. The railway is not fully utilized in the county and only passenger trains operate in the morning and evenings between the City of Nairobi and the four stations.

A connection between Gilgil and Nyahururu crosses Nyandarua County for a length of 60 km. There are two stations in the county: Ol’Kalou and Ol’Joro Orok. The railway line was constructed in 1927 and it is no longer in service. It was used to transport agricultural products to other counties.

The railway line is part of the economic strategy of Nakuru County. It is about 192 km, in length and crosses the major urban areas. It benefits from its line crossing the county to Uganda. A new railway is under construction (SGR) and is planned to end at the Naivasha inland dry port. The dry port is located some 13 km to the southwest of Mai Mahiu and occupies 1000 acre of land. It features an inland container depot, railway marshalling yard, logistics zone and public utility area. Also a new road was completed to link the dry-port to the Kamandura)Mai Mahiu_Narok Road (B3 Road). It is predicted to allow loading up to two million tonnes of cargo every year.

The Project interacts with the railway system at various locations as detailed in Section 4.4.11. Highway A8 crosses a railway at 5 different places and there are 3 such crossings for the A8 South.

6.4.10.3 ELECTRICITY, TELECOM AND PIPELINES

In Kiambu County, firewood is the principal source of energy used for cooking. Paraffin is used for lighting fuel. Although trading centres and public institutions are almost all connected to the grid, only few residences are connected. Kiambu County also benefits from sizeable rivers, which have potential for hydropower exploitation.

Kiambu County is well covered by mobile network. It is estimated at 98% of coverage, while only 214 landline connections are counted in the county (Kiambu County Integrated Development Plan 2018-2022).

Sources of energy in Nyandarua County are variable. Firewood and charcoal are the principal means of energy. Electricity is used by 11% of the population for lighting. Lanterns and lamps are also used for lighting. Nyandarua County is not fully connected and has a poor signal network.

Different sources of energy are used by the households in Nakuru County. Electricity is used for lighting, while firewood and charcoal are preferred for cooking. In the Nakuru County Integrated Development Plan 2018-2022, it is estimated that 80% of the county is covered with electricity. The Olkaria geothermal field is also situated in Hell’s Gate National Park (Navaisha sub-county) and is considered as the single largest geothermal plan in Africa. Another geothermal field is being developed in the Menengai Caldera, less than 10 km north of the city of Nakuru (see section 6.3.12 below).

Nakuru County benefits from a mobile network coverage estimated at 91% which translates into 82.5% of households owning a mobile phone. Only 16.3% of households benefit from access to the internet (KIHBS 2015-2016, quoted in Nakuru County Integrated Development Plan 2018-2022).

A network of electricity transmission lines also criss-crosses the project area, connecting the various load centres in the region. The Kenya Electricity Transmission Company (KETRACO) is responsible for bulk transmission and therefore owns and operates transmission lines and substations of 132 kV and above. Kenya Power (KPLC, formerly known as Kenya Power and Lighting Company) is responsible for distribution to consumers and as such owns and operates distribution lines and substations of 66 kV and under (KETRACO, 2021). Table 6-79 below shows the location and the chainage of the transmission lines crossing the A8 and A8S Highway, based on data provided by KETRACO and satellite picture analysis.

Table 6-79 Electricity Transmission Lines crossing the Project

Highway	Chainage	
A8S	15+400	Transmission line
A8S	24+500	Transmission line
A8S	28+000	Transmission line
A8S	45+000	Transmission line
A8S	45+100	Substation (West)
A8S	45+200	Transmission line
A8	11+700	Transmission line
A8	43+000	Transmission line
A8	47+700	Transmission line
A8	53+900	Transmission line
A8	55+500	Transmission line
A8	80+900	Transmission line
A8	81+000	Transmission line
A8	116+000	Substation (West)
A8	128+600	Transmission line + Substation (North)
A8	129+200	Transmission line
A8	135+000	Transmission lines (2X)

Source: KETRACO data and WSP satellite picture analysis.

Pipelines are also crossing the Project at three different locations in Nakuru County. Specific features will be installed to protect shallow pipes during the construction stage. Table 6-80 presented below shows location and chainage of the pipelines crossing the A8 Highway.

Table 6-80 Pipelines crossing the Project in Nakuru County

Subcounty	Chainage	Piping
Nakuru West	128+650	2 x 14 inch pipes 2 x 8 inch pipes
Rongai	135+700	1 x 14 inch pipes 1 x 8 inch pipes
Kuresoi North	172+200	2 x 10 inch pipes

6.4.10.4 WATER SUPPLY AND SEWAGE

Eight water providers serve customers in Kiambu County. Only 54% of the population is served by Water Service Providers. Those who do not have access are served by private water operators, direct abstraction from surface and ground water sources, or by Community Based Organizations. Five urban centres benefit from sewer treatment system, including Limuru. Septic tanks are used as an alternative for the areas not covered by sewage networks.

Households from Nyandarua County are mostly relying on pit latrines for sewage disposal and their compound is used to pour wastewater. Two registered water companies are present in the county and community managed water suppliers serve the households. Some areas remain unserved by these services. It is estimated that 46,400 households have access to piped water (Nyandarua County Integrated Development Plan 2018-2022).

Nakuru County counts different schemes for water supply such as public water companies, community water supply or private water vendors. It is estimated that 63% of the county have access to improved treated water (Nakuru County Integrated Development Plan 2018-2022). Pit latrines remains the most common means for sewage disposal, and only 15.3% of households were connected to the main sewer according to KIHBS (2015-2016).

Sewage connection is implemented only in a few locations. Wastewater treatment plants are found in Limuru (one station), Naivasha (one station), Gilgil (one station) and Nakuru (two stations).

6.4.11 ARCHAEOLOGY AND CULTURAL HERITAGE

Table 6-81 lists the heritage and cultural sites in Kiambu and Nakuru County as identified in their County Integrated Development Plan 2018-2022 (County Government of Kiambu, 2018; County Government of Nakuru, 2018). None of these sites are located in the Project area. There are no heritage and cultural sites mentioned in the Nyandarua County Integrated Development Plan.

Table 6-81 Heritage and cultural sites in Kiambu and Nakuru counties

Heritage or Cultural Site	Location (Sub-County)
Kiambu County	
PCEA Church of Torch	Kikuyu
Mensa Kikuyu	Kikuyu
Watson Scott memorial	Kikuyu
Ondiri swamp (covered lake)	Kikuyu
Fort Smith	Kikuyu
Paradise lost sanctuary and Mau Mau caves	Kiambu
Banana hill art Gallery	Kiambaa
Old Italian Church	Juja
Italian prisoners of war pillar	Juja
Mugumo Gardens	Thika
Ngecha Art Center	Limuru
Manguo swamp Eco tourism	Limuru
Mwanya wa Ruhuho	Limuru
Idelyc resting sanctuary place, restraint and meeting place	Kiambu
Nakuru	
Hyrax Hill prehistoric site and museum	Nakuru East
Kariandusi prehistoric site and museum	Gilgil
Lord Egerton Castle	Nakuru City
Lanet prehistorical site	Nakuru East
Lake Nakuru	Nakuru West
Lake Elmentaita	Gilgil
Naivasha colonial prison site	Naivasha
Naivasha historical caves	Naivasha

In addition, two other sites were identified in Nakuru County during baseline surveys. The Mai Mahiu Catholic church is located outside the RoW but has a direct access from the A8 South near CH17+700. The Molo fire victim memorial site is bordering the southern side of the A8 Highway's right-of-way between CH161+300 and 161+350).

6.4.12 VISUAL ENVIRONMENT

The Project crosses the Rift Valley region, which is characterized by agricultural plains, hills, settlements, vegetation and conservation areas. Viewpoints with beautiful scene of the Rift Valley are found at some specific places along both A8 and A8 South. There are all located in Kiambu County. About five viewpoints are located on the A8 South (Limuru and Lari Sub-counties – between PK 9+000 and PK 11+000) and three others on the A8 (Lari subcounty – between PK 12+700 and 14+000). At theses viewpoints curio shops are present and tourists stop to admire the breathtaking view. None of the viewpoints are affected by the Project.

Kiambu County is characterised by four broad topographical zones: Upper Highland, Lower Highland, Upper Midland and Lower Midland Zone. High elevation plains' altitude varies from 1,300 to 2,550 meters above sea level. The A8 Highway crosses mainly through the urban and peri-urban areas and most of the landscape along the highway constitute settlements and small areas of farming and grazing.

The Project crosses a short distance in Nyandarua County. This part of the county is characterized by plains, agricultural lands, and dispersed settlements. Linear settlements are also observed along the highway.

In Nakuru County, the main topographic features are the Mau Escarpment (Western part of the county), the Rift Valley floor, Akira plains and various inland lakes. Naivasha and Gilgil sub-counties' land topography is characterized by savannah vegetation and mountainous landscape.

6.4.13 KNOWN AND RELATIVELY FORESEEN DEVELOPMENT PROJECTS

The project already being a major transport corridor, development projects of various sizes and importance are likely to sprout sporadically. A few of those projects were identified via various consultations conducted during the ESIA preparation and listed in Table 6-82.

In addition to the projects mentioned in the table below, recent information has been obtained that there are plans to implant roadside stations along the Trans-African Highway (Northern Corridor) which stretches between Mombasa and the northern frontier of Kenya and includes the A8 Highway section associated with the Project. A total of 22 such stations are foreseen, five of which are to be set along sections of the Project's alignment that is in Mai Mahiu, Naivasha, Nakuru, Salgaa, and Mau Summit (Roadside Stations & NCTTCA, 2021). Unfortunately, no official timeline nor any exact locations were available for these five stations.

Currently known information has also been added regarding toll stations to be developed by KeNHA and which are considered associated facilities to the project. Although still at concept stage, it is currently assumed that a minimum of five such toll stations will be developed, including two on the A8s and three on the A8. Their exact locations are currently unknown. They are planned to become operational at the same time as the project itself, to be operated by a toll operator which remains to be selected.

Table 6-82 Known and Relatively Foreseen Development Projects in The Project Area

County	Sub-county	Road	Chainage	Description	Development Stage
Kiambu	Limuru	A8	Approx. 4.5 km West of 6 + 000	540 km road from Gataka to Njengo (KeNHA, 2019b)	Under construction and scheduled to be completed in 2022
Kiambu	Currently unknown	A8S	Exact location unknown	Toll station developed by KeNHA for upgraded A8 South Highway. Footprint likely to extend beyond the existing right-of way.	Concept stage. Planned to be operational when each section of the highways enters into operation phase. Design and ESIA to be completed (No date).
Nyandarua	Kinangop	A8	30 + 000	Magumu Ward Market and Logistic Center - Planned mixed residential and commercial area (Cities Alliance, 2020)	Concept stage: area reserved for development by county authorities. No official construction schedule available.
Nakuru	Currently unknown	A8	Exact location unknown	Toll station developed by KeNHA for the dualled A8 Highway. Footprint likely to extend beyond the existing right-of way.	Concept stage. Planned to be operational when each section of the highways enters into operation phase. Design and ESIA to be completed (No date).
Nakuru	Currently unknown	A8S	Exact location unknown	Toll station developed by KeNHA for upgraded A8 South Highway. Footprint likely to extend beyond the existing right-of way.	Concept stage. Planned to be operational when each section of the highways enters into operation phase. Design and ESIA to be completed (No date).
Nakuru	Currently unknown	A8	Exact location unknown	Toll station developed by KeNHA for the dualled A8 Highway. Footprint likely to extend beyond the existing right-of way.	Concept stage. Planned to be operational when each section of the highways enters into operation phase. Design and ESIA to be completed (No date).
Nakuru	Currently unknown	A8	Exact location unknown	Toll station developed by KeNHA for the dualled A8 Highway. Footprint likely to extend beyond the existing right-of way.	Concept stage. Planned to be operational when each section of the highways enters into operation phase. Design and ESIA to be completed (No date).
Nakuru	Naivasha	A8S	Exact location unknown	RoadSide Station at Mai Mahiu (RSS RoadSide Stations and NCTTCA, 2021)	Planning and initial design stage. No official construction schedule available.
Nakuru	Naivasha	A8S	Exact location unknown	RoadSide Station at Naivasha (RSS RoadSide Stations and NCTTCA, 2021)	Planning and initial design stage. No official construction schedule available.
Kiambu	Gilgil	A8	89+000	RoadSide Station at Kikopey (RSS RoadSide Stations and NCTTCA, 2021)	Planning and initial design stage. No official construction schedule available.

County	Sub-county	Road	Chainage	Description	Development Stage
Nakuru	Rongai	A8	Exact location unknown	RoadSide Station at Salgaa (RSS RoadSide Stations and NCTTCA, 2021)	Planning and initial design stage. No official construction schedule available.
Nakuru	Kuresoi North	A8	Exact location unknown	RoadSide Station at Mau Summit (RSS RoadSide Stations and NCTTCA, 2021)	Planning and initial design stage. No official construction schedule available.
Nakuru	Naivasha	A8s	19 + 900	Redesign and reconstruction of the B7 road section from Mai Mahiu to Suswa (KeNHA, 2020)	Planning (ESIA was presented to NEMA in June 2020)
Nakuru	Naivasha	A8s	23 + 000 to 34 + 600	Naivasha ICD-Longonot railway line project. Standard Gauge railway project (24.35 km)	Currently under construction parallel to the west of the A8 South and scheduled to be completed in 2022
Nakuru	Naivasha	A8	51 + 000	Shopping mall	Construction
Nakuru	Gilgil	A8	102 + 000 to 106 + 200	Kingdom City urban development – approx. 500 acres, including residential, commercial and industrial areas as well as health, education and sports facilities and a cemetery	Concept
Nakuru	Nakuru City East	A8	124 +100 to 124 + 350	Bus park at the level of the first roundabout.	Planning and initial design stage. No official construction schedule available
Nakuru	Nakuru City East	A8	1.5 km East of 116 + 000	Construction of the Nakuru Airport. The project is built on the site of an existing military airfield	To be completed between 2021 and 2022
Nakuru	Bahati	A8	8km North of Nakuru City	Geothermal steam and electricity generation project to be developed in five (5) phases with the long-term goal of developing 465MW of geothermal steam equivalent	Construction
Nakuru	Nakuru City West	A8	126 + 200	Shopping mall	Construction
Nakuru	Kuresoi North	A8	173 + 200	Karonga market	Construction

Source: Stakeholder consultations and other cited sources.

7 STAKEHOLDER ENGAGEMENT

7.1 INTRODUCTION AND OBJECTIVES

This chapter sets out the general approach to participation and communication with stakeholders, proposed as part of the Environmental and Social Impact Assessment (ESIA).

Properly informing and consulting local communities and stakeholders is an important component of any successful project delivery. The stakeholder engagement program aims to create and sustain through various Project development phases, a constructive and collaborative relationship with local authorities, organizations and communities that are likely to be directly or indirectly affected by the Nairobi-Nakuru-Mau Summit Highway Project (hereafter "the Project").

Stakeholder engagement is not about a single conversation, but rather requires several opportunities to inform those who are likely to be affected or have an interest in the Project. This is also to provide an opportunity to learn how these external parties view the Project and its related risks, impacts, and opportunities.

Stakeholder concerns and feedback are valuable sources of information that can improve Project design and outcomes, and help the Project proponent identify and control external risks. It can also form the basis for future collaboration and partnerships with local communities.

Aligned with the International Finance Corporation (IFC) Performance Standards (PS) on Environmental and Social Sustainability, 2012, relevant IFC Guidance Notes (GN), and the associated legislation in Kenya, namely the Environmental Management and Co-ordination Act (EMCA) 1999 (Amended 2015) Section 58; this chapter outlines the ESIA-Stakeholder Engagement Plan (SEP), which will evolve throughout the ESIA process.

Stakeholder engagement is defined in the IFC PS as the broad, inclusive and continuous process of relationship building between a company and its stakeholders. This includes a range of activities and spans the entire project lifecycle. "Stakeholders" refer to individuals or groups who are directly or indirectly affected by the project, as well as those who have interests in the project and/or the ability to influence its outcomes, either positively or negatively (International Finance Corporation (IFC), 2007).

7.1.1 OBJECTIVES

7.1.1.1 GENERAL OBJECTIVES

As required by IFC PS 1, the SEP aims to engage in communication and to disclose information.

Communication with stakeholders shall:

- be meaningful and conducted at decision-making stages of the Project;
- help build a socially acceptable Project by considering opinions, grievances and questions from affected communities in an iterative way;
- be tailored to the characteristics of each stakeholder group, including Indigenous communities.

Disclosure of information shall be:

- relevant, transparent, and documented.

7.1.1.2 NAIROBI-NAKURU-MAU SUMMIT PROJECT ESIA-SEP SPECIFIC OBJECTIVES

In accordance with the general objectives, the project specific purposes are:

- Identify project stakeholders;
- Inform stakeholders of the Project infrastructures and activities and involve them in the identification of the socio-environmental risks and opportunities potentially associated with the Project, and the measures and actions that need to be taken to manage the anticipated impacts;
- Inform Indigenous communities (namely for the current Project, the Maasai, the Ogiek, the Turkana and Samburu) of the Project infrastructures and activities and seek, if necessary, their Free, Prior Informed, Consent (FPIC) for the Project, and collect their views regarding measures and actions that need to be taken to manage anticipated impacts;
- Collect complementary environmental and social baseline information that will be included in the ESIA as stakeholders typically have a thorough understanding of the Project's receiving environment;
- Collect and document stakeholder concerns, expectations, recommendations, and questions regarding the Project and its assessment process;
- Generate a social and institutional dialogue to assess and strengthen the Project's social acceptability and help to consolidate the efforts made by RVH and KeNHA to establish lasting relationships with affected communities and other stakeholders;
- Encourage stakeholder participation in the identification of opportunities with special attention given to women, vulnerable groups, and youths;
- Present the ESIA report to stakeholders, integrating their recommendations and concerns.

7.2 OVERVIEW OF ENGAGEMENT REQUIREMENTS

7.2.1 NATIONAL REQUIREMENTS

Consultation and Public Participation (CPP) is a mandatory requirement for proposed projects as entrenched in the Constitution of Kenya, 2010 and in EMCA 1999 (Amended 2015) Section 58, by achieving sustainable development. Part III Section 17 of the Environmental (Impact Assessment and Audit) Regulations of 2003, further requires that all ESIA Studies incorporate public consultation, with an aim to ensure all parties interested in a proposed project are informed of anticipated project impacts and benefits, and that their views, concerns and recommendations are incorporated in project planning, design, construction, operation and decommissioning phases. The CPP process is further supported by the Kenya Public Participation Bill of 2018.

It is important to mention that given the COVID 19 pandemic situation, all national COVID 19 protocols and guidelines were observed and respected during the various consultation activities. A continuous follow-up was also made to adjust and adapt to new national directives regarding the pandemic health measures. Specific COVID 19 considerations are exposed in Chapter 5 – Section 5.1.

7.2.2 INTERNATIONAL REQUIREMENTS

7.2.2.1 IFC PERFORMANCE STANDARDS

As mentioned in Chapter 2, the Project is to be developed and implemented according to the IFC Performance Standards on Environmental and Social Sustainability.

Stakeholder engagement is a cross-cutting requirement throughout all PS, but its core principles are presented in PS1 **"Performance Standard 1: Assessment and Management of Social and Environmental Risks and Impacts,"** which states, "Performance Standard 1 underscores the importance of managing environmental and social performance throughout the life of a project. An effective Environmental and Social Management System (ESMS) is a dynamic and continuous process initiated and supported by management, and involves engagement between the client, its workers, local communities directly affected by the project (the Affected Communities), and where appropriate, other stakeholders." It aims "to ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed."

As per Performance Standard 1, the stakeholder engagement section of the ESIA must highlight the various degrees of a systematic process that may involve the following elements required by IFC:

- **Stakeholder Analysis and Engagement Planning:**
  - Identify the range of stakeholders that may be interested in the project and consider how external communications might facilitate dialogue with all stakeholders;
  - Develop and implement a Stakeholder Engagement Plan that is scaled to project risks, impacts and development stages. It will be tailored to the characteristics and interests of the Affected Communities.
- Disclosure of Information:
  - "Access to relevant information should be provided to Affected Communities on: (i) the purpose, nature, and scale of the project; (ii) the duration of proposed project activities; (iii) any risks to, and potential impacts on, such communities and relevant mitigation measures; (iv) the envisaged stakeholder engagement process; and (v) the grievance mechanism. ″
  - Disclosure of information must be done on an ongoing basis by communicating periodically with affected communities to inform them of project progress.
- **Consultation:**
  - "Effective consultation is a two-way process that should: (i) begin early identification of environmental and social risks and impacts and continue on an ongoing basis as risks and impacts arise; (ii) be based on the prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information. This should be in a culturally appropriate local language(s) and format that is understandable to Affected Communities; (iii) focus on the inclusive engagement of those directly affected, as opposed to those not directly affected; (iv) be free of external manipulation, interference, coercion, or intimidation; (v) enable meaningful participation, where applicable; and (vi) be documented."
- **Informed Consultation and Participation:**
  - In the event of significant negative impacts on affected communities, IFC requests an informed consultation and participation (ICP). This consultation process should consider: (i) in the case of separate forums or meetings, the opinions of both females and males; and (ii) the preoccupation and differing priorities of men and women regarding impacts, mitigation mechanisms, and benefits, as appropriate.
  - Detailed documentation of the measures taken to avoid or minimize risks will need to be produced to address the concerns of people.

- **Indigenous Peoples:**
  - Indigenous Peoples potentially impacted by a Project need to be engaged in a ICP process that is culturally appropriate, and in certain circumstances, the client is required to obtain their Free, Prior, and Informed Consent (FPIC). The requirements related to Indigenous Peoples and the definition of the special circumstances requiring FPIC are described in IFC Performance Standard 7.
- **Private Sector Responsibilities Under Government-Led Stakeholder Engagement:**
  - Cases where public consultation is conducted by the government, complementary processes, and where appropriate, supplemental actions, will need to be undertaken if the stakeholder engagement does not meet the relevant requirements of the IFC Performance Standard.

Lastly, IFC expects the proponent to implement and maintain a procedure for external communications that includes methods to: (i) receive and register external communications from the public; (ii) screen and assess the issues raised and determine how to address them; (iii) provide, track, and document responses, if any; and (iv) adjust the management program, as appropriate. In addition, clients are encouraged to make periodic reports on their environmental and social sustainability publicly available.

A Grievance Mechanism for Affected Communities to review and record complaints and concerns is requested by the IFC to facilitate the resolution of issues. It should aim to enable a quick resolution of issues using an understandable and transparent consultation process.

7.3 RATIONALE FOR DISTINCT CONSULTATION PROCESSES

The IFC Performance Standard 7 (IFC, 2012) recognises that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. In many cases, their economic, social, and legal status limits their capacity to defend their rights to and interests in lands and natural and cultural resources and may restrict their ability to participate in and benefit from development. Indigenous Peoples are particularly vulnerable if their lands and resources are transformed, encroached upon, or significantly degraded. Their languages, cultures, religions, spiritual beliefs, and institutions may also come under threat. Consequently, Indigenous Peoples may be more vulnerable to the adverse impacts associated with project development than non-indigenous communities. This vulnerability may include loss of identity, culture, and natural resource-based livelihoods, as well as exposure to impoverishment and diseases.

IFC PS7 requires a different consultation approach for Indigenous Peoples, commonly referred to in Kenya as Vulnerable and Marginalized Groups (VMGs). Indeed, Informed Consultation and Participation (ICP) with Indigenous Peoples should involve a more in-depth exchange of views and information, and an organized and iterative consultation. In addition to ICP, the proponent must under certain circumstances ensure the Free, Prior, and Informed Consent (FPIC) of the affected communities of Indigenous Peoples.

For successful outcomes to be achieved for the mutual benefit of all parties, it is important that the parties have a shared view of the process for achieving ICP and, where applicable, FPIC. To achieve PS7 objectives, a distinct consultation process that is tailored, flexible, and adaptive was implemented with affected communities of Indigenous Peoples. Although consultations with Indigenous Peoples are presented in three rounds, similarly to consultations held with the general public, their timing and content differs as a relationship had to be established with the different communities, information needed to be gathered to ensure consultations were culturally appropriate, and consultations needed to occur in a manner that respect customary protocols. However, this does not mean that they were excluded from consultation activities for the general public. For example, Maasai traditional practitioners and the Ogiek People Development Program (OPDP) participated in baseline-oriented meetings and a questionnaire was developed for Maasai pastoralists encountered grazing near the highways

7.4 ENGAGEMENT APPROACH: AFFECTED COMMUNITIES AND OTHER STAKEHOLDERS

7.4.1 STAKEHOLDER IDENTIFICATION

Many stakeholders are concerned about the Project since the current condition of the Nairobi-Mau Summit Highway and the A8 South Highway is insufficient in serving travelers and freight transporters using it. In order to reach out inclusively to all potentially affected persons, organizations, and governmental authorities, a detailed stakeholder mapping exercise was completed at the early stage of the Project. It was then updated as required throughout the ESIA activities to ensure the participation of all stakeholders who have interest in the project. Special attention was given to vulnerable people, including Indigenous Peoples (commonly referred to as Vulnerable and Marginalized Groups (VMGs) in Kenya), women, people living with disabilities (PLWD), elders and youth. The stakeholder map can be found in Appendix 7-1.

At this stage of the project, the methodology used for the stakeholders mapping was to identify the largest range of people affected directly or indirectly by the project, keeping great representativity and respecting covid restriction for the number of persons allowed to participate in each public meeting. The establishment of the interest and influence analysis will be done during the contractor's stakeholder engagement plan.

The following list categorises main stakeholder groups targeted by the public information and consultation activities carried out by WSP and RVH as part of the ESIA.

- Governmental and regulatory authorities including national and decentralized agencies (county, sub county, ward, location and sub-location authorities);
- External stakeholders including environmental and social related NGOs and advocacy groups that work in or have interests in the project area; proponents of other programs or projects in the area that may interact with the Project;
- Community members of all age, sex and origin.

7.4.2 CONSULTATION AND MESSAGE

At every stage of the ESIA, the message and the method used for the consultation and participatory process was adapted. The following elements were carefully planned for each consultation activity:

- the message to convey to each group of stakeholders (in collaboration with RVH);
- how stakeholders will be notified for upcoming meetings and the invitation process;
- the choice of the appropriate venue;
- the preparation of tools and visual support to be used during consultation;
- the resources required to facilitate the consultation;
- how minutes will be written, recorded and disclosed;
- how grievances will be addressed. How should RVH or the contracting authority (KeNHA) be involved in grievances redress or questions.

7.4.3 CONSULTATION ACTIVITIES FRAMEWORK

The ESIA-SEP activities planned for the Project included a series of technical meetings with targeted actors, social surveys, as well as three rounds of public consultation. They were all oriented around a participatory process that aimed to elaborate an ESIA and environmental and social management plan (ESMP) involving stakeholders at each step, with a social and gender inclusion approach.

7.4.3.1 BASELINE-ORIENTED MEETINGS AND SOCIAL SURVEYS

In order to collect territory information and to better understand the environment in which the project will be implemented, informal and formal baseline-oriented meetings were planned whenever needed during experts' field missions. Each expert, in collaboration with RVH, proposed a schedule each time it was needed.

Due to the nature of the Project, a thorough social survey was also planned to better understand the affected communities, their mobility needs, their livelihood sensibilities, as well as their views on the project. In addition to the social survey, specific studies of the wildlife movement were done and workshop with targeted stakeholders to understand the biodiversity of the project area. A detailed methodology for those activities can be found in the chapter 5 of the ESIA.

7.4.3.2 ROUNDS OF PUBLIC CONSULTATION

A total of three rounds of public consultation was planned as part of the Project. The objectives for each round, methodology and timeline are presented in Table 7-1.

Table 7-1 Rounds of public consultations for the ESIA

Objectives	Methodology	Location
Round 1: Inception stage / January and February 2021		
– Present the project and the ESIA process to key authorities and informants, including traditional authorities (in line with the FPIC principles) – Identify key issues, grievances, concerns and expectations related to the project and its study area – Prepare chiefs for the upcoming social surveys (conducted after the 1st round) – Complete ongoing stakeholder mapping	<u>Courtesy visits with officials at their office</u> – County Governors – County Commissioners (CC) – Deputy County Commissioners (DCC)	<u>Counties and Sub-counties</u> – Kiambu County – Lari Sub-County – Limuru Sub-County – Nyandarua County – Kinangop Sub-County – Nakuru County – Nakuru East and West Sub-Counties – Molo and Kuresoi Sub-Counties – Rongai Sub-County – Gilgil Sub-County – Naivasha Sub-County – Baringo County – Koibatek Sub-County
	<u>Plenary meetings at subcounty level</u> – DCC – Ward administrators – Members of parliament (MP) – Members of County Assembly (MCA) – Chiefs of affected locations – Sub-Chiefs of affected sub-locations – Key community members – Gender and social inclusion representatives – Other affected stakeholders.	<u>Sub-counties and locations</u> – Lari Sub-County (Kijabe, Lari, Kinale, Gatithia, Gitithia, Kirenga) – Limuru Sub-County (Limuru, Rironi, Tigoni, Ndieya) – Kinangop Sub-County (Magumu, Mugumo) – Nakuru East and West Sub-Counties (Lanet, Central, Lake Nakuru, Kaptembwo) – Molo and Kuresoi Sub-Counties (Molo, Sachangwan, Elburgon, Mau Summit) – Rongai Sub-County Boror, Rongai, Lenginet, Kampi ya Moto, Ngata) – Gilgil Sub-County (Kiambogo, Gilgil, Karunga) – Naivasha Sub-County (Longonot, Mai-Mahiu, Karati, Naivasha Town, Lake View, Naivasha East, Malewa, Kinungi, Hell’s Gate) – Koibatek Sub-County: Forestry Services
Round 2: Impact Assessment and Design / May and June 2021		
– Validate design with County Governor’s Office (performed by RVH and KeNHA)	<u>Technical meetings at County level</u> – County Governor – Technical team from County Government Office – Members of parliament (MP) – State owned Agencies – NGOs	<u>Counties</u> – Kiambu – Nyandarua – Nakuru
– Present the ESIA progress and outcomes of baseline activities – Discuss the issues and potential main impacts of the project, showing detail design and crossing points – Collect input on potential impacts and proposed design – Provide answers to collected grievances	<u>Plenary meetings at subcounty level</u> – DCC – Ward administrators – Members of parliament (MP) – Members of County Assembly (MCA) – Chiefs of affected locations – Sub-Chiefs of affected sub-locations – Key community Members – Gender and social inclusion representatives – Other affected stakeholders	<u>Sub-counties and locations</u> – Limuru Sub-County (Limuru, Rironi, Tigoni, Ndieya) – Lari Sub-County (Kijabe, Lari, Kinale, Gatithia, Gitithia, Kirenga) – Naivasha Sub-County (Longonot, Mai-Mahiu, Karati, Naivasha Town, Lake View, Naivasha East, Malewa, Kinungi, Hell’s Gate) – Kinangop Sub-County (Magumu, Mugumo) – Kuresoi Sub-County (Mau Summit) – Rongai Sub-County (Boror, Rongai, Lenginet, Kampi ya Moto, Ngata) – Molo and Koibatek Sub-Counties: (Molo, Sachangwan, Elburgon, Maji Mazuri, Kiplombe) – Gilgil Sub-County (Kiambogo, Gilgil, Karunga) – Nakuru East and West Sub-Counties (Lanet, Central, Lake Nakuru, Kaptembwo)
Round 3: ESIA result / November and December 2021		
– Present the progress made throughout the ESIA process – Follow up on the outcomes of the second round of public consultation and any impact it had on the project’s design – Reinforce the county contribution through the collection of observations, questions, and queries (performed by RVH and KeNHA)	<u>Technical meetings at County level</u> – County Governor – Technical team from County Government Office – Members of parliaments (MP) – NGOs	<u>Counties</u> – Kiambu – Nyandarua – Nakuru

Objectives	Methodology	Location
– Present the modifications to the proposed design; – Present the proposed mitigation measures and action plans, integrating stakeholders' inputs and collect comments and recommendations – Provide answers to questions or grievances – Evaluate the social acceptability of the project – Ensure compliance with the requirements of regulatory authorities	Plenary meetings at subcounty level – DCC – Ward administrators – Members of parliament (MP) – Members of County Assembly (MCA) – Chiefs of affected locations – Sub-Chiefs of affected sub-locations – Key community Members – Gender and social inclusion representatives – Other affected stakeholders	Sub-counties and locations – Limuru and Lari Sub-Counties (Limuru, Rironi, Tigoni, Ndieya, Kijabe, Lari, Kinale, Gatithia, Gitithia, Kirenga) – Kinangop Sub-County (Magumu, Mugumo) – Kuresoi North, Molo and Koibatek Sub-Counties: (Mau Summit, Molo, Sachangwan, Elburgon, Maji Mazuri, Kiplombe) – Rongai Sub-County (Boror, Rongai, Lenginet, Kampi ya Moto, Ngata) – Gilgil Sub-County (Kiambogo, Gilgil, Karunga) – Nakuru East and West Sub-Counties (Lanet, Central, Lake Nakuru, Kaptembwo) – Naivasha Sub-County (Longonot, Mai-Mahiu, Karati, Naivasha Town, Lake View, Naivasha East, Malewa, Kinungi, Hell's Gate)

7.4.4 GRIEVANCE REDRESS MECHANISM

Grievance management is one of the pillars of good stakeholder engagement. A Grievance Redress Mechanism (GRM) provides for the reception, treatment and documentation of project stakeholders' grievances. The GRM applies to all stages of the Project: from preparation (ESIA) to construction and operation.

During the first round of public consultations, grievances and opinions were collected and email addresses were provided for stakeholders to send additional comments or recommendations after the consultation activities. Secondly, during social surveys and meetings with stakeholders, a dedicated question on people's opinion and grievances were asked. Lastly, during the second and third round of public consultations, answers to grievances and questions were provided.

7.4.5 RECORDING AND DISCLOSURE OF PROJECT INFORMATION AND MINUTES OF CONSULTATIONS

The SEP (and its GRM) core principle is that all communications and decisions that derived from meetings and community consultations are written down and recorded. During stakeholder engagement activities, notes were recorded, and an attendance register list was available for all the attendees to facilitate formal registration of interest.

7.4.6 INTEGRATION OF CONSULTATION OUTCOMES IN THE ESIA

Consultation outcomes are key inputs to any ESIA and were used to enhance the present one in various ways:

- Project design requests were collected and shared with the project design team for consideration. As demonstrated in section 7.5.3.4 below, a vast majority of those requests were integrated in the design, thereby avoiding many negative impacts and making the project better adapted to its environment.
- Baseline data and information was fed into chapter 6, which in turn fed the impact assessment and development of mitigation measures in chapter 8.
- Potential project impacts identified by stakeholders were considered and assessed in chapter 8, therefore also feeding the development of mitigation measures. Examples can be seen in the following sections:
  - Section 8.1.3.1 – consideration of flood-prone areas identified by stakeholders in hydrological impact assessment;
  - Section 8.2.2 – consideration of wildlife workshops (see section 7.4.3.1 above) in the assessment of project impacts on fauna;
  - 8.2.4 – consideration of consultation data on ecosystem services, in the impact assessment
  - Section 8.3.5 – impacts on labour conditions;
  - Section 8.3.6 – impacts on Vulnerable and Marginalized Groups;
  - Section 8.3.7 – assessment of impact on gender aspects;
  - Section 8.4 – evaluation of social acceptability;
  - Section 8.5 – cumulative impacts assessment.

7.5 ENGAGEMENT ACTIVITIES DESCRIPTION AND RESULTS: AFFECTED COMMUNITIES AND OTHER STAKEHOLDERS

The following organizations have contributed to the undertaking of stakeholder engagement activities: KeNHA, Rift Valley Highway Limited Consortium (Vinci and Meridiam), Sogea Satom, WSP Canada Inc. and Norken International Limited.

A description of the stakeholder activities completed in the context of the ESIA is presented hereafter.

7.5.1 BASELINE-ORIENTED MEETINGS AND SOCIAL SURVEYS

As mentioned in the consultation framework, baseline-oriented meetings (see Table 7-2) took place whenever experts were on the field. Organized on an ad hoc basis, as needed throughout the ESIA process, they aimed at contacting stakeholders, establishing focal points, or collecting, validating, and exchanging data on the study areas. Most meetings were held during the inception stage to initiate a first contact with strategic stakeholders and gather information to start the ESIA process. Meeting minutes and attendance sheets can be found in Appendix 7-2.

Table 7-2 Baseline-oriented meetings held during the ESIA process

No	Stakeholders	Date	Time	Venue	Number of participants
1	Soysambu Private Reserve	November 17, 2020	9h00	295, Dagoretty Rd, Karen, Nairobi, Kenya	2
2	Kiambu County Commissioner	November 17, 2020	13h00	County Commissioner Office, Kiambu	3
3	Nakuru County Commissioner	November 19, 2020	9h00	County Commissioner Office, Nakuru	7
4	Nyandarua County Commissioner	November 19, 2020	11h00	County Commissioner Office, Nyandarua (Borad Room)	7
5	Nakuru County Governor	November 20, 2020	8h00	County Government Headquarter, Nakuru	8
6	Marula Estate Ltd	November 20, 2020	9h00	Marula Estate Ltd	4
7	Ogiek People's Development Program (OPDP)	November 20, 2020	11h00	OPDP office in Nakuru	4

In addition to those meetings, social surveys were undertaken as part of the ESIA to feed the social baseline description, provide stakeholders feedback and allow the collection of grievances and opinions of stakeholders directly affected by the Project. Details on those surveys can be found in chapter 6 of the ESIA.

As per the biodiversity aspect, specific consultation activities and working sessions were performed to collect data and ensure important stakeholders can give their views on the potential impacts of the project and help developing a strong baseline. This had for objective to ensure all potential impacts were captured and appropriate mitigation measures proposed.

Tables 7-3 and 7-4 list the baseline-oriented participatory activities accomplished for the biodiversity components. Minutes of meeting were not produced for those baseline-oriented activities as their main purpose was to collect data that were incorporated directly in the chapter 6. However, list of attendees and photos for ecosystem services characterisation activities are provided in Appendix 7-2.

As for the two wildlife movement workshops completed to date, they were virtual meetings for which exchanges and discussions that needed to be officialised have been recorded in the form of minutes of meeting for the first workshop and as a Power Point summary for the second (see Appendix 7-2). A list of attendees is also presented in the same Appendix while the list of invitees is presented hereafter. Outcomes from those workshops have fed the baseline data presented in section 6.3.6 (subsection on mammal movement and connectivity), as well as the impact assessment and mitigation measures (section 8.2.2.4 and Appendix 8-2).

- Kenya Wildlife Services (KWS)
- Kenya Forest Services (KFS)
- Marula Estates
- Soysambu Wildlife Conservancy
- Kigio Wildlife Sanctuary
- Rift Lakes Conservancies Association / Nakuru County & Kenya Wildlife Conservancies Association
- Rhino Ark
- Naivasha Municipal Board
- Lake Naivasha Riparian Association
- Naivasha Professional Association
- Imarisha Naivasha
- WWF Naivasha
- Kenya National Museum
- Kijabe Forest Trust
- The Forest
- Conservation Alliance of Kenya
- Care of Creation Kenya
- Endangered Wildlife Trust
- Ewaso Lions & Grey's Zebra Trust
- Giraffe Conservation Foundation (GCF)
- University of Nottingham (Malaysia)
- FFMES
- Wildlife Direct
- Nature Kenya
- Friends of Kinangop
- Natural Justice

A third workshop on wildlife movement was held on January 20th 2022, to present the final results of the proposed wildlife movement measures that will be implemented in the project.

Table 7-3 Groups consulted for ecosystem services characterisation

No	Dates	Date	Time	Venue	Number of participants
1	Limuru Sub County Community Meeting	May 24, 2021	13h30	PCEA Church, Limuru, Kiambu	12
2	Lari Sub County Community Meeting	May 25, 2021	14h30	DCC's Office Compound, Lari, Kiambu	13
3	Kimende Traditional practitioner / Herbalist	May 25, 2021	15h00	Herbalist shop, Kimende	3
4	Naivasha Sub County Community Meeting (South)	May 26, 2021	15h00	Chief Compound, Mai Mahiu, Naivasha, Nakuru	14
5	Maasai traditional practitioners	May 26, 2021	15h00	Chief Compound, Mai Mahiu, Naivasha, Nakuru	4
6	Kinangop Sub county Community Meeting	May 27, 2021	14h00	DO's office in Kanywa, Magumu, Kinangop, Nyandarua	16
7	Fisheries Representative: Karagita Beach Management Unit (BMU)	May 27, 2021	15h00	Karagita Beach	3
8	Kuresoi North Sub County Community Meeting	May 28, 2021	13h15	Chief Compound, Kuresoi North, Nakuru	11
9	Rongai Sub County Community Meeting	May 31, 2021	14h30	ACK Church Rongai Compound, Nakuru	11
10	Molo and Koibatek Sub Counties Community Meeting	June 2, 2021	14h15	A/Chief Compound, Kibunja, Molo, Nakuru	20
11	Gilgil Sub County Community Meeting	June 3, 2021	15h00	Gilgil CDF Ground, Nakuru	11
12	Nakuru East and Nakuru West Sub Counties Community Meeting	June 4, 2021	14h30	County Commissioner Office compound, Nakuru City, Nakuru	9
13	Naivasha Sub County Community Meeting (North)	June 7, 2021	14h15	Kayole Hall, Lake View, Naivasha, Nakuru	10

Table 7-4 Baseline-oriented working sessions held during the ESIA process for the biodiversity aspects

No	Stakeholders	Date	Time	Venue	Number of participants
1	Wildlife Movement Study First Workshop	April 7, 2021	13h30	Online - Gotowebinar	33
2	Web-based expert mapping and survey	April 7 – April 16, 2021	-	Online-Maptionnaire	17
3	Soysambu Conservancy CEO	May 29, 2021	9h00	Soysambu Conservancy	2
4	Marula Estate Livestock Manager	May 30, 2021	9h00	Marula Estate Offices	2
5	Wildlife Movement Study Second Workshop	July 21, 2021	14h00	Online Teams Meeting	7
6	Web-based expert mapping and survey	July 21– July 27, 2021	-	Online-Maptionnaire	9
7	Wildlife Movement Study Third Workshop	January 20, 2022	13h30	Online Teams Meeting	22

7.5.2 FIRST ROUND OF CONSULTATION

The first round of consultations took place from January 25th to February 2, 2021. A total of 17 meetings were held aimed at presenting the project to the various stakeholders, collecting their concerns, answering their questions, and explaining the ESIA process and its different steps. It was also an opportunity to introduce the team working on the Project, create focal points to allow an easy exchange of data, and invite stakeholders to collaborate in upcoming field surveys.

Sub-county community meetings were carried out by a group composed of representatives from KeNHA, Rift Valley Highway Limited Consortium (Vinci and Meridiam), Sogea Satom, WSP Canada Inc. and Norken International Limited.

7.5.2.1 STAKEHOLDER ENGAGEMENT ACTIVITIES

The methodological approach for the first round of consultation with affected communities and other stakeholders includes 2 types of stakeholder engagement activities: courtesy visits and plenary meetings.

COURTESY VISITS

The first type of meeting consisted of courtesy visits made with officials at their office. They aimed to introduce the team working on the Nairobi-Nakuru-Mau Summit Highway Project, present the ESIA process and the upcoming activities. They also had objectives to take the views and recommendations of officials and ask for their collaboration and support for activities held under their jurisdiction and territory (ESIA surveys and public consultation). The courtesy visits were performed for both sub-county community meetings and vulnerable and marginalized groups' meetings. A total of 8 courtesy visits were completed during the first round of consultation, mostly a few hours before the subcounty community meetings. They were addressed to Governors, County Commissioners and Deputy County Commissioners of territories concerned by the Project.

SUBCOUNTY COMMUNITY MEETINGS

The second type of meeting consisted of community-level meetings in plenary. A total of 9 community meetings were performed during the first round. They had for objectives to present the Project to participants, collect their concerns, answer their questions, and explain the ESIA process and its different steps. It was also an opportunity to introduce the team working on the Project, create focal points to allow an easy exchange of data, and invite stakeholders to collaborate in the upcoming field surveys.

Plenary meetings consists of a community-level group. This is aimed to inform the chiefs and main representatives of all locations affected by the Project, with a gender and social inclusive sensibility. Those meetings were held outside for COVID-19 security purposes. Microphones, water and tents for shade were also provided. A large map of the project was also displayed at the venue. Organized at the subcounty level, those meetings were hosted by the DCC of each subcounty, however, for logistic purposes, some sub-counties were paired into the same meeting.

The activities started with a prayer and an official opening by the DCC of the subcounty where the meeting was held. A representative from KeNHA or from the Rift Valley Highway Limited Consortium was then invited to introduce the project team and describe the Project, and its technical components. A representative from WSP Canada explained the ESIA process and its different steps. These presentations were made in plenary. A list of interventions was then opened by a facilitator from Norken International Inc. to allow participants to react to the presentations and to formulate their observations and comments. Youth, elders, women and PLWD were specifically invited to give their views during the meetings. Questions were answered by KeNHA and the Consortium and each person's observations and comments were collected. The next steps were presented following the discussions and the official ended the activity after inviting a member of the community to make a closing prayer.

Table 7-5 presents the details of the courtesy visits followed by the subcounty plenary meetings performed by group 1, during the first round of consultations. Courtesy visits have been identified with an asterisk. Meeting agenda, attendance sheets, photos and minutes of these activities can be found in Appendix 7-3.

Table 7-5 Courtesy visits and subcounty community meetings held during the First Round of Consultation

No	Stakeholders / Participants	Day and Date	Time	Venue	Number of participants
1	Kiambu County Commissioner*	Monday January 25, 2021	9h30	County Commissioner Office, Kiambu	12
2	Lari Sub County Community*		11h30	Full Gospel Church Nyambari Compound, Lari, Kiambu	147
3	Kiambu County Governor		15h00	County Government Office, Kiambu	10
4	Limuru Sub County Community	Tuesday January 26, 2021	9h30	PCEA Church, Limuru, Kiambu	167
5	Nyandarua County Commissioner*	Wednesday January 27, 2021	9h30	County Commissioner Office, Nyandarua	13
6	Nyandarua County Governor*		10h00	County Government's Office, Nyandarua	20
7	Kinangop Sub County Community		13h00	DO's office in Kanywa, Magumu Location	110

No	Stakeholders / Participants	Day and Date	Time	Venue	Number of participants
8	Nakuru County Commissioner*	Thursday January 28, 2021	9h00	County Commissioner Office, Nakuru	8
9	Nakuru County Governor*		10h30	County Government Office, Nakuru	24
10	Nakuru East and Nakuru West Sub Counties Communities		11h30	County Commissioner Office compound, Nakuru	95
11	Kenya Forestry Service*		16h30	Kenya Forestry Service Office, Baringo	12
12	Molo and Kuresoi Sub Counties Communities	Friday January 29, 2021	10h00	DO's office compound in Total Center, Nakuru	180
13	Koibatek Sub-County Deputy County Commissioner (DCC)*		13h45	DCC's Office in Ravine, Baringo	11
14	Rongai Sub County Community	Monday, February 1, 2021	10h15	ACK Church Rongai Compound, Nakuru	106
15	Gilgil Sub County Community		14h30	Gilgil CDF Ground, Nakuru	172
16	Naivasha Sub County Community	Tuesday, February 2, 2021	10h30	Longonot town Chief Office, Nakuru	97
17	Naivasha Sub County Community		14h00	Chief Kinungi Office, Nakuru	125
				Total Participation:	**1309**

7.5.2.2 TOOLS AND SUPPORTING MATERIAL

The first round of consultation consisted of the distribution of an informative leaflet and the display of an A0 format map of the highway project. The map was displayed at the venue and the leaflet was distributed, along with an agenda to all participants before the beginning of the presentation. The tools and supporting material can be found in Appendix 7-8.

7.5.2.3 MAIN CONCERNS AND OBSERVATIONS

The main concerns and observations raised during the first round are summarized hereafter. They have been classified per county and subcounty. It is important to note that stakeholders were also invited to give their comments in writing during or after the meetings or using the email address provided on the leaflet. All comments received are included in the present section.

COUNTY OF KIAMBU

- Land acquisition **-** all compensation should be given before construction and the process should be completed as quickly as possible to minimize effects on the population. ROW limits should be identified more clearly (fence) to better identify affected land users;
- Allow for the population to salvage material of structures along the highway before construction;
- Presence of many trucks can slow traffic **-** an increase in the number of trucks is used to predict and mitigate potential issues as the Project will attract more trucks (shift from A8 South to A8);
- Toll stations might generate delays that will slow traffic flow;
- Share design: design with us and not for us;
- Continuous stakeholder's consultation is important;
- Make sure the **runoff water** doesn't pollute the quality of existing water sources;
- Offer local employment and training for skilled and unskilled workers: consider vulnerable groups, such as single parents and youth;
- Wish for a clear and transparent process;
- Offer landscape contracts to locals;
- Offer compensation through a Community Development Plan;
- Use high quality material to avoid road collapse and consider using same standard of tarmac for connecting roads (e.g., road Acre to Ithano misses tarmac on 0.8 km of the road when connecting to A8 – outside the Project area);
- Ensure good integration of the Project with other major projects in the area **-** Mau Mau and Mai Mahiu Road Projects. Drainage system should be planned at a larger scale to avoid storm water that could affect families.

SPECIFICITIES FOR LARI SUBCOUNTY

- Important farming area **-** make sure farmers can easily cross the highway to deliver tea to collection senders;
- Give access and properly integrate the Soko Mjinga Market into the Project **-** this is important for agricultural shopping;
- High level of road users **-** provide an interchange at Lari and footbridges for human traffic;
- Many viewpoints with businesses trading next to the road **-** need to restore livelihood and plan for other business sites if relocated;
- Need for **drainage** at Ngarariga **-** make sure water is redirected adequately to avoid flooding farms;
- Protect fauna and flora at Gituamba sub location (outside but close to project area);
- Corporate Social Responsibility (CSR): Help schools by providing sanitary pads for girls;
- Alcohol and Drug Abuse (ADA) in the area is on the rise **-** make sure the contractor has mitigation measures to address ADA risks and gender-based violence.

SPECIFICITIES FOR LIMURU SUBCOUNTY

- Provide adequate compensation and mitigation measures if the Project interferes with their water pipe system (The Bibirioni Community Water Project has a water pipe system along the highway);
- Include an **interchange** at the junction between class A and B roads in Mutarakwa region (section 5);
- Presence of a lot of swamps in the territory - appropriate design to withstand natural conditions, protect Manguo Wetland and plan for adequate interchange for Manguo (many accidents at that location);
- Provide **a footbridge** at Kamandura Primary School and at Kwambura area where there are many churches;
- Ensure adequate junction and flow for the Mai Mahui Road that gets jammed in case of an accident.

COUNTY OF NYANDARUA

SUBCOUNTY KINANGOP

- Consider the Urban Plan of Nyandarua County and the Magumu Development Plan (commercial hub);
- Consider the market and logistic center inside your Social Corporate Responsibility Program;
- Include a remarkable design for the interchange in Nyandarua as it is the key entry point in our County;
- Improve Kijabe Road (Kiambu) as part of the Project to help farm products reaching the Mai Mahiu Dryport (provide design of the road);
- Add service lanes (easy access), additional acceleration/deceleration lanes, pedestrian path/footbridge at Soko Mjinga and Soko Mpya Markets (presence of many schools);
- Involve Nyandarua young engineers for knowledge transfer and job opportunities;
- Ensure there are service lanes in Nyandarua for motorbikes users;
- Share the project design - important to include access culvert and lay bays for trucks and heavy vehicles;
- Consider helping Magumu location for its vulnerable population (orphans, aged people, sicknesses, etc.);
- Ensure the **drainage** is well designed to avoid flooding and damage to houses and farms (storm water), bad drainage between Gilgil and Nyahururu;
- Add acceleration lane along Olkalou stadium;
- Ensure distance between bus stops isn't too big for safety at night (women and children);
- Include safety training program during construction for drivers and a noise mitigation plan for sensitive areas such as schools, health centres, etc.

COUNTY OF NAKURU

- Examine the possibility of **bypasses** and alternative routes for Nakuru instead of the proposed flyover;
- Include rest areas along the highway and services for truck drivers such as washrooms, places to sleep and eat;
- Include special measures for local traffic inside the tolling system;
- Maintain fluidity on A8 South during construction as it is used by tourists to reach Maasai Mara. The shoulders should be increased in case of an emergency;
- Offer local employment and training for skilled and unskilled workers - consider vulnerable groups, such as people with disabilities, women and youths, etc. Clear process and treating employees well;

- Consider the future urban development generated by the Project - plan for shopping areas to avoid businesses from appearing randomly along the highway;
- Ensure land acquisition compensation is given before construction and that the process is completed as quickly as possible to minimize effects on population;
- Include all categories of affected persons in the social surveys;
- Include **footbridges** for persons (including persons with disabilities) and animal crossing (ensure distances for kids doesn't exceed 800 m);
- Maintain continuous stakeholder engagement activities including measures for people with hearing impairment;
- Ensure nice landscape with vegetation along the highway and replant trees to compensate lost ones (locals can plant trees);
- Ensure a good **drainage** system and unclog the existing one;
- Plan mitigation measures for potential sexual harassment and gender-based violence by foreign workers during construction and other social ills such as robbery;
- Rehabilitate borrow pits and quarries;
- Ensure that air quality, water quality and soil conditions are considered in the EIA and special mitigation measures for the increase in noise generated by the highway;
- Plan for adequate truck parking to avoid trucks from using bus bays;
- Ensure adequate disposal of used materials during construction and plan for awareness campaigns within communities on possible infectious diseases.

SPECIFICITIES FOR EAST AND WEST NAKURU SUBCOUNTIES

- Provide various **footbridges** at Free Area as many schools are present;
- Provide **service lanes** to easily access businesses and adequate **crossing** to get stock from both sides;
- Help for schools in slums as part of the Social Corporate Responsibility Program.

SPECIFICITIES FOR MOLO AND KURESOI SUBCOUNTIES

- Provide safe **services lanes**, adequate signs, and access for schools (speed bumps, pedestrian path, etc.);
- Improve feeder roads (culvert);
- The market is the main economic activity of the region - provide stalls, a small market and a marketplace for women to sell vegetables, as part of the Social Corporate Responsibility Program;
- Ensure access to water points on each side of the road to avoid crossing;
- Refurbish the Mau Summit Police Station with new materials and provide laboratories or additional classrooms at Molo Highway Secondary School as part of the Social Corporate Responsibility Program;
- Include an **interchange** at the junction between Kibunja and the road to Molo;
- Add toilets along the highway;
- Provide a **pedestrian walkway** at GSU section approaching Mau Summit;
- Provide **footbridges** at Kibunja, Nyanja, an **underground passage** and a parking area at Kamara;
- Consider a truck park at Kibunja;

- Consider road from Lelaitich to Chemolel to Tabain Primary School and via Tabain AGC Church as a service lane;
- Ensure a safe **interchange** at Total Center with underpasses or overpasses for crossing as there are many accidents (emergency measures);
- Include an **interchange** at the junction of the A8 and the road to Molo;
- Plan for a rapid response center at the section along Total area and speed limit at Sogea and Total areas.

SPECIFICITIES FOR RONGAI SUBCOUNTY

- Area with a lot of markets and businesses - provide truck parking bays at Salgaa (14 had land available) and Sachangwan;
- Provide a new safe direct access to Kirobon Boys High School in Sobea and a footbridge for students. Help the school as part of the Corporate Social Responsibility Program;
- Provide an **underground passage or footbridge** for Leldet Primary School, add barriers on diversions to avoid children falling into the river and repair holes on the road;
- Increase safety at Salgaa and Ngata (many accidents) and ensure adequate **drainage** (poor drainage and flooding at Salgaa area) – streetlights, speed bumps, etc.;
- Add additional bus stops between Rongai town and Salgaa - the distance is 7 km and too far;
- Consider constructing a road within Rongai Estate from Eveready area to Teachers' college;
- Provide a **footbridge** at Sobea, Ngata (near the bridge), Ngata Primary School, Rironi Primary School, and Belbar Primary School;
- Include wildlife crossing points (zebras);
- Provide **feeder road** at Eveready Nakuru and Merovia Ngata (both sides), and from the Magnet farm to Simba Cement in Salgaa.

SPECIFICITIES FOR GILGIL SUBCOUNTY

- Include an **interchange** at both entrances for Gilgil, or at least at the second one coming from Nairobi (include monumental design for Gilgil Identity), and at the section between Mau, Elmentaita and Kikopey;
- Consider a **roundabout** to enter Gilgil with clear signs;
- Bring water to the community by offering boreholes - leave all new boreholes, rehabilitate boreholes at Kikopey Catholic Church, Kasambara and create one at Kambi Somali preferably Gilgil Highway Secondary School;
- Provide **service lanes** at Gilgil and Kikopey and ensure that all access roads to the main highway have tarmac (dusty area);
- Elaborate exit from the highway and C717 road (Ebburu Road);
- Ensure that subcontracts for supply of materials and services are locally sourced;
- Provide washrooms along the way for long-distance buses at Kasambara, Soysamba, Marula areas with canteen areas (accessible to persons with disabilities – Nakuru County has budgeted for 2 washrooms);
- Flat area with flooding problems - design adequate **drainage** for storm water in Gilgil town and Kikopey area – culverts should be extended some meters away from the main road;
- Provide proper modern parking areas in Gilgil, Kikopey and Barnabas for trailers and trucks, including washrooms, food and snacks;

- Consider cyclists and motorcyclists in the road design (runaway);
- Help community by offering 10 km of tarmac on local roads, a church in Elmentaita and a place to pray for Muslim as part of the Social Corporate Responsibility Program;
- Compensation of commercial or industrial structures should be given to committees and not individuals;
- Provide containers where red cross first aiders can operate from;
- Include a wildlife **crossing point** at Kasambara;
- Provide a **footbridge or underpass** at Hell's Gate, Soysambu, Laikipia Campus, Shinners Boys, Greensted International School, Barnabas, Kasambara (after St-Mary Hospital);
- Consider locals to operate toll system and give local investors subcontracts to supply materials;
- Plan reasonable distances between exits (avoid driving too far to access localities) and provide U-turns;
- Involve Nakuru Water and Sewage company because some **water pipes** are **crossing** the highway;
- Include an exit around Kaugwa as there are many hotels;
- Consider providing an **underpass** to access parking at Kikopey roadside station.

SPECIFICITIES FOR NAIVASHA SUBCOUNTY

- Include an **interchange** at the entrance of Naivasha (near the police stop);
- Improve the **access road** to Ereri village (8 km), expand the Mai Mahiu truck parking, improve the Rift Valley Viewpoint business kiosks, restore the Kohoto primary school fence, and offer new classrooms, and help provide water to communities as part as the Social Corporate Responsibility Program;
- Provide truck parking and expansions along viewpoints to promote economic development (consider cabro paving for truck parking);
- Protect or replant trees along the road to beautify the road;
- Provide access to Longonot market;
- Include mitigation measures against dust during construction;
- Consider 3 lanes at the hilly section of the road (over 15 km long);
- Use material from local quarries;
- Provide **footbridge and underpasses** at Kihoto, GK Prisons Primary School, Mithuri (flower farms), Kayple School, Karai, Kinungi Market and Secondary School, Ihindu Market and Primary School, Minera Primary School, Nyakairo, High Peak Area (include proper lighting);
- Provide a **wildlife crossing** at Delemare Farm, Kigio Conservancy and Kinangop junction;
- Drainage issue: provide **drainage** and sewage across the road channeling the stormwater to Lake Naivasha or River Karati;
- Consider a separate road for motorcycles and bicycles;
- Consider providing **streetlights** at Kinangop-Kinungi section, Delemare-Naivasha section and Kayole-Buffalo Mall;
- Consider within project planning, the future growth of both Mai-Mahiu and Longonot towns in terms of sewerage systems development needs.

COUNTY OF BARINGO

SUBCOUNTY OF KOIBATEK

- Ensure nice landscape with vegetation along the highway and replant trees to compensate lost ones (KFS can help);
- Ensure a good **drainage** system to avoid sanitary problems - the population is using the Molo River close to the Project. Siltation to that river should be verified;
- Protect small trees during construction to avoid them from dying (dust);
- Plan mitigation measures for potential sexual harassment and gender-based violence by foreign workers during construction - protect the village of Kibunja;
- Rehabilitate borrow pits and quarries;
- Get the adequate permit from the Kenya Forestry Office (KFS) for tree cutting;
- Ensure the valuation of trees does not exceed 6 months before construction;
- Offer free alternative roads to the highway for local users;
- Ensure there is a mitigation plan to avoid potential construction material being stolen;
- Inform the Officer Commanding Police Department (OCPD) for Koibatek when starting activities involving security.

7.5.3 SECOND ROUND OF CONSULTATION

The second round of consultation took place from May 24th to July 6, 2021. A total of 16 meetings were held to present the Project progress since the first round, to look at the proposed detail design for each subcounty territory crossed by the project, and to identify the potential environmental and social impacts generated.

7.5.3.1 STAKEHOLDER ENGAGEMENT ACTIVITIES

The methodological approach for the second round of consultation only consisted of subcounty community meetings. The courtesy visits were not necessary during this round, as all administrative authorities were already engaged and part of the planning. Following the courtesy visit and the stakeholder engagement process of the first round, each county government was invited to create a Technical Committee composed of selected County Executive Members. These Committees would act as focal points allowing the Counties to be part of the entire process of the ESIA and participate into the design revision.

Community-level meetings were conducted by the same group as for the first round. In addition, a second group composed of RVH and KeNHA representatives organized specific technical meetings with key participants and the new County Technical Committees created to look more deeply into the design and reinforced the relationship between the project team and stakeholders.

Minutes and attendance sheets of all meetings can be found in Appendix 7-4 and 7-7.

SUBCOUNTY COMMUNITY MEETINGS

A total of 10 subcounty community meetings were held during the second round. In order to better identify the potential impacts of the project and allow stakeholders to give their views on the detail design, the methodology used for the second round involved a two-part activity.

The first part consisted of a plenary meeting, where a presentation was shown to all participants followed by a question-and-answer period. The second part consisted of a focus group mapping session, where a small group composed of representatives from the consulted communities, had an in-depth look at the detail design and the territory sensitive elements. This was to ensure the best integration for the project regarding its environment and recognize all environmental and social related issues. It also allowed to collect complementary information on socioeconomic aspects.

The guests invited to the meetings were representatives of affected sub counties, wards, members of parliament, members of county assembly, chiefs, sub chiefs, and other main representatives of locations or sub-locations. Invitation took into account gender and social inclusive consciousness. An example of an invitation letter and a guest list can be found in Appendix 7-4. All meetings were held outside for COVID-19 security purposes. Microphones, water and tents for shade were provided. Visual materials were also used during presentation, such as a large map to locate the entire project, another focusing on the consulted subcounty territory, and images of new infrastructures (overpass, underpass, flyover) to better help visualize the project.

PLENARY ACTIVITY (FIRST PART)

As per the first round, each meeting started with a prayer and an official opening by the DCC of the subcounty where the meeting was held. The facilitator from Norken International Inc. then took over the meeting and invited each speaker according to the meeting agenda (refer to Appendix 7-4). The first speaker was a representative from KeNHA or from RVH. They were invited to introduce the project team and present a brief overview of the Project's progress. A representative from WSP Canada was invited to complete the information providing more technical details on the project and going through the specific design for the consulted subcounty territory. Following the design presentation, the WSP representative explained the ESIA process and gave an update of the work done since the first round and ended by explaining the potential environmental and social impact of the project. These presentations were made in plenary. A list of interventions was then opened by the facilitator to allow participants to react to the presentations and to formulate their observations and comments. Youth, elders, women and PLWD were specifically invited to give their views during the meetings. Questions were answered by KeNHA and RVH. Each person's observations and comments were recorded and collected. Priority for the Q &A period was given to stakeholders invited for the first part of the activity only. The next steps were presented following the discussions and the official ended the activity after inviting a member of the community to make a closing prayer.

The complete meeting was done in both English and Swahili. Some meetings also had language sign translators for higher inclusiveness. As per the first round, stakeholders were invited to give their concerns or comments in writing during or after the meeting, or by email using the addresses included in the leaflet.

FOCUS GROUP MAPPING SESSION ACTIVITY (SECOND PART)

In addition to the plenary meeting, two groups of community representatives were kept after the first activity, for a more in-depth consultation. The first group was mostly composed of chiefs or sub chiefs, religious leaders, educators, or other community leaders, and was created to allow a revision of the proposed design by community leaders having a global knowledge of the territory. As per the second group, it was composed of woman leaders, elders, youth leaders, and PLWD representatives, for the purpose to revise the proposed Project through a social inclusive dimension approach.

Members of the two groups were selected by the Sub-County administration and/or chief, in democratic ways to ensure a good representation of the community. An example of the group composition can be found in Appendix 7-4. Questions were asked to those two groups to better understand their land use and revise the proposed detail design to ensure it responds to population mobility challenges, avoid unnecessary negative impacts, and integrate the urban and social fabric of each community. Attention was given to the following elements with a look at the mobility needs:

1. Location of farming activities and crossing points (livestock and machinery)
2. Location of main community places (schools, worship places, markets, health facilities, etc.)
3. Location of drainage problem areas
4. Revision of all proposed design components' locations (bus and truck bays, service lanes, interchanges, crossing infrastructures, lighting, etc.)

In addition to the above-mentioned elements, the groups reflected on the positive and negative impacts of the project, and areas of need for the community. This last point would contribute to better identify potential areas of work for the CSR program.

Table 7-6 presents the details of the consultative activities performed during the second round of consultation. Agenda, attendance sheets, photos and minutes of meetings (plenary and focus group mapping activities) can be found in Appendix 7-4.

Table 7-6 Subcounty meetings held during the Second Round of Consultation

No	Stakeholders / Participants	Day and Date	Time	Venue	Number of participants
1	Limuru Sub County Community	Monday, May 24, 2021	10h00	PCEA Church, Limuru, Kiambu	114
2	Lari Sub County Community	Tuesday, May 25, 2021	10h30	DCC's Office Compound, Lari, Kiambu	176
3	Naivasha Sub County Community (Southern Part)	Wednesday, May 26, 2021	11h20	Chief Compound, Mai Mahiu, Naivasha, Nakuru	140
4	Kinangop Sub County Community	Thursday, May 27, 2021	11h00	DO's office in Kanywa, Magumu, Kinangop, Nyandarua	97
5	Kuresoi North Sub County Community	Friday, May 28, 2021	10h30	Chief Compound, Kuresoi North, Nakuru	108
6	Rongai Sub County Community	Monday, May 31, 2021	10h30	ACK Church Rongai Compound, Nakuru	111
7	Molo and Koibatek Sub Counties Communities	Wednesday, June 2, 2021	10h30	A/Chief Compound, Kibunja, Molo, Nakuru	124
8	Gilgil Sub County Community	Thursday, June 3, 2021	12h00	Gilgil CDF Ground, Nakuru	117
9	Nakuru East and Nakuru West Sub Counties Communities	Friday, June 4, 2021	11h00	County Commissioner Office compound, Nakuru City, Nakuru	152
10	Naivasha Sub County Community (Northern Part)	Monday, June 7, 2021	10h45	Kayole Hall, Lake View, Naivasha, Nakuru	158
				Total Participation:	**1 297**

SPECIFIC TECHNICAL MEETINGS HELD BY RVH AND KENHA

During the second round of consultations, the following meetings were held by RVH and KeNHA team in order to validate some technical details and look more deeply into the proposed design for the projects and the potential challenges that might occur:

NYANDARUA COUNTY TECHNICAL MEETING

This meeting was held on 20th May 2021 at Fly Over Hotel and involved Nyandarua County Government Senior Technical Officers led by the Deputy Governor, County Executive Members in charge of transport, trade and ICT and their technical officers. The meeting was preceded with a site visit of the Soko Mpya Market and other notable features along the stretch of road covered by Nyandarua County. The project was then presented to the County technical team and RVH, KeNHA and the PPP Unit representatives who were present, responded to their questions.

NAKURU COUNTY TECHNICAL MEETING

This meeting was held on 21st of May 2021 at Sarova Woodlands Hotel, and involved Nakuru County Government Senior Technical Officers led by the County Executive Member in charge of roads and his technical officers. The meeting was preceded with a site visit of the road from PK 35 to PK 150 with stops at notable features along the stretch of road covered by Nakuru County. The project was then presented to the County technical team and RVH, KeNHA and the PPP Unit representatives who were present, responded to their questions.

KIAMBU COUNTY TECHNICAL MEETING

This meeting was held on 26th May 2021 at Jumuia Conference Centre, Limuru and involved Kiambu County Government Senior Technical Officers led by the County Executive member of Environment and the County Executive Member in charge of roads, and their technical officers representing urban planning, water, environment and roads. The project was presented to the County technical team and their questions were responded to by RVH, KeNHA and the PPP Unit representatives who were present. The meeting was followed by a site visit of the stretch of road from PK 00 to PK 30 where the county boundary is.

MEMBERS OF PARLIAMENT

This meeting was held on June 3rd at Crown Plaza Hotel in Nairobi, and involved parliamentary representatives from the project area. The chief guest at this meeting was the Cabinet Secretary for Transport, Infrastructure, Housing, Urban Development and public works accompanied by the Director General of KeNHA. The Director General for the PPP Unit of the Treasury attended virtually. The project was then presented to the Members of Parliament present and their questions were responded to by RVH, KeNHA and the PPP Unit representatives who were present.

STATE-OWNED AGENCIES TECHNICAL MEETING

The meeting was held on June 30th and involved National Government State Agencies who are affected by the project including Kenya Pipeline, National Museums of Kenya, Kenya Forrest Services and Directorate of Occupational Health and Safety Services. The project was then presented to the State-owned agencies teams and their questions were responded to by RVH, KeNHA and the PPP Unit representatives who were present.

NGO MEETING

This meeting was held on 6th July 2021 at Crown Plaza. It was a hybrid meeting with members attending both physically and virtually. The meeting included a wide range of non-governmental organizations representing conservation agencies, private sector representatives and other non-state actors. The project was then presented to the State-owned agencies team and their questions were responded to by RVH, KeNHA and the PPP Unit representatives who were present.

Table 7-7 presents the details of the consultative activities performed during the second round by RVH and KeNHA. Attendance sheets, photos and minutes of meetings can be found in Appendix 7-4.

Table 7-7 Specific meetings held by RVH during the Second Round of Consultation

No	Stakeholders / Participants	Day and Date	Time	Venue	Number of participants
1	Nyandarua Technical County Committee	Thursday, May 20, 2021	10h00	Flyover Hotel, Nyandarua	26
2	Nakuru Technical County Committee	Friday, May 21, 2021	15h00	Sarova Woodlands Hotel, Nakuru	52
3	Kiambu Technical County Committee	Wednesday, May 26, 2021	10h30	Jumuia Conference and Country Home, Limuru, Kiambu	35
4	Members of parliament	Thursday, June 3, 2021	7h00	Crown Plaza Hotel, Upper Hill, Nairobi	22
5	State-Owned Agencies	Tuesday, June 29, 2021	10h25	Crown Plaza Hotel, Upper Hill, Nairobi	25
6	NGOs	Tuesday, July 6, 2021	9h15	Virtual meeting	27
				Total Participation:	**187**

7.5.3.2 TOOLS AND SUPPORTING MATERIAL

The tools used for the second round of consultation consisted of the distribution of an informative leaflet and the display of an A0 format map of the highway project. In addition, specific maps were prepared for each subcounty meeting to show the detail design proposed for the consulted territory. Some visual materials were also presented, such as images of crossing structures (overpass, underpass, flyover) to help the community better visualize the project and its components. The tools and supporting material for this second round can be found in Appendix 7-8. An atlas was also used for the focus group mapping sessions.

7.5.3.3 MAIN CONCERNS AND OBSERVATIONS

The main concerns and recommendations from the second round are summarized hereafter. There is a section for the community meetings, and one for the specific technical meetings performed by RVH and KeNHA. In addition, a summary of other comments received sporadically after the second round, through email or other informal discussions with stakeholders outside the organized consultation activities, is provided (refer to Appendix 7-9).

SUBCOUNTY COMMUNITY MEETINGS

Results from the plenary meetings were divided into 3 categories, the first one was concerns related to the design of the project; the second one was concerns specific to community needs that could be part of a potential CSR program; the third one presents other relevant comments mentioned.

For the three categories, inputs have been organized to identify their origin: plenary session, leader focus group mapping session or social inclusion focus group mapping session. The specific chainage (CH) has been added whenever possible, to help better locate the various stakeholders' inputs.

Table 7-8 Results of the stakeholders inputs for the second round of subcounty community meetings

<table>
<tr><th colspan="4">Kiambu County</th></tr>
<tr><th colspan="4">Limuru Sub-county Community Meeting</th></tr>
<tr><th colspan="2">Design Concerns and Request</th><th rowspan="2">Community Needs and CSR Suggestions</th><th rowspan="2">Other Comments, Concerns or Recommendations</th></tr>
<tr><th>Plenary session</th><th>Leader and Social Inclusion Representatives Focus Group Mapping Session</th></tr>
<tr><td colspan="4">A8 Highway (CH 0 to 8)</td></tr>
<tr><td>Flooding area:
– Flooding area near Manguo swamp (flooding of the road) (A8 CH 2+900 to 3+500)
Crossing:
– Add a footbridge for Kamandura Primary School (A8 CH 0+700 – west)
– Keep underpasses clean and clear from dirt
– Consider adding light inside underpasses for security
Bus bay:
– Add more bus bays to serve the increasing population in Murengeti area (A8 CH 7+000 to 8+000)
Service lanes:
– Ensure an easy access to businesses by adding service lanes (ensure business vibrancy)
Climbing lane:
– Add around Manguo area and other hilly sections (A8 CH 3+200)
Other
– Avoid damaging Bibirioni water project pipes during construction (serves 40,000 people) (A8 CH 5+250 – west)
– Ensure a good management of the motorcyclist road users (important accident cause);</td><td>Flooding area:
– A8 CH 1+300 to 1+600
– A8 CH 2+100 to 2+300
Crossing:
– Add footbridge at A8 CH1+900
– Add underpass at A8 CH 5+000 (for farming area)
Bus bay:
– Add on both sides: A8 CH 2+000
– Add on one side: A8 CH 2+700; A8 CH 3+100
Service lanes:
– Add on both sides: A8 CH 1+400 to 2+500</td><td>Leaders and social inclusion session:
– Classroom construction for Kamandura Primary School including a Special Needs Unit (A8 CH 0+700 – west)
– Improve roads around Bibirioni/(Ngarariga) Shopping area (A8 CH 6+000 – west)
– Upgrade road at A8 CH 1+450, west.</td><td>Plenary session:
– Provide job opportunity for youth (include Ndiuni population even if further)
– Put in place adequate measures to restore livelihood of affected curio shops, kiosks and viewpoints along the road
Leaders and social inclusion session:
– There are a lot of farms in the area, make sure farmers are not negatively impacted</td></tr>
<tr><td colspan="4">A8 South (CH 0 to 10)</td></tr>
<tr><td>Interchangeà:
– Add an interchange at the intersection of Mutarakwa Limuru Road and the A8 South (A8S CH 2+625)</td><td>Flooding area
– A8S CH 2+400 to 2+700
Bus bay
– Add on both sides: A8S CH 1+500
Service lanes
– Add on both sides: A8S CH 1+200 to CH 1+700; CH 3+200 to 3+500
Climbing lane
– Add at A8S CH 2+000 to 2+500
Interchange
– Add at A8S CH 2+600</td><td>Leaders and social inclusion session:
– Improve Ngenia High School Road (A8S CH 1+500 – west)</td><td></td></tr>
</table>

<table>
<tr><th colspan="5">Kiambu County</th></tr>
<tr><th colspan="5">Lari Sub-county Community Meeting</th></tr>
<tr><th colspan="3">Design Concerns and Request</th><th rowspan="2">Community Needs and CSR Suggestions</th><th rowspan="2">Other Comments, Concerns or Recommendations</th></tr>
<tr><th>Plenary Session</th><th>Leader Representatives Focus Group Mapping Session</th><th>Social Inclusion Representatives Focus Group Mapping Session</th></tr>
<tr><td colspan="5">A8 Highway (CH 8 to 30)</td></tr>
<tr>
<td>Flooding area:
– Add proper drainage near Kimende secondary school (flooding area)
Crossing:
– Add a footbridge at Magina Secondary School and underpass at Karemba for livestock
– Add wildlife crossings at Kijabe Hospital Area, at Kinari and Kinale Forest
– Provide crossing points and lanes for farmers and animals
– Provide pedestrian and vehicle crossings (bridge/underpass) especially at Nyambari
Bus bay:
– Provide bus bays with shelters between Nyambari and Kariko
Street lighting
– Put streetlights along the whole ROW (from Rironi to Mau Summit) as a security measure
Other:
– Avoid diverting traffic to Kimende town to prevent business loss in Kimende and Nyambari</td>
<td>Flooding area :
– A8 CH 10+400 to 11+400
– A8 CH 17+600 to 18+000
Crossing :
– Add footbridge at A8 CH 20+000
– Ensure adequate height for farming machinery at A8 CH 10+400 (underpass)
– Add cattle crossing at A8 CH 21+500
Service lanes:
– Ensure access to Nyambari market: A8 CH 9+100
– Ensure access to farms: A8 CH 9+200)</td>
<td>Accident blackspot:
– A8 CH 12+200; CH 12+600; CH 20+100 (crossing points for pedestrians and cattle)
– A8 CH 16+500 to 25+500 (need to slow down speed)
Crossing:
– Add cattle crossing point to Kikuyu escarpment (CH 20+300)
– Add cattle crossing at A8 CH 23+500; CH 23+700 and CH 28+900
Street lighting:
– Add at A8 CH 15+800 to 16+100
– Add at A8 CH 17+500; CH 21+600; CH 29+400
Interchange:
– Add at A8 CH 29+400 and CH 16+900
Signage:
– Add at A8 CH 8+000 to 30+000 (poor visibility)
Other:
– Bus bay and crossing design to accommodate PLWD</td>
<td>Plenary session:
– Boost existing health centers with pharmaceuticals
– Support the expansion of the Rukuma Level 4 Hospital (A8 CH 14+350)
– Add lights at DCCs office, Police Post, polytechnics and at Rukuma Level 4 hospital
– Upgrade bridges near Kijabe Hospital to bigger ones to enable ferrying of goods using trucks
– Improve Kimende Road pavement quality (increase in truck traffic is anticipated)
– Upgrade link roads in the area, such as Kirothe Road and A6 Road
– Construct access roads from Kinale and Kariko to the forest
Leaders session:
– Offer public health facilities in Nyambari
– Add a maternity at Kago (Magina) dispensary, and improve facilities (CH 20+900 - North of Kago Primary School)
– Add a maternity Unit at Kireita Dispensary in Kimende
– Upgrade the road from Lari Hospital to Kirenga Market (A8 CH 14+300 to 15+100 – East side of the road)
– Upgrade Nairobi Road from Kimende Secondary School to road leading to Bathi Primary and Secondary Schools (A8 CH 16+900 to 18+000).
– Provide equipment for Kirenga Polytechnic (A8 CH 14+400 – further east from the road)
Social inclusion session:
– Improve Kimende police post.
– Upgrading and improving Mukeu special school and other schools including Kimende primary, Getithia mixed secondary and Kango primary school.
– Upgrading Lari level 4 Hospital and Magina Dispensary (e.g. Need X-ray, Cancer screening, maternity and wards)</td>
<td>Plenary session:
– Offer employment opportunities for youth and PLWD as well as training
– Inform the community on any plan to relocate water pipes; avoid damage and interference of water supply
– Protect flora and fauna (gituamba) as well as Mugumo trees (sacred Kikuyu community trees)
– Protect wildlife: lots of bats in Kiambu County
– Mitigate properly environmental pollution and rehabilitate borrow pits
– Adequate livelihood restoration plan for affected farming and trading kiosks along the road
– Work with elected leaders and National Government Administrative Officers to ensure proper representation of the affected communities.
Leaders session:
– Plant vegetation in the area (scarcity of trees/vegetation)
Social inclusion session:
– Mitigate noise and dust during construction
– HIV/AIDs may be on the rise due to the influx of workers in the area.
– The project may expose the young unemployed girls/ladies into immoral behaviours including prostitution
– Compensate affected traders and offer priority for potential job opportunities</td>
</tr>
</table>

<table>
<tr><th colspan="5">Kiambu County</th></tr>
<tr><th colspan="5">Lari Sub-county Community Meeting</th></tr>
<tr><th colspan="3">Design Concerns and Request</th><th rowspan="2">Community Needs and CSR Suggestions</th><th rowspan="2">Other Comments, Concerns or Recommendations</th></tr>
<tr><th>Plenary Session</th><th>Leader Representatives Focus Group Mapping Session</th><th>Social Inclusion Representatives Focus Group Mapping Session</th></tr>
<tr><td colspan="5">A8 South (CH 9 to 19)</td></tr>
<tr><td></td><td>Protect Viewpoint:
– A8S CH 11+000
– A8S CH 10+400
– A8S CH 10+100 to 10+300
– A8S CH 9+000</td><td>Accident blackspot:
– A8S CH 9+600
– A8S CH 18+000
– A8S CH 16+900
Crossing:
– Add pedestrian and animals crossing: A8S CH 15+900 and CH 17+700
Street lighting:
– Add at A8S CH 16+900
– Add at A8S CH 17+300 to 19+000</td><td></td><td>Refer to above A8 table</td></tr>
<tr><td colspan="5">A8 Highway (CH 29 to 39)</td></tr>
<tr><td>Crossing
– Crossing infrastructures must consider PLWD
– Add a footbridge at Soko Mpya market area (A8 CH 31+000)
Bus bay
– Add a bus bay at Soko Mpya market area (A8 CH 31+000)
Signage
– Improve road signage (use material that will not interest thieves)</td><td>Accident Black Spot:
– A8 CH 31+950
Flooding area:
– A8 CH 30+600 to 32+000
– Drain water to Dam A8 CH 30+100 to 30+500
Crossing:
– Add footbridge at A8 CH 31+000; and CH 32+700
Service lanes:
– Extend from A8 CH 31+000 to 31+300
– Extend from A8 CH 30+900 to 31+200
Development area:
– Magumu market and logistic centre (A8 CH 29+800 to 30+200
Other:
– Video surveillance of highway for security</td><td>Accident Black Spot:
– A8 CH 35+400 (fog)
– A8 CH 37+200 (Ihundu market - crossing)
Flooding area:
– A8 CH 29+300; CH 33+100
Crossing:
– Add cattle crossing at A8 CH 28+900
– Add underpasses for farmers between A8 CH 30+000 and CH 30+400; at CH 32+200, CH 33+500; and CH 36+800
Bus bay:
– Add at A8 CH 31+500 and A8 CH 33+500 (both sides)
Street lighting:
– Add from A8 CH 30+600 to CH 33+600
Signage:
– Add signage warning (foggy area) from A8 CH 8+000 to 30+000
Truck bay:
– Add at A8 CH 33+500</td><td>Leaders session:
– Add a unit for accidents/emergency with ambulance at the health center
– Add classrooms (3 new classrooms) to Muchorui school
– Construct a parliament office on the subcounty land (ACC)
– Upgrade and repair the road connecting the Kobil Viewpoint to the local road as well as the Viewpoint road itself for tourism: A8 CH 33+000 to 33+300 and A8 CH 33+300 to 33+600
Social inclusion session:
– Drill boreholes for residents to fetch clean drinking water
– Offer scholarship opportunities to local youths to gain technical skill
– Support local talents by introducing talent shows
– The contractor should utilize its machinery to fulfill community needs and improve access roads to public institutions and markets (St. Christopher primary/secondary and Ihindu market, etc.)</td><td>Plenary session:
– Ensure the project will not create a stagnation of business vibrancy for Mugumo and Gitwe
– Ensure compensation is done before construction, a lot of residents are still waiting for their compensation
Leaders session:
– Presence of truck drivers delivering products into the area will attract commercial sex workers and possibly risk introduction of new diseases in the area.
– Farmers disturbed by detours
– The road expansion could attract robbers who engage in theft of cars and robbery of road users (crime)
Social inclusion session:
– Consider local businessmen for material supply
– Offer local job opportunities, with priority to PLWD
– Provide mobile clinics and toilets (construction)
– Protect Kinale Forest
– All the design components should consider PLWDs, especially hearing impairment and locomotor disability
– Potential erosion of culture and crime by incomers in the area (crime of material and property)
– Rehabilitate material sites/borrow pits</td></tr>
</table>

Nakuru County				
Naivasha Sub-county Community Meeting				
Design Concerns and Request			Community needs and CSR Suggestions	Other Comments, Concerns or Recommendations
Plenary Session	Leader Representatives Focus Group Mapping Session	Social Inclusion Representatives Focus Group Mapping Session		
A8 Highway (CH 33 to 66)				
Crossing: – Add enough pedestrian crossings in Naivasha (accessible for PLWD) – Add a footbridge in Mithuri area, in front of Semita Girls High School (A8 CH 55+825 – west) – Add at least 3 footbridges in Karai area, between Kinungi and Hells Gate (population growth) – Add an underpass at A8 CH 57+200 **Street lighting:** – Actual streetlights should be maintained (ex: Victor Chapel area – A8 CH 51+650 – west)	**Flooding area:** – Flooding area: A8 CH 55+900 to 56+100; A8 CH 59+400 to 60+000 and A8 CH 64+500 to 65+900 **Crossing:** – Add a footbridge in flower farm area at A8 CH 58+200 – Move footbridge from A8 CH 52+200 to 52+300 – Move underpass from A8 CH 56+050 to 55+700 **Street lighting:** – Add streetlights from A8 CH 61+950 to 62+500	**Accident blackspot:** – A8 CH 38+000 (Ihindu) – A8 CH 43+300 to 43+700 – A8 CH 48+000 (Karai) – A8 CH 50+600 (resident don't use the underpass) – A8 CH 52+300 (Kayole) – A8 CH 53+500 to 53+800 (road too narrow) – A8 CH 59+700 – A8 CH 61+300 to 62+700 **Flooding area:** – A8 CH 54+800 to 59+800 **Crossing:** – Add a footbridge at A8 CH 50+600 **Bus bay:** – Add between A8 CH 43+300 and CH 43+700 – Add on both sides of the road: A8 CH 48+000; CH 51+500; CH 55+600; CH 57+600 **Street lighting:** Add at A8 CH 61+300 to 62+700 **Truck bay:** – Add at A8 CH 53+300	**Social inclusion session:** – Construct daycare facility for children whose parent are flower farm workers – Construct youth recreational facility in the area	**Plenary session:** – Mitigate properly environmental impacts and rehabilitate borrow pits – Bring environmental protection awareness by adding signage and waste bins along the road – Ensure compensation is fair and done prior to construction – Provide local employment (inclusion of liaison officers to help with communication) – Avoid water supply disruption and consider providing tunnels to place water pipes and ensure water connectivity to nearby areas **Leaders session:** – Include appropriate compensation for traders along the ROW: Kiosk owners and street vendors will lose their source of income – Provide mitigation measure for the increase in property value especially land (unaffordable for the average person) – Add trees to beautify the road – Use material like murram and stones from local quarries **Social inclusion session:** – Displaced roadside traders should be considered for employment during the project implementation phase – Provide mitigation measures for moral degradation by foreign contractors – Provide mitigation measures to prevent crime during construction – Provide mitigation measures against potential rise in respiratory disease during construction – Ensure mobile clinic or ambulance on site during the construction phase.

Nakuru County				
Naivasha Sub-county Community Meeting				
Design Concerns and Request			Community needs and CSR Suggestions	Other Comments, Concerns or Recommendations
Plenary Session	Leader Representatives Focus Group Mapping Session	Social Inclusion Representatives Focus Group Mapping Session		
A8 South (CH 15 to 57)				
Flooding area: – Flooding area at Mogas area that connects Mai Mahiu to Kijabe **Crossing:** – Provide ramp and universal access for PLWD to cross safely – Add child crossing sign at the junction of Ngeya Primary School, (option of overpass can be analysed as well)- (A8S CH 20+500 – east) – Add a safe crossing for children at Mirera Primary School A8S CH 47+400, further west – Add a footpath between Longonot and Moi South Lake Road junction, – Add a footbridge at A8S CH 24+900 – Mai Mahiu Primary – Add wildlife crossing between Maili Mbili and Panorama Park – Add cattle crossing in the Mogas area **Service lanes:** – Ensure livelihood of businesses by providing services lanes and easy entry to town – Add services lanes in the Mogas area – Add service lanes to access Lower Kijabe Road from the highway (Moi South Lake Road); – Add an inner lane on either side of the highway at A8S CH 17+700 – east – Italian Church) – Add service lanes from Lakeview Primary School to Buffalo Mall Roundabout (A8S CH 53+000 to 57+000) **Interchange:** – Consider adding interchanges at A8S CH 53+000 – west), at Musaka, at Nyaikuri, and between lake View and Kwa Mwangi. **Street lighting:** – Add more streetlights along the highway **Truck bay:** – Make sure truck bays are big enough to solve traffic snarl-up	**Accident blackspot:** – A8S CH 20+100; A8S CH 24+900; A8S CH 34+900 **Flooding area:** – A8S CH 22+300 to 22+500 – A8S CH 32+900 to 33+400 – A8S CH 54+300 to 54+500 – A8S CH 55+000 to 55+200 **Crossing:** – Add safe pedestrian crossing: A8S CH 20+100; A8S CH 24+900; A8S CH 34+900; A8S CH 53+000; A8S CH 54+400; A8S CH 55+050 and A8S CH 56+100 **Truck bay:** – Expand truck bay to 250 m from A8S CH 21+100 to 21+350 – Expand truck bay to 250 m from A8S CH 27+700 to 27+900 **Bus bay:** – Move bus bays from A8S CH 26+800/27+000 to 27+600 – Add small kiosks and light for sellers at bus bay **Other:** – Add toilets at truck bays and bus bays – Cover drainage for PLWD – Reinstall motorcycles shelters	**Accident blackspot:** – A8S CH 48+800 – A8S CH 51+300 – A8S CH 53+000 – A8S CH 54+400 **Flooding area:** – A8S CH 20+900 to 21+100 – A8S CH 22+300 – A8S CH 51+300 – A8S CH 51+300 to CH 53+000 **Crossing:** – Add cattle crossing at: A8S CH 20+900; CH 21+400; CH 22+300; CH 34+300; and CH 35+400 – Add safe pedestrian crossing at: A8S CH 20+800, CH 21+400; CH 25+600 (Mararo village); CH 31+000; CH 31+800; CH 33+500, CH 34+300) – Add safe pedestrian and cattle crossing at : A8S CH 19+200; CH 24+900; CH 26+100; CH 27+700 **Bus bay:** – Add at A8S CH 35+000 (both sides) **Protect/promote Viewpoint** – A8S CH 15+900 to 16+200, CH 28+000 to 28+400) **Other:** – Quarry site approximately 500 meters from the road – (CH 28+000) – Ensure access to Longonot, Githarane village, SGR station and quarry – Ensure access to Ereri Primary, Catholic church, AIC, VIC Church, etc.	**Plenary session:** – Provide a recreational park for the people of Mai Mahiu – Sponsorship of health facilities and provide supply – Provide boreholes (water) – Establish a special needs school in the area – Upgrade the road leading to Ngeya Primary School **Leaders session:** – Add a maternity unit in Longonot Dispensary (A8S CH 35+000 – further from the road, east side) – Available land around A8S CH 19+200 (further west inside), need for financing to construct a secondary school – Construction of a Secondary school (on a 5-acre community land) – Provide seeds for trees (through Community Based Organizations- CBO) – Provide water supply (boreholes) – Provide more classrooms at Unity Primary School – Provide more classrooms and a special needs unit at Manera Primary School – Furnish the YMCA Health Center with more laboratory equipment – Construct a Maternity Unit/Ward at the Kayole Dispensary **Social inclusion session:** – Drilling boreholes in public lands (schools, hospitals and churches) where the community members can easily access. – Improve existing hospitals. – Need to improve schools (Gathima primary, Lare Primary, Ngeya primary, Namja primary, Mai Mahiu boys and girls)	Refer to above A8 table

Nakuru County				
Naivasha Sub-county Community Meeting				
Design Concerns and Request			Community needs and CSR Suggestions	Other Comments, Concerns or Recommendations
Plenary Session	Leader Representatives Focus Group Mapping Session	Social Inclusion Representatives Focus Group Mapping Session		
Other: – Consider expanding A8 South to alleviate the heavy traffic – Provide a diversion at the Kikuyu escarpment to ease traffic during construction – Consider a diversion at Musaka				
A8 Highway (CH 167 to 175)				
Interchange: – Consider adding a U-turn at Total Center (A8 CH 174+800) **Crossing:** – Add an underpass at the Mau Summit police station (A8 CH 173+800) **Bus Bay:** – Add at A8 CH 173+800	**Flooding area:** – A8 CH 173+100 to 171+250 – CH 173+700 to 173+850 **Crossing:** – Add cattle crossing at A8 CH 168+200 – Move footbridge from CH 170+900 to 171+200 – Add a footbridge at A8 CH 173-800 – Rehabilitate existing pedestrian underpass and allow vehicle at A8 CH 174+600 **Interchange:** – Add a possibility of U-turn before or at total interchange (A8 CH 174+400 to 174+800) **Street lighting:** – Add from A8 CH 171+000 to 175+000	**Accident blackspot:** – A8 CH 167+600 – A8 CH 173+500 **Crossing:** – Add cattle crossing at A8 CH 169+400 – Add footbridge at A8 CH 171+500 (Jogoo Center) **Bus bay:** – Add at A8 CH 171+500; CH 173+000; and CH 173+500 (both sides) **Street lighting:** – Add from A8 CH 169+100 to 169+300 **Truck bay :** – Add at A8 CH 171+300 (both sides) **Other:** – Suggested proper signage for sharp curve at A8 CH 173+300	**Plenary session:** – Tarmac the road leading to the health center up to Karonga and offering an ambulance for emergency purposes during construction – Develop of a new marketplace (before the total center flyover or next to the future truck bays where KeNHA bought some extra land) **Leaders session:** – Expand dispensary – Koige (CH 171+200 – east, exact location to confirm) – Improve Mau Summit Police Post and Ward Office A8 CH 173+750 and CH 173+850, east) – Improve Total Dispensary/Health Center (CH 174+200 – further west from road) and construct a local quality access road – Install shelters for boda (motorcycles) – Install stalls for local economy at A8 CH 171+700 and both sides of total center for local economy (CH 174+800) – Install toilets at Total Center **Social inclusion session:** – Drill boreholes for resident water supply – Improvement of existing local health facilities (lack amenities personnel) – Construct market center at Jogoo center and Total centre	**Plenary session:** – Ensure adequate compensation and proper livelihood restoration, mostly for the traders and businesses owners. – Ensure water pipes are not damaged and the water supply is not interrupted **Leaders session:** – Sensibilization work to inform and prepare the population beforehand will be necessary – Ensure mitigation measure for the potential increase in diseases and unwanted pregnancy. **Social inclusion session:** – Build a market with an interchange from the main highway – Employ a Community Liaison officer for grievance Redress (construction) – Consider introducing mobile clinics to help save lives in case of accident – The access roads to the farm and homesteads are poor due to silt from floods during rainy seasons – The area has no police post and the level of insecurity is high. – Tribal clashes especially during elections

Nakuru County				
Rongai Sub-county Community Meeting				
Design Concerns and Request			Community Needs and CSR Suggestions	Other Comments, Concerns or Recommendations
Plenary Session	Leader Representatives Focus Group Mapping Session	Social Inclusion Representatives Focus Group Mapping Session		
A8 highway (CH 129 to 156)				
Accident blackspot: – Review geometry at section between Nakuru-Salgaa and Sachangwan **Flooding area:** – Project area is subject to flooding **Crossing:** – Add footbridge at A8 CH 133+000; A8 CH 134+300; and between Kirobon and Crater View Schools – Ensure livestock can cross easily and safely **Bus bay:** – Add little business stalls integrated to the bus shelters **Service lanes:** – Design proper exit and entrance on the highway, including one at Ngata – Consider including speed bumps on service lanes (descent) – Consider bicycle and motorcycle lanes both sides of the road **Interchange:** – Consider a U-turn at Simba Cement (around A8 CH 147+450) **Street lighting:** – Add at Ngata bridge at A8 CH 132+150, as well as at Sobea area at A8 CH 140+250 **Truck bay:** – Add truck parking on both sides of the highway in Saalga (A8 CH 151+000 to 152+000) **Other:** – Design a proper connection between the new highway and Mangu as well as Njoro – Presence of volcanic underground tunnels loosening the soil at Ngata Bridge during construction	**Flooding area:** – A8 CH 138+400 to 138+800 – A8 CH 140+000 to 140+400 – A8 CH 141+100 to 141+400 – A8 CH 148+775 to 149+000 **Crossing:** – Add cattle and pedestrian crossing at A8 CH 140+100 and CH 154+000 – river – Add footbridge at A8 CH 147+450 - Simba – Add an underpass or an overpass for pedestrians – (CH 148+700) **Service lanes:** – Extend both sides of police post from A8 CH 135+600 to 136+000 – Extend from A8 CH 136+200 to 137+000 (west) and from A8 CH 137+100 to 137+700 (east) – Extend from A8 CH 139+400 to 140+000 (west) and from A8 CH 139+700 to 140+000 (east) – Add both sides from A8 CH 147+200 to 147+800 (Simba) – Extend from A8 CH 148+500 to 149+200 (west) and from A8 CH 148+400 to 148+950 (east) **Interchange:** – Add U-turn around A8 CH 174+400 to 174+800 **Street lighting** – Add from A8 CH 135+500 to 136+000 – Add from A8 CH 139+800 to 140+800 **Truck bay:** – Add both sides from A8 CH 151+200 to 151+500 (Saalga) – Add truck parking zone: A8 CH 152+400 to 153+500 **Other:** – Underground vaults (3 holes) present in the area: (A8 CH 132+100 to 132+500) – Pipeline in the area from A8 CH 132+400 to 132+500	**Accident blackspot:** – A8 CH 130+300; CH 140+400; CH 145+600, and CH 153+800 **Flooding area:** – A8 CH 130+600 to 131+200 – A8 CH 138+300 to 140+400 – A8 CH 148+600 to 149+000 **Crossing:** – Add cattle and pedestrian crossing at A8 CH 129+200, CH 136+500; CH 139+900; CH 140+400, CH 143+700, CH 147+200; CH 148+400 and CH 154+000 – Add footbridge or underpass at A8 CH 144+400 **Bus bay:** – Add both sides of the road at A8 CH 129+200; CH 132+200; CH 136+500; CH 139+400; CH 141+400; CH 144+400; CH 151+400; CH 151+900 **Service lanes:** – Add on both sides from A8 CH 132+200 to 140+300; from CH 145+600 to 148+700 and from A8 CH 148+600 to 149+000 **Truck bay:** – Remove from A8 CH 142+700 and CH 143+300 – close to school area – Add at A8 CH 140+600 and CH 151+800 **Signage:** – Proper signage to indicate climbing lanes at A8 CH 141+400 **Other:** – Constructing bridges with guard rails at A8 CH 153-700	**Plenary session:** – Build an emergency hospital on the 10 acres of land set aside by the County – Tarmac the road leading to Bonasan secondary school – Rehabilitate the road from Ngata Bridge (A8 CH 132+150) – Improve Saalga police station (A8 CH 151+250, west) **Leaders session:** – Construction of ablution facilities for the community – Planting of vegetation i.e., trees in the area – Provide piped water connection to homesteads **Social inclusion session:** – New modern hospital to serve Rongai residents – Improve administrative facilities (Ngata police post, Salgaa Police station and Mimwaita police post) – Introduce Child defilement desk/office at Salgaa Police Post – Improvement of Chepsoen Primary School	**Plenary session:** – Mitigate social negative impacts such as prostitution, child labour, increased cases of school dropouts and organize sensitization campaigns – Involve local youth for sensitization campaigns on road safety (CBO like Kirobon Development Youth of Kenya) – Apply appropriate mitigation measures for dust and vibration (construction phase) – Ensure an adequate management of borrow pits that can be an environment for the breeding of mosquitoes if left open during the construction **Leaders session:** – Proper compensation for loss of income for street sellers and kiosks along the road (psychological distress) – Educate road users, pedestrians and motorbikes on safety **Social inclusion session:** – The influx of project workers in the area will lead to a surge in crime rates. – Mitigate potential child labour, physical abuse and sexual exploitation from the new workers in the area – No truck bays near schools and residential areas to reduce cases of child defilement from truck drivers.

<table>
<tr><th colspan="5">Nakuru County</th></tr>
<tr><th colspan="5">Rongai Sub-county Community Meeting</th></tr>
<tr><th colspan="3">Design Concerns and Request</th><th rowspan="2">Community Needs and CSR Suggestions</th><th rowspan="2">Other Comments, Concerns or Recommendations</th></tr>
<tr><th>Plenary Session</th><th>Leader Representatives Focus Group Mapping Session</th><th>Social Inclusion Representatives Focus Group Mapping Session</th></tr>
<tr><td colspan="5">A8 Highway (CH 153 to 170)</td></tr>
<tr>
<td>Crossing:
– Reduce as much as possible distance between pedestrian crossings.
Bus bay:
– Add bus bays along Mukinyai area
Service lane:
– Add demarcations for motorcycles and pedestrians on service lanes
Street lighting:
– Add in Sachangwan area
– Add at the memorial monument at A8 CH 161+275 – west
Climbing lane:
– Add climbing lane with shoulders in Sachangwan</td>
<td>Flooding area:
– A8 CH 158+900 to 159+100
Crossing:
– Add cattle crossing at A8 CH 159+000 and CH 159+600
– Add footbridge-at A8 CH 157+000
– Rehabilitate existing underpass for cattle and pedestrians at A8 CH 160+400
– Move footbridge from A8 CH 161+500 to 161+800
– Move underpass-from A8 CH 165+750 to 165+900
Bus bay:
– Add both sides at A8 CH 166+050
Interchange:
– Add a U-turn at A8 CH 155+500
– Add U-turn somewhere between A8 CH 162+000 and 162+600 for GSU
Service lane:
– Extend from A8 CH 158+800 to 159+100 (east side)
– Add from A8 CH 162+000 to 162+700 for GSU (east side)
– Extend from A8 CH 162+100 to 162+700 for GSU (west side)
Street lighting:
– Add from A8 CH 155+000 to 156+000 (Migaa)
– Add from A8 CH 158+400 to 159+100 (east)
– Add from A8 CH 162+000 to 162+700 (GSU)
Truck bay:
– Add truck bay both sides in this area- (CH 166+150 to 166+350)
– Add toilet and washroom with shower for truck drivers</td>
<td>Accident blackspot:
– A8 CH 162+600 to 165+800 (GSU)
– A8 CH 165+300
Flooding area:
– A8 CH 158+600 to 159+000
– A8 CH 165+600 to 166+300
Crossing:
– Add cattle crossing at A8 CH 156+200; CH 158+300, CH 159+900, CH 161+700, CH 166+000, CH 166+700)
– Add underpass access to GSU at A8 CH 162+400
– Ramps should be provided for PLWDs at crossing points
– Need for wildlife crossing along A8 Highway (CH 153 to 170).
Bus bay:
– Add on both sides at A8 CH 154+000; CH 162+400 and CH 166+500
Street lighting:
– Add from A8 CH 153+800 to 156+600; from A8 CH 158+300 to 162+700; from A8 CH 162+600 to 165+300, and from A8 CH 165+100 to 166+700</td>
<td>Plenary session:
– Set up a dispensary at Kibunja for emergency cases accidents (A8 CH 165+250 to 166+600)
– Upgrade Sachangwan dispensary and consider provide ambulances (A8 CH 158+950 – west)
– Provide ablution facilities in the area (specially at memorial monument)
– Train first aiders to respond to motor vehicle or motorcycle accidents
– Set up market stalls or create a market at Sachangwan and/or Kibunja including ablution facilities
– Upgrade main road leading to Kibunja Primary School as well as feeder roads in the area
– Set up a police post in Kibunja;
– Help with adequate classes or staff room for teachers at Kibunja Primary School (A8 CH 167+300 – west)
Leaders session:
– Upgrade health center in Sachangwan and upgrade the road leading to the hospital (400 m)
– Construct a dispensary at Kibunja
– Add light (on one side-opposite the climbing line) at Molo River and Sachangwan for first aiders
– Upgrade Road to Molo Highway Secondary School (CH 165+300 – west)
– Upgrade local road leading to Kimanyi Nursery School CH 159+200 to 159+800
Social inclusion session:
– Build new hospital and dispensary in Kibunja
– Drill boreholes for water supply
– Proposed development of toilets to serve traders at the trading centers Kibunja and Sachangwan Residents.
– Improvement of the feeder roads
– Build a police post in the area
– Offer designated marketplace in the area for traders</td>
<td>Plenary session:
– Provide a channel for water pipe system and a proper drainage of storm water
– Put up a first aid centre on the ROW
– Provide employment to local youth
Leaders session:
– Requested for physical site visits with the design team to properly identify areas where the different infrastructure will be placed
– Difficulty to access the river for animals based on the locations of the livestock/pedestrian crossings provided in the design
– Construction labour to be sourced locally
Social inclusion session:
– Inadequate health facilities in the region.
– PLWDs request for employment opportunity during the construction phase.</td>
</tr>
</table>

Nakuru County				
Gilgil Sub-county Community Meeting				
Design Concerns and Request			**Community Needs and CSR Suggestions**	**Other Comments, Concerns or Recommendations**
Plenary Session	**Leader Representatives Focus Group Mapping Session**	**Social Inclusion Representatives Focus Group Mapping Session**		
A8 Highway (CH 60 to 114)				
Flooding area: – Ensure a good drainage system **Other:** – Use materials that are not interesting for thieves for signage along the road, to avoid vandalism – Avoid diversion in sensitive town, such as Kariandusi prehistoric town that must be protected and preserved (graves and cultural sites)	**Accident blackspot:** – A8 CH 108+100 **Flooding area:** – A8 CH 64+500 to 65+900 – A8 CH 89+700 to 90+100 **Crossing:** – Add footbridge at A8 CH 84+700 and CH 108+100 – Move footbridge from A8 CH 89+000 to 89+500 – Potential removal of underpass at A8 CH 103+300 and CH 104+650 **Bus bay:** – Add on both sides at A8 CH 88+900; CH 89+700 and CH 92+900 **Service lane:** – Add on both sides from A8 CH 104+700 to 106+800 (Kingdom City) – Extend on both side to A8 CH 108+000 **Interchange:** – Add at A8 CH 96+900 (hospital and heaven gate) **Street lighting:** – Add from A8 CH 106+550 to 107+500, from CH 108+300 to 109+150, and from CH 110+200 to 110+500, **Signage:** – Use weld bolts for guard rail and plastic posts for road signage to avoid vandalism – Provide clear road signage and marking **Development area:** – Kingdom City Development from A8 CH 103+250 to 106+200 **Other:** – Add a runaway ramp from A8 CH 86+000 to 89+000	**Accident blackspot:** – A8 CH 79+900; CH 87+200 to 88+000; CH 96+500 to 98+000; CH 99+400 to 106+700; CH 106+800 to 108+200 and CH 111+200 **Flooding area:** – A8 CH from 85+500 to 85+800, from CH 88+500 to 89+700, and from CH 112+500 to 114+000 **Crossing:** – Add footbridge at A8 CH 85+200 – Add cattle crossing at A8 CH 88+300 – Add wildlife crossing at A8 CH 75+300 and A8 CH 101+400 **Street lighting:** – Add from A8 CH 82+200 to 84+200, and A8 CH 112+500 to 114+000 **Interchange:** – Add between A8 CH 89+500 and CH 89+600) **Other:** – Installation of speed bumps and rumble strips at A8 CH 79+900 – Prehistoric site around A8 CH 92+150 to preserve	**Plenary session:** – Consider installing ablution facilities for the construction staffs and leaving them to the community **Leaders session:** – Upgrade Gilgil Highway Primary School (A8 CH 84+950 – west) – Provide training facilities for technical skills i.e., plumbing, welding for Mbaruk – More classes at Murindu Primary School or possibility of new school (A8 CH 89+400, further east from road) **Social inclusion session:** – Build or improve markets at Kikopey and Mbaruk – Build a polytechnic at Kiambogo – Build a secondary school at Gilgil constituency – Consider improving access roads to the major town centres such as Gilgil should be improved. – Improvement of access road leading to Lanet and Kiundu	**Plenary session:** – Offer employment to local youth – Protect trees and replant those cut during construction. The Go all Green Foundation could be involved as well as affected tree seedling traders as a compensation measure **Leaders session:** – Construct a central conduit for internet cables, water pipes and power **Social inclusion session:** – Rampant theft and insecurity due to high unemployment rate. – Interclan land disputes and land grabbing is common in the area – Scarcity of clean drinking water

Nakuru County				
Nakuru East and West Sub-counties Community Meeting				
Design Concerns and Request			**Community Needs and CSR Suggestions**	**Other Comments, Concerns or Recommendations:**
Plenary Session	**Leader Representatives Focus Group Mapping Session**	**Social Inclusion Representatives Focus Group Mapping Session**		
A8 Highway (CH 114 to 131)				
– Ensure footbridge is designed for PLWD (ramp) – Special attention to the presence of fault lines in the area, mostly on the Barnabas-Njoro turnoff section.	**Flooding area** – A8 CH 123+800 to 124+100 – Provide adequate drainage at the railway section and divert storm water from Milimani Estate before reaching the highway **Crossing** – Improve pedestrian safety at A8 CH 121+700 – Add footbridge at A8 CH 124+650 and A8 CH 126+900 **Climbing lane** – Add from A8 CH 129+500 to 131+000, and from A8 CH 131+800 to 135+800 **Truck bay** – Move truck bay (east side only) from CH 122+800 to 122+200 to avoid being directly in front of the State House) **Other** – Ensure Safety for motorcycles.	**Accident blackspot:** – A8 CH 113+700 to 114+400 – A8 CH 116+500; CH 118+500; CH 123+100, and CH 125+600 **Flooding area:** – A8 CH 112+000 to 112+400 – A8 CH 120+800 to 124+100 **Crossing:** – Add Footbridge at A8 CH 118+500 and 125+600 **Bus bay:** – Add on both sides at A8 CH 113+600; CH 115+500, CH 120+400; CH 122+300; CH 125+600 and CH 127+700 **Signage:** – Add signage to guide PLWDs. **Truck bay:** – Add on both sides from A8 CH 113+100 to 113+600	**Plenary session:** – Provide a non-motorized transport for pedestrians from Molo to Barnabas **Leaders session:** – Add more classes and toilets to Nakuru West Primary School/ construct a perimeter fence around the school to protect children (CH 126+750 – west) – Offer equipment for Nakuru West Clinic in Shaabab (expansion, drugs, maternity wing, etc. – Construct classrooms at Nairobi Road Primary School (CH 112+200, further west from the road) **Social inclusion session:** – Improvement of the nearby schools – Improve the hospitals in the area including Nakuru West Hospital, Muguga Dispensary and develop a Free area maternity and dispensary. – Improve police post/stations including Baraka Police Post, Muguga Police Post, Kamungi Police Post and Viwandani Police Station. – The project should consider putting public toilets which can be managed by local CBOs.	**Plenary session:** – Reduce as much as possible the construction period to shorten the impact duration on population. – Consider using speed buses on the highway from Barnabas to Njoro turnoff – Provide job opportunities to youth **Leaders session:** – Ensure appropriate mitigation measures for dust during construction (watering) – Procure construction materials and equipment locally – Rehabilitate diversion after finishing the project. Diversions Road is often left in poor state with degraded pavement **Social inclusion session:** – Concern that projects have not been implemented in the area due to interference by political leaders. – Exclusivity of PLWDs in major development project and development agendas – Rise in property value in the region is a concern

SPECIFIC TECHNICAL MEETINGS HELD BY RVH AND KENHA

A summary of the main results of the technical meetings performed by RVH and KeNHA to ensure a close participation of key stakeholders in the design is presented here after. They have been divided by meeting:

COUNTY OF NYANDARUA

- Ensure design of urban areas provide pedestrian walks and proper lighting;
- Provide U Turn facility to the logistical centre and Soko Mpya market in both directions (200 metres from Soko Mpya);
- Provide truck and bus bay 300 metres from the market on either side of the Soko Mpya market to ease congestion. The bus and truck bays would be for Nakuru and Nairobi bound vehicles;
- Provide 100m acceleration and deceleration lanes around the Soko Mpya market to enable easy access as well as a foot over bridge;
- Include County master plan for the market into the design;
- Ensure a continuous Service lane to Matches Police junction and a footbridge;
- Add an underpass at the logistics centre to facilitate cattle movement (CUP);
- Expand the existing underpass located between Soko Mjinga and Matches Land;
- Create a U Turn Facility at Njabini Road;
- Construct an underpass at Gwa Kanyua Road - this road generates traffic to the Nairobi - Nakuru Highway;
- Create artistic and well-designed overpasses as a County branding initiative and strategy; the presented design to be redesigned.

COUNTY OF NAKURU

- Consider a Bypass from Stem Area instead of viaduct because this will expand Nakuru City;
- Consider allowing the County to collect a portion of the cess collected on this road;
- Protect environment during and after the construction by rehabilitating the quarries;
- Include clear signage of diversions and safety measures by the contactor during construction;
- Incorporate County development plans;
- Ensure a continued liaison and consultation with the County Government during and after construction;
- Ensure there are continuous links between both sides of the road;
- Consider building parking bays for heavy commercial vehicles – since the number of lorries parked every evening at both Salgaa and Kikopey is very large and feasibility study needs to be done to determine how many vehicles are parked at Salgaa and Kikopey;
- Ensure water generated by the project is well managed and directed safely to lakes;
- Take into account the communities growth;
- Integrate County Spatial Plan into the project design (Naivasha, Nakuru, Longonot, Salgaa, Kibunja);
- Source material locally as much as possible.

COUNTY OF KIAMBU

- Protect viewpoints on the A8 to ensure livelihood safeguard;
- Incorporate County development plans and involve County Government at all stages;
- Ensure population not able to afford paying the toll still have access to other alternative roads;
- Ensure quarries and roads are rehabilitated after construction activities;
- Consider moving the U-turn closer to Level 4 hospital (Rukuma) in Lari.

MEMBERS OF PARLIAMENTS

- Ensure the project offer job opportunities for local population;
- Provide CSR activities to support affected communities;
- Ensure the construction of the road is the shortest as possible to avoid affecting communities on a long period of time.

STATE-OWNED AGENCIES

- Ensure utility providers along the ROW are consulted and involved;
- Ensure road users are not being doble charged by paying the road toll fees while also incurring the fuel levy;
- Ensure to provide and maintain access to all Kenya Pipeline Company facilities along the project corridor;
- Protect the water quality of Magadi Soda I Lake Magadi;
- Ensure adequate safety measures:
  - Put in place a Health and Safety Committee;
  - Develop systems for ensuring the safety of equipment as per the Engineering construction rules;
  - Develop systems for hygiene measurements for hazardous substances and other substances that can affect the health of the workers;
  - Develop systems to ensure the health of the workers is taken care of i.e. medical examinations;
  - Develop systems for compensation of workers in the event of an injury from an accident that has occurred at the workplace i.e. WIBA.
- Protect high-value species from being pouched by construction workers;
- Compensate for lost vegetation by replanting new one;
- Develop mitigation measures to avoid having undesirable effect of the project on climate change.

NGOS

- Ensure job opportunities for local contractors;
- Protect wildlife and ensure their safe mobility (involve conservation specialists and scientists);
- Ensure road users are not being doble charged by paying the road toll fees while also incurring the fuel levy;
- Ensure toll booths don’t create traffic and that the tolling system is economically fair;
- Offer free alternative roads, in good condition, for users who are not willing to pay the toll fee;

- Consider motorcyclists specific needs in the project design;
- Consider improving modal choices, adding slip roads and footbridges for safe access to centers;
- Develop mitigation measures to avoid increase in bus fare by matatus because of the toll fees;
- Consider adding cyclist path between Kijabe and Nakuru;
- Consider providing transit parking space along the corridor during construction;
- Ensure adequate roadkill mitigation measures;
- Ensure adequate mitigation measures to avoid interference with water along the route;
- Consider developing some regional pockets of forest on sides of road;
- Develop a system of environmental audits on highway to monitor carbon sync and potential increase of air pollutants;
- Avoid interruption of existing utility services such as fibre optic cable;
- Consider providing lay bays and restrooms to manage fatigue which is one of the causes of road accident;
- Integrate town/urban development and land use plans;
- Consider offering specific space for market and selling of horticultural products.

OTHER STAKEHOLDER CONCERNS AND RECOMMENDATIONS RECEIVED

Some additional comments have been received by stakeholders through email sent or given to some project team members directly during some field activities. They are summarized here after and presented by territory (refer to Appendix 7-9):

NAKURU COUNTY

RONGAI SUBCOUNTY

- Request for a specific meeting to address the important truck stop in Salgaa and better analyze the proposed design for Salgaa area;
- Concerned about the proposed interchange at A8S CH 152+100. This will take a lot of space in the vibrant center of Salgaa. Would prefer an infrastructure like the overpass located at the Bahati/Section 58 junction.

GILGIL SUBCOUNTY

- Move interchange from A8 CH 65+450 to 68+700 (Kenya Pipeline Company request);
- Rehabilitate the existing underpass at A8 CH 74+800;
- Requests from Soysambu.
    - Soysambu fenced its property on both sides of the road and want to know if those fences will be maintained during construction;
    - Soysambu main gate - current underpass must be maintained and used by vehicles at A8 CH 101+400;
    - A8 CH 100+300 VOP/POP: not sure why there is a VOP/POP there.
- Requests from Marula
    - Marula carries out lots of farming on both sides of the road and usually crosses the existing road and had concerns on the crossing points for their machinery. Notably:
    - A8 CH 65+400 – U-turn PUP - There is an existing gate there. Will machinery be able to pass in the PUP? Will the service lanes remain within the right of way?

- A8 CH 67+200 – PUP/CUP - Very important for machinery to be able to cross there;
- A8 CH 68+700 - Very important access to Moi North Lake Road;
- A8 CH 69+200 PUP/CUP/WLC - There is a gate their which is mostly closed. Machinery needs to be able to pass;
- A8 CH 73+700 PUP/CUP/WLC - Road to Kigio. Lots of vehicles and machinery passes there. Important to have a vehicle crossing;
- A8 CH 78+500 - A crossing should be added in this area;
- A8 CH 82+200 - A VUP is needed because the railway (to the south) blocks access to the other side;
- General concern about the underpasses' height. Underpasses need to be high enough to allow the passage of agricultural machinery.

NAIVASHA SUBCOUNTY

- Add interchange or possibility of U-Turn and service lanes at the following locations:
  - Junction between Mai Mahiu Road (A8 South) and Moi South Lake Road (accident black spot) – A8S CH 51+200;
  - Between the National Museum of Kenya Kariandusi Prehistoric Site, Main Lake Elmentaita Access Toad and Lake Elmentaita Viewpoint;
  - Junction of Kikopey Pipeline Road and the A8;
  - At Karura Shopping Center;
  - Near St-Mary and St-Joseph Hospitals;
  - To access Soysambu Conservancy, Serena Camp, Lake Elmentaita Mountain Lodge.
- Need a safe crossing point for Mirera Primary and Secondary Schools (A8 CH 47+100, further west from road, junction around A8S CH 46+800);
- Add cattle crossing at A8 CH 63+400;
- Tarmac the 1km stretch of the Main Lake Elmentaita Access Road.

7.5.3.4 STAKEHOLDER INPUT INTEGRATION

Following the second round of public consultation, RVH technical and design teams worked in collaboration with WSP to revise all stakeholders' inputs. The aim was to improve the project by making changes to the proposed design that better serve the population's specific needs and help reach a higher level of integration into its environment for a greater social acceptability. Figure 7-1 presents stakeholders' inputs per subject. The main concern communicated by the population is related to their crossing capacity and the preservation of connectivity with a total of 43% of their inputs.

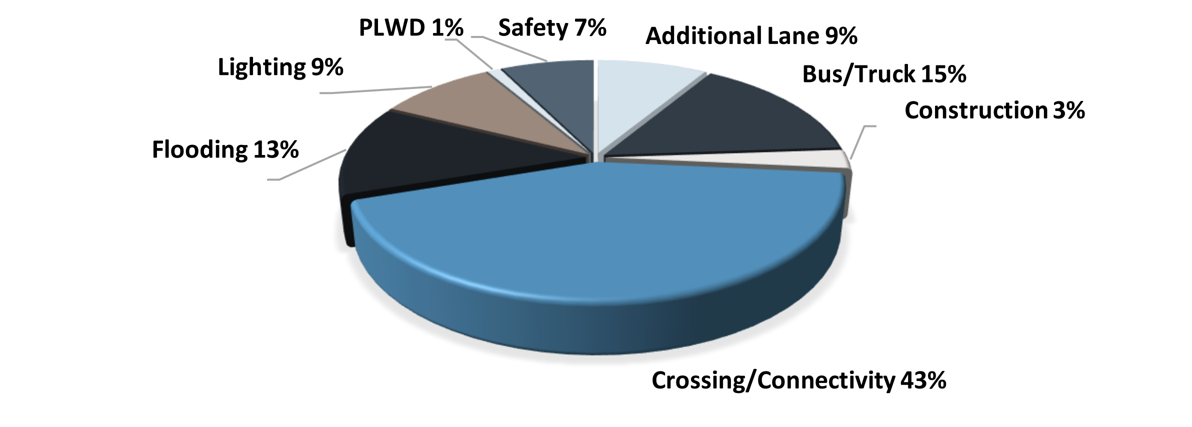


Figure 7-1 Stakeholder Requests per Topic

Revised design aspects include various types of crossings (foot overbridge, underpasses, overpasses, cattle crossing, wildlife crossing, train crossing) interchanges, lighting, truck bays, bus bays & shelters, service lanes, climbing lanes, pavement treatment, signage, etc.

Actions performed during the design change requests integration activity include:

- Field reconnaissance to identify and better understand physical-spatial related requests;
- Analysis of alternatives and road geometry optimization;
- Working sessions between RVH technical and design teams and WSP to examine stakeholders' requests and propose changes to the design whenever feasible.

RESULTS

The stakeholders input integration activity was beneficial as approximately 80% of all requests made during both first and second rounds of public consultations were either fully or partially addressed (refer to Figure 7-2). This resulted in modifications to the initial design to relocate or add project components based on the requests formulated. It's important to note that some of the other requests, currently not addressed, are being further investigated to better evaluate their feasibility and the possibility of completing some additional changes. Details of modifications made to the Project design following stakeholder requests are listed in Appendix 7-10. Actions performed to integrate the stakeholders' requests into the design are listed below:

- Relocation of some functionalities to better address population needs;
- Addition of new functionalities to improve the overall level of services associated with the Highway:
  - Additional pedestrian crossings (+14);
  - Additional service lanes (+1900 m);
  - Additional bus bays (+26 bus bays);
  - Additional lighting (+200 m of lighting along the road, memorial, urban pedestrian underpasses, etc.).

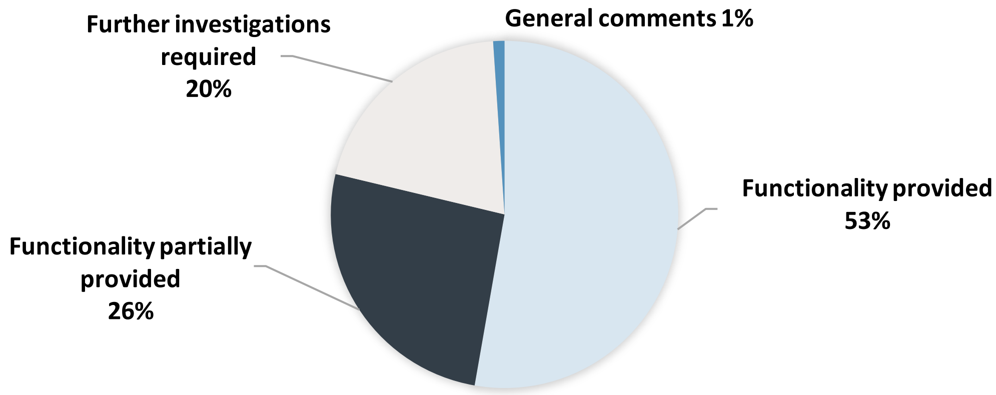


Figure 7-2 Request Integration Level

7.5.4 THIRD ROUND OF CONSULTATION

The third round of consultation took place from October 25 to November 12, 2021. A total of 12 meetings were held.

7.5.4.1 STAKEHOLDER ENGAGEMENT ACTIVITIES

The methodological approach for the third round of consultation was similar to the second round. It consisted of community meetings and some specific follow-up technical meetings with different key stakeholders (Counties technical teams, Member of Parliament and some key NGOs) organized by RVH and KeNHA to ensure a participative approach throughout the design revision process.

The purpose of the third round for the community meetings was to present the results of the ESIA assessment, including a summary of the stakeholders' inputs, the changes made to the design to better respond to the population needs, as well as a of the proposed environmental and social mitigation measures. Minutes and attendance sheets of all meetings can be found in Appendices 7-5.

SUBCOUNTY COMMUNITY MEETINGS

A total of seven subcounty community meetings was held during the third round. The meetings consisted of a plenary session, where a presentation was shown to all participants followed by a question-and-answer period. The guests invited to the meetings were representatives of affected sub counties, wards, members of parliament, members of county assembly, chiefs, sub chiefs, and other main representatives of locations or sub-locations. Invitation took into account gender and social inclusive consciousness. An example of an invitation letter and a guest list can be found in Appendix 7-5. All meetings were held outside for COVID-19 security purposes. Microphones, water and tents for shade were provided. A large screen was installed on a structure to allow for a power point presentation to be displayed.

As per the two previous rounds, each meeting started with a prayer and an official opening by the DCC of the subcounty where the meeting was held, or his representative. The facilitator from Norken International Inc. then took over the meeting and invited each speaker according to the meeting agenda (refer to Appendix 7-5). The first speaker was a representative from KeNHA or from RVH. They were invited to introduce the project team and present a brief overview of the Project's progress and structure. A representative from WSP Canada was then invited to present more technical details on the project, explain the

ESIA process and expose the results of the collaborative work done since January in terms of stakeholder's participation and inputs, as well as changes done to the design of each specific subcounty territory, to better answer the population needs and improve the overall project. Following the results of the participative activities, the representant of WSP presented the mitigation measures included in the environmental and social management plan (ESMP) and invited stakeholders to express their views and comments. A list of interventions was opened by the facilitator for the Q&A period. Youth, elders, women and PLWD were specifically invited to give their views during the meetings. Questions were answered by KeNHA and RVH. Each person's observations and comments were recorded and collected. The official ended the activity after inviting a member of the community to make a closing prayer.

The complete meeting was done in both English and Swahili. As per the previous rounds, stakeholders were invited to give their concerns or comments in writing during or after the meeting, or by email using the addresses included in the leaflet.

Table 7-9 presents the details of the consultative activities performed during the third round of consultation. Agenda, attendance sheets, photos and minutes of meetings can be found in Appendix 7-5.

Table 7-9 Subcounty meetings held during the Third Round of Consultation

No	Stakeholders / Participants	Day and Date	Time	Venue	Number of participants
1	Limuru and Lari Sub Counties Community	Thursday, November 4, 2021	10h30	Full Gospel Church, Nyambari, Lari, Kiambu	344
2	Kinangop Sub County Community	Friday, November 5, 2021	10h30	Chief Compound, Kuresoi North, Nakuru	124
3	Kuresoi North, Molo and Koibatek Sub Counties Community	Monday, November 8, 2021	10h30	Chief Compound, Kuresoi North, Nakuru	259
4	Rongai Sub County Community	Tuesday, November 9, 2021	10h00	ACK St. Walstans Church, Rongai, Nakuru	117
5	Gilgil Sub County Community	Wednesday, November 10, 2021	11h30	Gilgil CDF Ground, Nakuru	181
6	Nakuru East and Nakuru West Sub Counties Communities	Thursday, November 11, 2021	10h00	County Commissioner Office compound, Nakuru City, Nakuru	140
7	Naivasha Sub County Community	Friday, November 12, 2021	10h40	DCC's compound, Naivasha, Nakuru	119
				Total Participation:	**1 284**

SPECIFIC TECHNICAL MEETINGS HELD BY RVH AND KENHA

As part of the project's stakeholder engagement process and prior to the subcounty community consultative activities, a total of five meetings were held to engage with the county technical teams at Kiambu, Nyandarua and Nakuru respectively, the Members of Parliament, as well as various NGOs' representatives.

The objective of this second series of interaction with these stakeholders was to present the progress made throughout the ESIA process, the outcomes of the second round of public consultation and any impact it had on the project's design as well as to reinforce their contribution through the collection of observations, questions, and queries. The meetings format was the following:

A brief overview of the project was given by a representative from KeNHA highlighting the rationale of the project, the role of the PPP model in infrastructure development as well as the benefits that will accrue from the project.

This was followed by a further detailed presentation given by the E&S manager of RVH, with a brief overview of the project's general features and its rationale, a detailed explanation of the ongoing ESIA process, the different work streams that have been carried out so far as well as the next steps going forward. An overview of the concerns raised during the second round of public consultation and the main additional features integrated in the design as a result of addressing these concerns was also given.

Lastly, the Construction Contractor's design manager proceeded to further detail the process and design integration of the specific requests/comments raised during the 2nd round of public consultation meeting focusing on the consulted County territory.

At the end of the presentation the participants were given the opportunity to raise questions, make observations and react to the presentation. Questions were answered by KeNHA and RVH. Each person's observations and comments were recorded and collected.

Table 7-10 presents the details of the consultative activities performed during the third round of consultation. attendance sheets, photos and minutes of meetings can be found in Appendix 7-5.

Table 7-10 Specific meetings held by RVH during the Third Round of Consultation

No	Stakeholders / Participants	Day and Date	Time	Venue	Number of participants
1	Members of parliament	Monday, October 25, 2021	9am	Serena Hotel, Nairobi	11
2	Kiambu Technical County Committee	Tuesday, October 26, 2021	9am	Sovereign suites, Redhill, Limuru	28
3	Nyandarua Technical County Committee	Wednesday, October 27, 2021	2pm	Virtual meeting	23
4	Nakuru Technical County Committee	Friday, October 29, 2021	9am	Sarova Woodlands Hotel, Nakuru	19
5	NGOs	Wednesday, November 3, 2021	10am	Virtual meeting	46
				Total Participation:	**127**

7.5.4.2 TOOLS AND SUPPORTING MATERIAL

The tools used for the third round of consultation consisted of the distribution of an informative leaflet including the results of the consultative activities as well as the main environmental and social impact and proposed mitigation measures for the project, and the display of a Power Point presentation on a large screen. The tools and supporting material for this second round can be found in Appendix 7-8.

7.5.4.3 MAIN CONCERNS AND OBSERVATIONS

The main concerns and observations raised during the third round are summarized hereafter. They have been classified per county and subcounty, with a specific section meetings performed by RVH and KeNHA on more technical aspects. It's important to mention that stakeholders were also invited to give their comments in writing during or after the meetings or using the email address provided on the leaflet. All comments received are included in the present section.

SUBCOUNTY COMMUNITY MEETINGS

COUNTY OF KIAMBU

- Ensure the good integration of the ongoing Mau project with the Rift Valley Highway;
- Take measures to avoid delays in the implementation of the project and in the compensation process;
- Avoid corruption and ensure measures to mitigate the potential risks of corrupt practices such as embezzlement of funds for construction;
- Ensure employment of local labour as much as possible for both skilled and unskilled jobs (wards of Lari/Kirenga, Kijabe and Kinale) – offer available jobs through public participation forums;
- Plant trees along the road reserve to mitigate air pollution;
- Upgrade the minor road leading to Tigoni Level 4 hospital as part of CSR, as well as providing sewage (Kamirithu village, juste before Kwambira);
- Ensure mitigation measures to deal with HIV, GBV and child exploitation cases that might occur during construction;
- Ensure adequate compensation for the residents that will lose their land to the project;
- Encourage local farmers by buying their products if needed during construction;
- Provide mobile toilets for the construction workers;
- Provide an interchange at Soko Mjinga;
- Provide an interchange at Mutarakwa Junction (important accident black spot – A8 South);
- Protect Manguo wetland – examine the possibility to use the land on the opposite side instead of taking 20 acres out of 100 acres of wetland.

COUNTY OF NYANDARUA

SUBCOUNTY KINANGOP

- Design revise request for the Soko Mpya market to agree on the adequate infrastructure for crossing, u-turn and farming goods/products mobility – controversy between FOB or underpass in Soko Mpya area;
- Ensure safety training for the communities affected by the project;
- Ensure safe crossing at the flyover shopping center as well as good drainage system as the storm water are always flooding the area;
- Consider the following for CSR:
  - Local employment opportunities – including local youth;
  - Access to clean and reliable water for communities;
  - Provide an equipped casualty center at Bamboo health center;
  - Build classrooms for a new secondary school (Murchorwe Secondary School).

COUNTY OF NAKURU AND BARINGO

KURESOI NORTH, MOLO AND KOIBATEK SUBCOUNTIES

- Ensure adequate compensation of the evicted road traders and provide stalls similar to the ones in Kibarwa;
- Support the local healthcare facilities as part of CSR:
  - Sachangwan dispensary;
  - Eldama Ravine Subcounty Hospital.
- Consider improving local road in the area as part of CSR (deplorable road conditions):
  - Nakuru-Kabarak_Eldama Ravine-Makutano road;
  - Njoro-Molo road, etc.
- Make sure there is a pedestrian crossing facility at Sachangwan to serve the schools (Sachangwan primary and secondary schools);
- Offer employment opportunities for both manual and technical labour;
- Add an underpass for cattle at Mukinyei Center and fix the erroneous signboards;
- Ensure safe crossing at Karunga for schools;
- Provide crossing for the community living at the Koibatek forest section;
- Prove wildlife and cattle crossing at Molo junction – livestock graze at Koibatek forest;
- Consider providing foot walks along services lanes to allow children to walk safely;
- Ensure traffic is diverted away from Njoro-Molo road;
- Ensure bus bays are provided in Kibunja center;
- Ensure good security during construction for communities;
- Ensure a safe crossing in Tabain for schools (Jogoo) – keep existing cattle underpass;
- Additional requests resulting from the focus group mapping session done with design team after the consultation:
  - Add a CUP at PK 158+300;
  - Provide an underpass for people and livestock at PK 159+000;
  - Maintain the existing CUP at PK 160+400;
  - At PK 161+800 there is a new road that need to connect to the other side;
  - Replace FOB with underpass at PK 168+400;
  - Replace FOB with underpass at PK 173+300.

RONGAI SUBCOUNTY

- Ensure respect of dust mitigation measures;
- Start the creation of grievance redressal committee as fast as possible - recommendations:
  - Must be an institution that will be able to enforce proposed project interventions and ensure fairness in employment;
  - Should have its own staff working on a daily basis before and after implementation of the project;
  - Must be made up of men and women of substance;
  - Should be able to look into matters involving construction, operations and maintenance of the Road i.e. be empowered to handle project issues such dust pollution etc.;
  - The committee should have meetings on a monthly basis;
  - He stated that the committee should be funded and have TORs; and
  - Committee should be formed immediately after the meeting and be headed by the DCC.
- Ensure there are no corruption and nepotism for the job hiring and recruitment process;
- Take into account the road gradient from Ngata to Salgaa when designing the drainage (important storm water): ensure no contamination reaches the rivers – consider constructing water tunnels on the side of the highway;
- Make sure there is an exit and entrance point provided on the road in Sobea to avoid inconveniences;
- Consider moving the interchange at the Salgaa junction (Elburgon-Mutamaiyu road) or adding a vehicle underpass to allow the road continuation – controversy on the location of the interchange in Salgaa – request of a meeting with the design team on the subject;
- Ensure trucks can cross both side in Salgaa (underpass similar to the ones in Kimbo, Nairobi; Kikuyu town and section 58, Nakuru);
- Ensure the provision of an FOB at Ex-Margret’s Farm to serve Menengai Factory and schools present in the area;
- Ensure there is a bus bay at Kirobon Boys High school and that the underpass allow access to the school; also consider support the school as part of CSR;
- Ensure the compensation for loss of land are fair and lands are well evaluated;
- Put in place measures to regulate the speed of cars when going downhill to avoid accidents;
- Ensure mitigation measures for vibration of construction and potential creation of cracks on houses or commercial buildings;
- Consider tarmacking the 3km road from Salgaa to Elburgon as part as CSR;
- Ensure businesses located in the area close to the junction of Rongai and Elburgon are accessible (culvert were removed during Kobil road construction and access is now difficult);
- Consider extending light all the way from Rongai to Visoi;
- Add an underpass around PK 133+500;
- Make available a version of the detail design at the ACC office.

GILGIL SUBCOUNTY

- Provide solutions and good mitigation measures for challenges on wetlands and water supply;
- Ensure social mitigation measures are sufficient and complete, more specifically for the displaced traders;
- Ensure good mitigation measures against dust and air pollution;
- Offer CSR support and jobs opportunities to affected communities in a consultative and participative approach.
  - Inform communities and hold consultations to notify them of the employment opportunities – including rural communities such as Oljorai;
  - Consider sourcing construction materials locally (quarry in the area);
  - Consider upgrading the road from Eburru to Njoro and the access road to the Murindat River (CSR);
  - Support social community activities such as circumcision of boys and counselling session for young girls (CSR);
  - Consider providing maternity services to healthcare facilities – Murindat (CSR).
- Ensure the new roadside station project in Kikopey (truck parking) doesn't affect negatively the businesses along the highway or kill them – include mitigation measures to protect small businesses;
- Ensure safe pedestrian crossing In Mbaruk area;
- Add a FOB at Pema stage for children to cross over to the school on the other side;
- Add a safe crossing for pedestrian at the section known as "zero zero" where the road intersects with the A8 highway (from Eburru to Great Rift Valley) – lots of accidents;
- Bring special attention to the drainage in Jamaa and the road leading to Diatomite to avoid flooding;
- Organize a specific consultative meeting with the Kikopey community about the truck related issues;
- Provide boreholes in Murendu and Kikopey;
- Add FOB, bus bay and truck parking at Soysambu Estate.

NAKURU EAST AND NAKURU WEST SUBCOUNTIES

- Important to have CCTV cameras to monitor cases of vandalism of road components which is rampant in the area – how to avoid road signs from vandalism and robbery (use material that are not lucrative for the vandals);
- Important to compensate and include measures to preserve livelihood of the street vendors that will no longer be able to operate alongside the highway;
- Ensure the adequate rehabilitation of the construction material sites to avoid leaving them with gaping holes (safety hazard for community members especially children);
- Ensure that the affected landowners are adequately compensated for their land that will be acquired to accommodate the new highway;
- Ensure footbridges ramps are PLWD friendly and that the levelling of the ramps makes it easy for wheelchairs to climb up (some existing ramps are too steep and wheelchairs tip backward);
- Consider exempting PLWD from paying the road toll fees;
- Ensure adequate traffic diversion to avoid negative effects on the transport industry;
- Ensure truck drivers restrooms are provided along the highway as part of the project;

- Inform in advance businesses along the highway of all potential impacts and implement mitigation measures to protect them;
- Offer jobs to locals and a transparent hiring process;
- Protect motorcyclists shed along the highway and ensure that every shed that needs to be removed will be replaced after construction;
- Include landscaping and beautification of the road into the design;
- Ensure the financial viability of the project to avoid creating a burden of repayment of the loan to the Kenyan citizens.

NAIVASHA SUBCOUNTY

- Ensure there is a safe crossing for pedestrian and livestock in Kihoto, at the municipal offices;
- Inform every chief when the jobs will be available to allow the information to reach the communities and the youth;
- Consider giving compensation to Maasai for inconvenience during construction and the possible difficulty for them to cross the road with their livestock and pursue their economical activities;
- Consider replacing the FOB at Mithuri primary school by an underpass;
- Ensure there is a pedestrian crossing at Narok junction in Mai Mahiu;
- Important to provide a climbing lane at the Escarpment;
- Consider livelihood mitigation measures for sand harvesting in Mai Mahiu as the construction of the road might affect the businesses of over 10 000 youth in the area;
- Consider upgrading schools and medical centers along the road as part of CSR program (ex: Mandera Primary school);
- Include mitigation measures for vibration during construction that might affect the integrity of houses and properties (cracks);
- Ensure the material for the project is sourced locally (at least 40%);
- Give a particular attention to the drainage issue un Naivasha town, lots of flooding;
- Consider replacing the proposed zebra crossing at OK 53+000 to a FOB;
- Add a FOB at PK 54+400 for Naivasha Highway Primary.

SPECIFIC TECHNICAL MEETINGS HELD BY RVH AND KENHA

MEMBERS OF PARLIAMENT

- Ensure adequate measures to manage future roadside accommodation which could hamper the future development and traffic fluidity of the highway? Kikopey and Salgaa are recent examples of commercial expansions triggered by road traffic;
- Consider integrating gyn facilities next to bathrooms along the road as part of CSR;
- Ensure seamless connectivity in the design to avoid affecting mobility. For instance, farmers need access to connecting roads;
- Consider future road expansion, especially future service development in the design such as pipeline system in Nakuru City;
- Use water carefully to avoid lack of water for the communities;

- Consider adding canteens and washrooms in lay bays;
- Consider connection to maintain access to commerce and critical infrastructures such as hospital on the side of the road;
- Offer alternative roads that are not tolled for people that cannot afford the tolling;
- Include tree planting as an offsetting solution for loss of vegetation.

COUNTY OF KIAMBU

- Ensure surrounded towns are not cut-out because of the new infrastructure development;
- Ensure proper access to viewpoints to protect touristic development;
- Ensure to avoid disturbance or damage to existing pipelines;
- Take measures to avoid unwanted commercial development along the highway which could hamper traffic fluidity;
- Ensure contractors respect mitigation measures and don't act carelessly creating negative impacts on the surroundings – important to assure adequate supervision;
- Ensure appropriate mitigation measures for impacts created by diversion: dust, damage to small road, safety, etc.

COUNTY OF NYANDARUA

- Ensure easy and fluid access in and out Soko Mjinga (specially traffic from Soko Mjinga to Magumu and from Njabini to Soko Mjinga);
- Ensure good water management in Soko Mjinga area that is subject to flooding;
- Consider upgrading Bamboo Health Center as part as CSR.

COUNTY OF NAKURU

- Offer business opportunities in terms of local procurement for workers and materials;
- Ensure adequate environmental protection measures;
- Ensure a good traffic management during construction;
- Ensure the management of barrier effect resulting from the highway;
- Integrate truck bay parks improvement solutions;
- Ensure a good integration of future services along the road (micro-tunnel, water infrastructure, sewage, power lines, fiber etc.): locate these areas of crossings and provide for it in the design;
- Ensure fast and safe access to health facilities;
- Ensure a good integration of Vulnerable and Marginalized Groups' preoccupations within the development of the project: specifically to allow safe cattle crossing for shepherds;
- Ensure a good management of storm water to avoid pollution from construction to reach surrounding lakes and protect water quality – also good mitigation measures for hazardous leakage;
- Incorporate some emissions improvement measures for the long term;
- Include deterrent to discourage people from vandalizing highway furniture and avoid vandalism;
- Include local capacity building (training, internship, etc.);

- Provide for future expansion of the project;
- Ensure the fish market are taken into account and a space for them is included into the design;
- Manage properly the possibility of businesses developing along the corridor and affecting the traffic flow.

NGOS

- Consider integrating charging stations to the project design;
- Consider integrating the various emergency service providers along the highway: possibility of including a space for them in the design of the toll stations;
- Ensure a proper assessment of climate change;
- Include trees and vegetation in the wildlife crossing infrastructures;
- Ensure adequate mitigation measures for invasive species that might be brought up by construction activities;
- Ensure adequate waste management plan for both construction and operation;
- Plan for alternatives in the event that the toll system doesn't work in order to collect the funds as required;
- Include a sustainability report showing the resources used and how it might affect future generations;
- Ensure a good management of storm water to avoid pollution from construction to reach surrounding lakes and protect water quality – also good mitigation measures for hazardous leakage and potential erosion.

7.6 ENGAGEMENT APPROACH: INDIGENOUS PEOPLES

7.6.1 CONSULTATION ACTIVITIES FRAMEWORK

To manage the risk of adverse impacts to Indigenous Peoples, IFC PS7 requires that the responsible authorities provide measures to establish and maintain an ongoing relationship based on Informed Consultation and Participation (ICP) with the Indigenous Peoples affected by a project throughout the project's lifecycle. As previously mentioned, ICP with Indigenous Peoples involves a more in-depth exchange of views and information, and an organized and iterative consultation. The proponent is expected to incorporate affected Indigenous communities' views on matters that affect them directly, such as the proposed mitigation measures, the sharing of development benefits and opportunities, and implementation issues into its decision-making process. The consultation process should (i) capture both men's and women's views, if necessary, through separate forums or engagements, and (ii) reflect men's and women's different concerns and priorities about impacts, mitigation mechanisms, and benefits, where appropriate. The proponent must document the process, in particular the measures taken to avoid or minimize risks to and adverse impacts on the affected Indigenous communities and must inform those affected about how their concerns have been considered.

In summary, effective Indigenous consultation is a two-way process that should: (i) begin early in the process of identification of environmental and social risks and impacts and continue on an ongoing basis as risks and impacts arise; (ii) be based on the prior disclosure and dissemination of relevant, transparent, objective, meaningful and easily accessible information which is in a culturally appropriate local language(s) and format and is understandable to affected Indigenous communities; (iii) focus inclusive engagement on those directly affected as opposed to those not directly affected; (iv) be free of external manipulation, interference, coercion, or intimidation; (v) enable meaningful participation, where applicable; and (vi) be documented.

In addition to ICP, the proponent must ensure the Free, Prior, and Informed Consent (FPIC) of the affected communities of Indigenous Peoples when one or more of the following circumstances are present: (i) impacts on lands and natural resources subject to traditional ownership or under customary use; (ii) relocation of Indigenous Peoples from lands and natural resources subject to traditional ownership or under customary use; and/or (iii) significant impacts on critical cultural heritage. This consent relates to the design, implementation and operation of the Project which must be recorded in a FPIC Agreement that includes any conditions or commitments attached to the consent. Details about the FPIC principles in relation to the Project are presented in the Indigenous Peoples Plan.

For successful outcomes to be achieved for the mutual benefit of all parties, the parties must have a shared view of the process for achieving ICP and, where applicable, FPIC. These processes should ensure the meaningful participation of Indigenous Peoples in decision-making, focusing on achieving agreement while not conferring veto rights to individuals or sub-groups, or requiring the client to agree to aspects not under their control. Companies have thus a responsibility to work with Affected Communities of Indigenous Peoples to ensure a meaningful engagement process, including on achieving FPIC where appropriate. Affected communities of Indigenous Peoples are similarly expected to work with the proponent to establish an acceptable engagement process and to participate in this process. It is recognized that differences of opinion may arise, which in some cases may lead to setbacks or delays in reaching agreement.

7.6.2 FREE, PRIOR, AND INFORMED CONSENT (FPIC) PROCEDURE

The procedure for the obtention of FPIC in this project consists of 6 interrelated and iterative steps. While these are presented in a discrete fashion below, each element may be conducted in parallel and require more than one meeting to be completed. Overlaps and back and forth are to be expected as consultations will follow the lead and needs of affected Indigenous communities.

1 **Initial Consultations and Identification of Leadership Structures.** Project information is shared through in-person presentations and project brochures. Information is sought to identify suitable organizations representing affected Indigenous Peoples' interests.

2 **Mapping.** Locations of affected Indigenous communities and the territories under customary use relative to the proposed project will be identified.

3 **Consultation and Information Dissemination**. Maps produced as well as identified decision-making structures and clear information on the Project's benefits, risks, impacts and implications for the affected communities are shared. The consultation uses the maps to identify and validate the way territory and resources are used by various community groups to produce livelihoods.

4 **Time for Independent Community Deliberations.** Community institutions will be left to conduct their own decision-making deliberations in which they will give or withhold consent for the project. This is not expected to be a straightforward process. The community may revert to the consultants/proponent for more information and clarifications on information already provided. Provision of such additional information may entail further consultations. This stage will end with an independent decision. If consent is obtained, an agreement will be negotiated with the Maasai to determine the type of measures, benefit sharing or activities that are expected from this community.

5 **Establishment of Grievance Mechanisms**. This will be initiated during consultation and information dissemination and any outstanding issues regarding how grievances arising from the engagement with the Project will be handled will be addressed during community-level deliberations. The grievance mechanisms will reflect local conflict resolution structures and be open to formal administrative and justice systems in the country.

6 **Formalization of the Memorandum of Agreement (MoA)**. If consent is granted, a formal memorandum of agreement will be completed, detailing the conditions of the affected Maasai communities. The MoA will *inter alia* include parties' expectations, the Project's timelines and monitoring procedures, grievance procedures and mechanisms, terms of withdrawal of consent and a record of the FPIC process in a language that all parties understand.

7.6.3 STAKEHOLDER IDENTIFICATION AND PRELIMINARY CONSULTATIONS

Indigenous stakeholder identification and consultations began as part of the development of the Vulnerable and Marginalized Group Planning Framework (VMGPF) by the KeNHA (KeNHA, 2019). The Indigenous Peoples organizations (IPOs) and Indigenous Peoples who were mapped out as key stakeholders in the VMGF include the following:

- Pastoralist Development Network, Kenya (PDNK);
- Minority Rights Group;
- Indigenous Livelihoods Enhancement Partners (ILEPA);
- Ogiek Peoples Development Program (OPDP);
- Ogiek Welfare Council;
- Mainyoito Pastoralists Integrated Development Organization (MPIDO);
- Maasai Peoples;
- Ogiek Peoples.

Six consultations (including one information session) were undertaken: two with representatives of Indigenous Peoples Organizations (IPOs), two with Maasai Peoples and two with Ogiek and Endorois Peoples. The schedule and details of these consultative meetings with IPOs and Indigenous communities are listed in **Erreur ! Source du renvoi introuvable.**.

In summary, the information session with the representatives of the national-level IPOs along the project corridor aimed at providing information to Indigenous representatives to enable them to understand the project and give informed feedback to the KeNHA on any areas they perceived as necessary for consideration. The participants, drawn from the 9 IPOs listed above, agreed that targeted community level consultations with the affected Indigenous communities would need to be undertaken both during the preparation and implementation phases of the project. A second consultation with IPOs was held with the aim of getting feedback from them on the ESIA findings in relation to Indigenous Peoples, and to seek their guidance on how to conduct and who to invite to the community-level consultations.

Consultations were held with Ogiek and Endorois Peoples from various villages along the A8 highway and with the Maasai from various villages along the A8 South highway (**Erreur ! Source du renvoi introuvable.**7-11). Key issues and concerns from the various consultative meetings and commitments made by KeNHA are detailed in the VMGPF (KeNHA, 2019). The main purpose of these meetings was for KeNHA to ascertain the locations of the different Indigenous groups in relation to the project site to determine if any of them would be directly impacted. It was found that only the Maasai would be impacted by the Project as they are known to graze their livestock in some areas traversed by the project road and on both sides of the current highway. The Ogiek communities are located over 20 km away from the Project's footprint and will thus not be directly impacted nor have direct interactions with the project. The Endorois communities are located outside the Project area and were thus not consulted further. As a result, it was concluded that a process of Free, Prior and Informed Consent (FPIC) is required for the Maasai communities in the vicinity of the A8 South while other Indigenous communities in the Project area fall under the Informed Consultation and Participation (ICP) process.

Table 7-11 Details of Consultations Held by KeNHA as Part of the Development of the VMGPF

Date	Time	Venue	Participants		Institutions/ communities represented
			Males	Females	
Jan. 25, 2018	9:30am	Sarova Panafric Hotel Nairobi	14	5	MPIDO, PDNK, SCL, Ogiek Welfare Council, OPDP, ILEPA, MRG, Delamere, KeNHA, World Bank, ICT, Charles & Barker
March 19, 2018	10:30am	Sarova Panafric Hotel Nairobi	11	5	PDNK, Ogiek Welfare Council, ILEPA, MPIDO, OPDP, EWC, KeNHA, World Bank, PPP unit, Charles & Barker
Apr. 19, 2018	12:00pm	Willies Resort (on the Nairobi Nakuru Road)	16	6	Ogiek and Endorois communities
Apr. 20, 2018	10:00am	Mt Longonot Transit Hotel Mai Mahiu	31	9	Maasai communities
March 19, 2019	10:00am	Mt Longonot Transit Hotel Mai Mahiu	31	9	Maasai communities
March 19, 2019	3:30pm	Grill Park Hotel Nakuru	14	9	Ogiek and Endorois communities

Source: Vulnerable and Marginalized Group Planning Framework, 2019

7.6.4 CONSULTATION AND MESSAGE

As for non-Indigenous consultations, the message and methods used for Indigenous consultations were adapted. The following elements were carefully planned for each consultation activity:

- the message to convey to each group of stakeholders (in collaboration with Norken and RVH);
- how stakeholders will be notified for upcoming meetings and the invitation process;
- the choice of the appropriate venue;
- the preparation of tools and visual support to be used during consultation;
- the resources required to facilitate the consultation;
- how minutes will be written, recorded and disclosed;
- how grievances will be addressed. How RVH or the contracting authority (KeNHA) should be involved in grievances redress or questions;
- how the principles of Informed Consultation and Participation (ICP) and Free, Prior and Informed Consent (FPIC) as outlined in IFC PS7 will be implemented.

7.6.5 RECORDING AND DISCLOSURE OF PROJECT INFORMATION AND MINUTES OF CONSULTATIONS

The SEP core principle is that all communications and decisions derived from meetings and community consultations are recorded. During stakeholder engagement activities, notes were taken and an attendance registration list was available for all attendees to facilitate formal registration of interest.

7.6.6 INTEGRATION OF CONSULTATION OUTCOMES IN THE ESIA

Consultation outcomes are key inputs to any ESIA and those from Indigenous consultations were used to enhance the present one in various ways:

- Project design requests were collected and shared with the project design team for consideration. As demonstrated in section 7.4.3.4, a vast majority of all requests (from Indigenous and non-Indigenous stakeholders) were integrated in the design, thereby avoiding many negative impacts and making the project better adapted to its environment;
- Baseline data and information was fed into chapter 6, which in turn informed the impact assessment and development of mitigation measures in chapter 8;
- Potential project impacts identified by Indigenous Peoples were considered and assessed in chapter 8, therefore also informing the development of mitigation measures in section 8.3.6 (Impacts on Indigenous Peoples (VMGs)). They were also used in sections 8.4 (evaluation of social acceptability) and 8.5 (cumulative impact assessment).

7.7 ENGAGEMENT ACTIVITIES DESCRIPTION AND RESULTS: INDIGENOUS PEOPLES

Two rounds of consultations have been conducted to date, with a third round pending. The consultations were conducted in accordance with the Vulnerable and Marginalized Groups Planning Framework (VMGPF) developed by KeNHA in 2019 (KeNHA, 2019). They were carried out by a team from Norken International Limited, including a VMG specialist with the required qualifications outlined in the VMGPF. Meetings during both rounds proceeded according to the following general outline:

1. Opening prayer (by a chief, elder or chairman) and opening remarks by host of the meeting.
2. Introductions: All meeting participants introduced themselves, starting with the community and ending with the consultant team, in order to ascertain the representativity of the meeting (in terms of locations, associations, or groups represented).
3. Overview of the Project by the consultant team: presentation of the Project’s main features (current road conditions and proposed developments), explanation of the ESIA, and distribution of Project brochures. Community members translated the content into their native language when needed.
4. Guided discussions on specific topics:
5. Open Q&A session moderated by the meeting host and answered by the consultant team.
6. Closing remarks, vote of thanks, and closing prayer.

Attendance was registered as the meeting proceeded with the help of one community member.

For the first meeting with a community (conducted either during round 1 or 2), discussions focused on the current use and/or interactions with the A8 roads, delineation of land used for livelihoods (including transhumance) and challenges encountered with regards to the roads, perceived impacts of the Project and opinions, and possible mitigation during and after construction. Before the closing of the meeting, participants were prompted about leaders or organizations that represent their interests for future stakeholder engagement activities (i.e., to complete the stakeholder mapping).

7.7.1 FIRST ROUND OF CONSULTATION

The first round of consultation was conducted with selected Maasai and Ogiek communities in January 2021. The main objectives were to confirm the conclusions of the VMGPF in terms of which communities will be directly affected by the Project, present the Project, gain a deeper understanding of Indigenous Peoples' relation to the environment (including livelihoods), screen the Project's potential impacts on Indigenous Peoples, and initiate the FPIC process where relevant.

7.7.1.1 STAKEHOLDER ENGAGEMENT ACTIVITIES

The first round of consultations included three components. First, discussions were held with the Deputy County Commissioners of sub-counties where Maasai and Ogiek Peoples are located. Second, following the recommendations of national level Maasai and Ogiek Indigenous Peoples Organizations consulted for the VMGPF, targeted community level consultations with Maasai and Ogiek communities were initiated. Third, the VMG specialist met with the Ogiek People Development Program NGO to collect their views and recommendations.

The goal for the community consultations was to establish contact and initiate a relationship with concerned Indigenous Peoples. The process therefore did not follow a pre-planned protocol but occurred by continuous adaptation to local circumstances as those presented themselves. As a result, these meetings were participatory and people centered. While the VMG specialist guided the consultation activities, leadership of sessions was offered to local leaders, including elders, to respect customary protocols.

An effort was made at the outset to reach different levels of governance and be gender and intergenerationally inclusive by encouraging broad participation from different community members. On the one hand, meetings with the Maasai included both members from the Council of Elders and the only age-set chief for the Project area (see Section 6.4.8.1 for information on Maasai traditional governance structure). Meetings with the Ogiek also included members from the Council of Elders and youth representatives. On the other hand, despite our efforts, women were not present at these meetings. They were, however, significantly included in Round 2 and will be even more so in Round 3. During the community meetings, participants described the boundaries of their territories. These were then sketched and will be validated by respective communities during the third round of consultations. Table 7-12 presents the details of the consultative activities performed during the first round. Attendance sheets, photos and minutes of meetings can be found in Appendix 7-6.

Table 7-12 Meetings held during the First Round of Indigenous Consultations

No	Stakeholders / Participants	Day and Date	Time	Venue	Number of participants
1	Naivasha Sub-County Deputy County Commissioner	Monday January 25, 2021	9h00	Deputy County Commissioner Office, Naivasha, Nakuru	3
2	Maasai Longonot Traditional Leaders/Elders		14h00	Longonot town Chief Office, Nakuru	9
3	Maasai Community, Mai Mahiu	Tuesday January 26, 2021	13h30	Windy Ridge Resort, Mai Mahiu	16
4	Molo Sub-County Deputy County Commissioner	Wednesday January 27, 2021	9h00	Deputy County Commissioner Office, Molo, Nakuru	3
5	Njoro Sub-County Deputy County Commissioner		10h45	Deputy County Commissioner Office, Njoro, Nakuru	3
6	Ogiek Council of Elders		12h30	Mariashoni Community Guest House, Nakuru	20
7	Ogiek Community	Thursday January 28, 2021	11h00	Mariashoni Community Guest House, Nakuru	56
8	Ogiek People Development Program- OPDP (NGO)	Friday January 29, 2021	10h00	OPDP Office, Nakuru	4
				Total Participation:	**114**

7.7.1.2 TOOLS AND SUPPORTING MATERIAL

During the first round of consultations, an informative leaflet was distributed and an A0 format map of the highway project was presented. The tools and supporting material can be found in Appendix 7-8.

7.7.1.3 MAIN CONCERNS AND OBSERVATIONS

The main concerns and observations raised during the first round are summarized hereafter.

MAASAI COMMUNITIES, MAI MAHIU AND LONGONOT

The Maasai communities of Longonot and Mai Mahiu mainly live 3-4 km from the A8 South. Their settlements are therefore not at risk of relocation. However, their traditional territory is in the Project Area and the Project traverses lands under customary use (pastoralism). An FPIC process is thus triggered for these Maasai communities.

The Maasai community members in Mai Mahiu made the following requests:

- Provide **crossing points for the livestock** every 5 km, underpasses are preferred;
- Offer employment opportunities for skilled and unskilled Maasai during the construction phase and for sourcing construction material (transport);

- Provide two **footbridges** in Mai Mahiu Town;
- Avoid contamination of rivers in Mai Mahiu;
- Ensure adequate road signs;
- The A8 South at Mai-Mahiu towards Nairobi should be expanded to help reduce traffic.

OGIEK COMMUNITY, MARIASHONI

The consulted members of the Ogiek Council of Elders of Mariashoni and of the Ogiek People Development Program (OPDP) confirmed that they will not be directly affected by the Project as they do not live near the highway and that the Project will not affect their traditional territory nor lands or resources under customary use. The Ogiek Council of Elders agreed to signing a Memorandum of Understanding (MoU) (to be reviewed by the OPDP) to confirm this. As such, the free, prior, and informed consent of the Ogiek of Mariashoni is not required and they fall under the ICP process.

The Ogiek People made the following requests:

- Provide pedestrian and cyclist lanes and, if possible, truck lanes in busy towns/ centres;
- Ensure visible road signage, especially for the speed limits;
- Include additional weight bridges (further from the road to reduce congestion);
- Consider future plans for expansion into the design since this is a very busy major highway;
- Provide **footbridges** for pedestrians;
- Install road barriers;
- If possible, electric fences should be constructed in the wildlife conservancies and if need be, a central exit point and an underground tunnel should be considered;
- Regular painting of speed bumps and road markings;
- Replant trees to compensate lost ones;
- Offer employment opportunities for Ogiek;
- Rehabilitate borrow pits and quarries;
- Plan mitigation measures for potential sexually transmitted diseases by foreign workers during construction.

7.7.2 SECOND ROUND OF CONSULTATION

The second round of consultations was conducted in May-June 2021. Discussions related to the Free, Prior, and Informed Consent (FPIC) process were continued with the Maasai from Longonot and from Mai Mahiu. Discussions part of the ICP process were also deepened with the Ogiek community in Mariashoni. Finally, following reports of additional Indigenous communities being established in the Project area, two Indigenous communities were visited to ascertain they will not be directly affected by the Project and initiate the ICP process accordingly.

7.7.2.1 STAKEHOLDER ENGAGEMENT ACTIVITIES

Consultation activities with Indigenous Peoples during the second round were guided by the same team of specialists from Norken International Limited than for the first round. Discussions related to the Free, Prior, and Informed Consent (FPIC) process continued with the Maasai from Longonot and from Mai Mahiu, which focused on clarifying their demands for obtaining consent. As outlined in the VMGPF, consultations included the identification of suitable livestock crossing locations and discussions on benefits to be accrued by the Maasai such as employment opportunities, representation in the GRM, and potential CSR activities.

While consent is not required for Indigenous communities not directly affected due to their location further away from the Project and where no impacts are foreseen on lands and natural resources subject to traditional ownership or under customary use, discussions were deepened with the Ogiek community in Mariashoni. In order to remain culturally sensitive, the Maasai and Ogiek Councils of Elders were encouraged to invite a broad range of community members to ensure gender and intergenerational Indigenous inclusion in the consultation process. Women and youth participated in consultations and one meeting was held exclusively with Maasai women.

Meeting with the Maasai form Longonot and Mai Mahiu and the Ogiek from Mariashoni followed the same general proceedings. They began with a prayer by a chief, elder or chairman. The host of the meeting (the assistant county commissioner, chief, or chairman) followed with opening remarks. All meeting participants introduced themselves, starting with the community and ending with the consultant team, in order to ensure all were represented in the meeting (in terms of locations, associations, or groups). The consultant team presented an overview of the project, explained the ESIA and distributed project brochures. Community members translated the content into their native language when needed. There was then a Q&A session moderated by the meeting host and answered by the consultant team, and the meeting ended with a vote of thanks and a prayer. Attendance was registered as the meeting proceeded with the help of one community member.

Following reports of additional Indigenous communities being established in the Project area, two locations were visited for the first time during round 2: Eburru (comprising Ogiek and Maasai Peoples) and Kongasis/Oljorai (comprising different villages with Maasai, Turkana, and Samburu Peoples). These areas also include other Kenyan tribes, but they were previously invited to participate in similar consultative meetings. They were therefore not included in the target group for these specific meetings. These meetings followed the same outline as the first meetings for the Maasai of Longonot and Mai Mahiu, and Ogiek of Mariashoni.

Table 7-13 presents the details of the consultative activities performed during the second round. Attendance sheets, photos and minutes of meetings can be found in Appendix 7-7.

Table 7-13 Meetings held during the Second Round of Indigenous Consultations

No	Stakeholders	Topic	Date	Time	Venue	Number of participants
1	Maasai, Mai Mahiu – Women – Traditional practitioners	Ecosystem Services	May 26, 2021	14h40	Chief Compound, Mai Mahiu, Naivasha, Nakuru	12
2	Ogiek and Maasai, Eburru – Assistant chairman of the community	Ecosystem Services	June 17-18, 2021	*tbc*	By Telephone	1
3	Ogiek, Mariashoni – Assistant chairman of the Ogiek Council of Elders	Ecosystem Services	June 17-18, 2021	*tbc*	By Telephone	1
4	Maasai, Mai Mahiu – Elders – Women leaders	FPIC process: ESIA and project proposed design	June 2, 2021	9h00	Esidai Hotel, Mai Mahiu, Naivasha, Nakuru	20
5	Maasai Community Based Organizations (CBO) – Ilanyuak – Elparakuo Conservation Group – Kijabe Forest Trust representative – One youth representative	FPIC process: ESIA and project proposed design		14h00		4
6	Ogiek and Maasai community members of Eburru	ICP process: ESIA and project proposed design	June 3, 2021	10h00	Eburru Forest Office, Gilgil, Nakuru	36
7	Maasai, Samburu and Turkana community members of Kongasis/Oljorai	ICP process: ESIA and project proposed design		15h00	Lamp and Light Church, Kongasis, Oljorai	43
8	Maasai, Ereri, Longonot – Maasai Elders – Women – Youth	FPIC Agreement	June 4, 2021	10h00	Longonot, Chief's Camp	9
9	Maasai, Mai Mahiu – Maasai Elders	FPIC Agreement	June 7, 2021	10h30	Windy Ridge Resort, Mai Mahiu	12

No	Stakeholders	Topic	Date	Time	Venue	Number of participants
10	Ogiek, Mariashoni – Ogiek community members	ICP process: ESIA and project proposed design	June 8, 2021	10h00	Mariashoni Community Guest House, Nakuru	34
11	Mariashoni Ogiek Community-based Organizations (CBOs): – Macodev – Prohome – Malando	ICP process: ESIA and project proposed design		11h45	Mariashoni Community Guest House, Nakuru	3
12	Ogiek, Mariashoni – Ogiek Council of Elders	ICP process: MoU		12h30	Mariashoni Community Guest House, Nakuru	18
					Total Participation:	**193**

7.7.2.2 TOOLS AND SUPPORTING MATERIAL

The tools used for the second round of consultation consisted of the distribution of an informative leaflet and the display of an A0 format map of the highway project. In addition, specific maps were prepared for each subcounty meeting to show the detail design proposed for the consulted territory. Some visual materials were also presented, such as images of crossing structures (overpass, underpass, flyover) to help the community better visualize the project and its components. The tools and supporting material for this second round can be found in Appendix 7-8.

7.7.2.3 MAIN CONCERNS AND OBSERVATIONS

The main concerns and recommendations from the second round are summarized hereafter.

FREE, PRIOR, AND INFORMED CONSENT (FPIC) PROCESS

Below are the Indigenous communities' requests upon which consent is contingent. The communities also expressed a list of suggestions and potential mitigation measures which are provided in the following section.

REQUESTS FOR PROJECT CONSENT (TO BE NEGOTIATED AND FORMALIZED IN FPIC AGREEMENT)

MAASAI COMMUNITY, LONGONOT

1. a) Employment of community members - about 70% of unskilled jobs in the project along their geographical area.
   b) Inclusion of the community in the committee involved in construction hiring (they already have an existing community committee with a chairman).
2. Provision of a culvert on the Oleiyet seasonal river in Ereri village (about 4 km from Longonot town).
3. Provision of a livestock underpass at Hillstop, Longonot.
4. Provision of a crossing footbridge for the community and children at Longonot Primary and Secondary Schools in Longonot town.

5 Solving the water problem in the area by tapping from the already existing water pipeline about 3 km from Ereri Village. The water intake is from Lake Naivasha and terminates at the Inland Container Depot in Suswa (36°29'11.90"E, 1°2'36.40"S).

MAASAI COMMUNITY, MAI MAHIU

1 Improvement by murraming/tarmacking of an existing 20 km road (Junction-B3-Namuncha Primary School) that connects to the A8 South.

2 The proponent/contractor to connect and communicate with the community committee and 2 community liaison officers that will represent their interests and assist in grievances redress.

3 Employment of community members in skilled and unskilled job opportunities - about 80% of unskilled labour.

4 Consider local Maasai industries for material (e.g., sand, rock aggregates) since sand harvesting and quarrying are the main economic activities in the locality.

5 The construction of classrooms in Namuncha Primary School as part of a CSR project.

6 Provision of livestock underpasses, footbridges and speed bumps for the safety of the community and their livestock at Kanjo, Koroiro, and Monkey Corner.

OTHER REQUESTS AND CONCERNS

MAASAI COMMUNITY, MAI MAHIU & MAASAI COMMUNITY-BASED ORGANIZATIONS (CBOS)

- Inclusion of community members during both the construction and operation phases:
  - Include employment of women during the construction process;
  - Employ Maasai women and youth for unskilled jobs such as for vegetation clearing of the roadsides and waste collection at the roadside to ensure the community benefits from the project even after construction is over.
- Include the community in road construction committees to represent their interests;
- Provide a weighbridge along the road to protect it from excess heavy commercial trucks and provide job opportunities to the youth;
- Since a lot of dust will emanate from the construction sections, sprinkle water to protect nearby vegetation and other road users;
- Ensure continued access to livestock watering points along the road during the construction process (do not fence off or put out of bounds);
- If budget and design allow, provide Maasai women with roadside stalls to sell their produce, beadworks and artwork to help them improve their livelihoods;
- Provide Curio shops along the escarpment or in town to allow the community, especially women, to benefit from tourism since this is the main route followed by tourists on their way to Maasai Mara.
- Install roadside toilets for Road users;
- Erect Road signs at animal crossing points;
- Provide a motorbike shed (boda shed) in town;
- Protect water downstream, specifically the river should not be diverted;
- The stretch along the escarpment should be put under consideration in the 13 km of street lighting along A8 South;
- Fit steel bars along the escarpment to reduce the fatality of accidents;

- Implement speed bumps and road crossing signs at animal crossing points;
- Protect the forest:
  - Construction material should not be sourced from the forest and the construction waste should not be dumped in the forest;
  - The borrow pits should be covered after construction and trees planted around the area for restoration;
  - If there is any stone blasting, it should be regulated and done in a sustainable manner because the forest is the water catchment area for the locality.
- Improve security by:
  - Providing public toilets along the highway; recently there was an incident where a passenger was attacked and killed by a hyena;
  - Since there is no security in the forest, the community can be contracted as guards along the roads.

INFORMED CONSULTATION AND PARTICIPATION (ICP) PROCESS

OGIEK COMMUNITY, MARIASHONI & OGIEK COMMUNITY-BASED ORGANIZATIONS (CBOS)

The Ogiek People clarified their expectations and made the following requests:

- Improvement of either one of the following roads (6 km) to indirectly connect them to the A8 highway:
  - Mariashoni - Elburgon Road;
  - Nessuit - Njoro Road.
- Employment of community members during construction; consideration of the Ogiek youth in the unskilled and semi-skilled job opportunities;
- Inclusion of the Ogiek Council of Elders and Ogiek CBOs during recruitment for vetting purposes to avoid impersonation of Ogiek People;
- Sourcing of construction materials from the locality;
- Avoid cutting down trees and revegetate as the Ogiek bee keeping economy depends primarily on trees.

OGIEK AND MAASAI COMMUNITY, EBURRU

The consulted community members from Eburru confirmed that they will not be directly affected by the Project as they are located over 20 km away from the A8 and that the Project will not affect their traditional territory nor lands or resources under customary use. Community representatives will be asked to sign a Memorandum of Understanding (MoU) to confirm this during the third round of consultations. As such, the free, prior, and informed consent is not required from the Eburru community and they fall under the ICP process.

The Ogiek and Maasai community members of Eburru made the following requests:

- Consider constructing the road from Eburru to Gilgil;
- Include Ogiek in employment opportunities;
- Ensure the safety of road crossings by providing adequate lighting;
- Consider providing a water purification as part of CSR. At the moment, the community sources water from Lake Naivasha;
- Source local materials from the area if ballast and stones are suitable;
- The Maasai in the locality can be subcontracted to guard the toll stations;

- Consider conserving storm runoff water from the roads;
- Regulate roadside food kiosks for construction workers and allocate designated spaces for the community;
- Ensure proper mitigation of deforestation, dust and increased disease transmission due to influx of construction workers;
- Rehabilitate and restore borrow pits to their original state;
- Address the fact that women and girls in remote villages such as Eburru do not have formal education and therefore lack confidence. They also do not have access to internet and information. This can be achieved by the following initiatives:
  - Provide trainings and empowerment of women;
  - Consider organised women groups during recruitment without stringent measures;
  - Provide awareness sessions to the women and girls to prevent unwanted pregnancies.
- Consider improving roads used to divert traffic during the construction process at the end of the Project.

MAASAI, SAMBURU AND TURKANA COMMUNITY, KONGASIS/OLJORAI

- Consider employing youth from the community even though they are approximately 25 km from the highway;
- Provide underpasses and foot bridges;
- Marginalized communities should be organized into groups and included in the overall construction committee to ensure their voices are heard;
- Monitor if the communities have truly benefited from the Project, especially in terms of employment;
- Consider improving feeder roads to improve market access for produce from maize farming and mid-scale dairy farming which are the main economic activities in the community;
- Install streetlights along the Marula Conservancy where the community usually herd their livestock because it is very dark and forested;
- Provide toilets along the highway for road users.

7.7.3 THIRD ROUND OF CONSULTATION

As previously mentioned, a different consultation approach was adopted for Indigenous Peoples as per the requirements of PS7. As such, these consultations have their own timeline to respect Indigenous schedules and needs. The third round of consultation with Indigenous communities will take place in early February 2022 to provide sufficient time to the consultants to devise a strategy in collaboration with Indigenous partners to ensure the broadest and most inclusive participation possible.

7.7.3.1 STAKEHOLDER ENGAGEMENT ACTIVITIES

Meetings with Indigenous communities will take place in late January, following a slightly modified approach in order to achieve all PS7 objectives. As determined in the first and second round of consultations, Indigenous communities are involved in either one of two streams: the Informed Consultation and Participation (ICP) process or the Free, Prior and Informed Consent (FPIC) process. Objectives for each stream, as well as a workplan and schedule are presented in detail below.

The objectives for Round 3 Indigenous consultations are outlined in Figure 7-3, showing the specificities for communities involved in the ICP process and those involved in the FPIC process. A detailed workplan and schedule are presented in Table 7-14. It is important to note that Round 3 consultations will be flexible and adapted as needed. They will therefore include as many meetings as necessary with each community in both streams (ICP and FPIC) to achieve all objectives. For example, since the communities of Eburru and Oljorai have only been met once, we anticipate that several meetings will be necessary, while only one meeting with the Ogiek community of Mariashoni may be sufficient.

While the exact consultation outline is still under development, it will likely include two components: (1) a community meeting to share general information about the project, the ESIA conclusions, and proposed processes; and (2) focus groups to collect Indigenous views in a disaggregated manner (see Figure 7-3 and Table 7-14). Proposed processes that need to be discussed with and agreed to by Indigenous communities include the Grievance Redress Mechanism (GRM), the signing of a MoU for the ICP stream, and the Good Faith Negotiation (GFN) process and signing of a FPIC Agreement for the FPIC stream. Once a GFN process that is satisfactory to both parties has been agreed to, official negotiations will be initiated. The FPIC process will end with the official signing of a FPIC Agreement that has garnered collective agreement at the community level

Preparation for round 3 consultations is underway (see Table 7-14). This has included further work on the stakeholder identification such as identifying vulnerable groups within Indigenous communities, gathering information to clarify the formal and informal governance structures for each community, and identifying other stakeholders with an interest in the Project. A preliminary list of stakeholders to include in the third round of consultation is presented in Table 7-15. The Indigenous Peoples Plan already contains a proposed GRM which will be presented to Indigenous communities. For the FPIC stream, a proposed Good Faith Negotiation (GFN) process that includes Maasai preferences and requests has been developed. For example, Maasai communities have already indicated that they would like the Pastoralist Development Network to review the FPIC Agreement before signing, and time for this has been allocated in the proposal. A culturally appropriate mechanism to ensure that collective agreement on the FPIC Agreement has been achieved will also be built into the GFN. What this mechanism will entail still needs to be discussed with Maasai communities, but it could, for example, be a joint presentation by Maasai and RVH representatives to community members, followed by a discussion to assess the level of agreement and collect potential amendments.

During January 10-14, 2022 a social specialist from Norken International Limited that was involved in the first and second rounds of Indigenous consultations will travel to all five Indigenous communities. She will meet with key informants including the Area Chief and Assistant Chief, as well as Elders, to confirm and refine the stakeholder identification, determine the best strategy to maximize participation, and set meeting dates and identify a suitable venue. In addition, the proposed GFN process will be introduced to Maasai leaders in Longonot and Mai Mahiu to allow them time to deliberate about their negotiation preferences ahead of the third round of consultations.

All Indigenous Communities

- Refine stakeholder identification to leave no one behind
- Document concerns and priorities about impacts, mitigation, and benefits disaggregated by gender and vulnerable groups within Indigenous communities
- Present latest project design and how concerns were incorporated
- Present conclusions of impact assessment
- Develop GRM in partnership with Indigenous communities
- Identify process and outcome indicators for monitoring in partnership with Indigenous communities
- Develop a participatory monitoring process in partnership with Indigenous communities

ICP Stream (Eburru, Oljorai, Mariashoni)

- Validate territory map to justify ICP process
- Identify or confirm representatives for MoU
- Ensure collective agreement of MoU
- Sign MoU

➢ Document ICP process, in particular measures taken to avoid or minimize risks to and adverse impacts on Affected Communities

FPIC Stream (Namuncha, Ereri)

Consultations:

- Validate territory map and customary land use in the project area to justify FPIC process
- Agree on Good Faith Negotiation (GFN) process
- Identify or confirm representatives for MoA

GFN Process:

- Determine conditions for Maasai consent including rights and entitlements related to mitigation of project-induced adverse impacts on the one hand, and broader development opportunities if relevant on the other hand
- Ensure collective agreement of negotiated MoA
- Sign MoA

➢ Document FPIC process (ICP and GFN), in particular measures taken to avoid or minimize risks to and adverse impacts on Affected Communities

Figure 7-3 Objectives for Round 3 Consultations with Indigenous Communities

Table 7-14 Workplan and timeline to meet third round of consultation objectives

Stage and timeline	Activity/Approach
Preparation for round 3 consultations: completed by early January	– Identify – in collaboration with Indigenous key informants – subgroups for focus groups, including vulnerable groups within the community – Develop a tailored strategy and mobilization plan to ensure broad participation, particularly that of vulnerable groups within Indigenous communities (may have to be different for different communities) – Refine documentation tools to facilitate recording of concerns and priorities about impacts, mitigation, and benefits disaggregated by gender and vulnerable groups within Indigenous communities – Develop consultation plan and outline for ICP stream and FPIC stream ***ICP stream (Eburru, Oljorai and Mariashoni):*** – Develop a proposed strategy to ensure, in a culturally appropriate manner, broad agreement of the MoU ***FPIC stream (Ereri and Namuncha):*** – Draft a proposed Good Faith Negotiation (GFN) process that includes already expressed Maasai preferences and requests – Develop a proposed strategy to ensure, in a culturally appropriate manner, broad agreement on the legitimacy of the engagement process and the MoA content
Community invitations: mid-January (2 weeks before actual consultations)	– Implement mobilization plan (e.g., letters, posters in communities, etc.)
Round 3 consultations – ICP stream: to begin at the start of February	– Present final design and how concerns were incorporated (done by RVH representative) – Present conclusions of impact assessment – Present proposed Grievance Redress Mechanism (GRM) as drafted in the Indigenous Peoples Plan – Validate territory maps to justify ICP stream – Continue to document concerns and priorities about impacts, mitigation, and benefits disaggregated by gender and vulnerable groups within Indigenous communities – Document views on the proposed GRM – Agree on MoU content – Identify process and outcome indicators for monitoring in partnership with Indigenous communities – Ensure and document broad community agreement – Signing of MoU

Stage and timeline	Activity/Approach
Round 3 consultations – FPIC stream	
a) Community consultations: start of February	– Present final design and how concerns were incorporated (done by RVH representative) – Present conclusions of impact assessment – Present proposed Grievance Redress Mechanism (GRM) as drafted in the Indigenous Peoples Plan – Validate territory map and customary land use in the project area to justify FPIC process – Continue to document concerns and priorities about impacts, mitigation, and benefits disaggregated by gender and vulnerable groups within Indigenous communities – Document views on the proposed GRM – Reach agreement between the Maasai and RVH on a culturally appropriate Good Faith Negotiation (GFN) process which will ensure collective community agreement
b) Good Faith Negotiations (GFN): dates to be determined	– Initiate approved GFN process – Agree on content of FPIC Agreement
c) Completion of FPIC process: dates to be determined	– Ensure collective community agreement – Signing of FPIC Agreement

Table 7-15 Preliminary list of stakeholders to reach during the third round of consultations

Stakeholder Group	Details
Village Chairmen or other representative	– Chairman/representatives of Ereri village, Longonot – Chairmen/representatives of each village with Maasai people in Mai Mahiu (list to be confirmed during ground truthing in Jan. 10-14) – Chairman/representative of Ex Lewis village, Eburru – Chairmen/representatives of the 11 villages with either Maasai, Ogiek, Turkana and Samburu people in Kongasis sub-location of Oljorai location
Women of all ages and girls	– Women representatives – Women-headed households: including unwed mothers and single parents – Widows – Young married girls – Women excluded from property ownership (where relevant)
People with chronic health issues	– HIV/AIDS – Others (to be determined)
People without access to land property	– IDPs – Squatters/landless
People living with disabilities (PLWD)	– PLWD representative – Other PLWD
Youth	– Ensure the youth representative is present in each site, including the Maasai age set chief from Longonot – Youth excluded from property ownership (where relevant)
Elders	– Council of Elders – Other elderly people
Livelihood interest	– Businesses representatives (sand harvesters, curio shops, beekeepers, etc.) – Herders

7.7.3.2 TOOLS AND SUPPORTING MATERIAL

Although the tools for the third round of consultation are still under development, they will likely include the following:

- An informative leaflet presenting the main results of the consultation activities, the environmental and social impacts, and proposed mitigation measures for the project;
- A Power Point presentation outlining the results stemming from the consultation activities with the concerned community, a summary of the environmental and social impacts on Indigenous communities, and proposed mitigation measures to address these;
- Maps to validate territory boundaries and territory use;
- More detailed attendance sheets in order to better capture the representativeness of participants.

8 IMPACT ASSESSMENT AND MITIGATIONS

The assessment conducted in this chapter is based on the methodology presented in section 5.4 of Chapter 5: Approach and Methodology. The spatial boundaries considered hereafter were previously defined in section 5.1.

The prescriptive approach assesses pre-mitigation and residual impacts on VECs using the following parameters:

- Intensity of the impact indicates the degree to which the VEC will be disturbed;
- Geographic extent of the impact refers to the spatial area of influence affected;
- Duration of the impact refers to the period during which the impacts will be felt;
- Magnitude of the impact reflects the overall degree of disturbance considering the intensity, the geographical extent, and the duration according to the matrix presented in Table 5-14.

The following subsections describe the Project-related impacts on VEC's of the physical, biological and human environments.

Considering the similitude of the activities in the pre-construction and construction phases and the relative importance of the impacts associated with the construction activities compared to the pre-construction activities, both phases will be treated jointly in this chapter.

The nature of the impact source "Heavy Maintenance & Rehabilitation" associated with the operation phase is composed of activities that will require a specific environmental impact assessment evaluation prior to their realization. The resulting impacts and mitigation measures will be similar to those of the Project's Pre-construction and Construction phases presented in the following sections. They will however be of a lesser scale since they will be associated with one or few of the construction activities related to the Project. For these reasons, these impacts and mitigation measures are not considered in the current ESIA to allow for a stronger focus on the immediate impacts and mitigation measures associated with the main operation phase activities, namely routine maintenance and presence/operation of the highway.

Unless otherwise specified, pre-mitigation impacts that are of minor magnitude will only be assigned general mitigation measures.

Finally, it must be underlined that the implementation of the mitigation measures proposed in this chapter will be ensured through monitoring and follow-up actions presented in chapter 10. In addition, the measures will be integrated in various management/action plans composing the Engineering, Procurement and Construction (EPC) Contractor's and the Operation & Maintenance (O&M) Contractor's Environmental and Social Management Plan, supported by an Environmental and Social Management System. These documents are presented separately from the ESIA but briefly presented in Chapter 10.

8.1 PHYSICAL ENVIRONMENT

This subsection describes Project-related impacts on VEC's of the physical environment, including ambient air quality, GHG emissions, ambient noise, surface water quality and management, groundwater quality and quantity, soil stability/erosion, soil quality and sediment quality.

8.1.1 ATMOSPHERIC ENVIRONMENT

Assessment of atmospheric environment considers two VECs, ambient air quality and GHG emissions.

8.1.1.1 AMBIENT AIR QUALITY

The ambient air quality will be impacted at the Pre-Construction, Construction and Operation phases. Information relating to the ambient air quality baseline conditions are presented in section 6.1.2 of the Environmental and Social Baseline chapter. The expected effect of the project on ambient air quality was also considered and a model-based survey was conducted (see section 5.3.2.1 for associated methodology and parameters) for time zero of the project (point just before operation begins), that is 2025 and 2040, used as a reference year for operation. The model considered IFC EHS Guidelines air quality criteria for all air quality parameters except for TSP (24h) and NO_2 (24 h) for which NEMA standards were used in the absence of an IFC guideline. Both with and without the project situations were considered. Results from this model-based survey are presented in the subsection related to the operation phase.

The following describes the main Project-related sources of impacts, proposed mitigation measures, and resulting residual impacts for this VEC.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

Considering the baseline situation when the sampling activities were conducted during the dry season, particulate matter standards were exceeded at all sampling stations for the PM_{10} and $PM_{2.5}$. These are more important at the A2 station located in the dense urban setting in the city of Nakuru. As for the total suspended particles (TSP), exceedances were only recorded at this A2 station. For gases, NO_2, SO_2, O_3 and TVOCS were also sampled, but no standards were exceeded apart from TVOCS at one of the sampling stations where the conditions were considered abnormal due to painting works conducted nearby during the sampling period. In conclusion, air quality in the project area is generally good with regards to atmospheric emission of gases but a moderate to high concern when it comes to particulate matters.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes several Pre-Construction and Construction activities that may affect ambient air quality:

- operation of mechanical equipment and machinery that will contribute to the release of various air contaminants;
- transportation of equipment, workers and truck traffic required to move fill material, granular material, asphalt, concrete and prefabricated elements to the site and unsuitable excavated material from the site will contribute to the emission of various atmospheric pollutants;
- operations at quarries, including mining activities and stone crushing, which will generate dust and various atmospheric pollutants;
- handling large quantities of granular material on the work site for filling works that may generate dust;
- trucks leaving the work site with muddy tires may transfer this mud to local roads which, once dried, could generate dust from regular traffic.

Table 8-1 summarizes the pre-mitigation impacts and presents the impact assessment for ambient air quality.

Table 8-1 Pre-Construction and Construction Phases Impact Assessment for Ambient Air Quality

Assessment of Pre-mitigation Impacts	These activities will alter ambient air quality without being the cause of a significant degradation but will contribute to the existing particulate matter problem. Thus, the intensity of the impacts caused by the project is considered medium. Impacts will occur during specific work phases or during the full construction period (30 months) (trucking and operation of machinery and equipment) and therefore would be characterized as having a medium-term duration. The impacts should mainly be felt at the LAA level, that is within the work site and in its immediate surroundings, thus resulting in an impact of moderate magnitude.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographic Extent	☐ Limited (PDA)	☒ **Local (LAA)**	☐ Regional (RAA)
Duration	☐ Short-term	☒ **Medium-term**	☐ Long-term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES:

- Avoid leaving mechanical equipment, machinery, trucks, and vehicles idling unnecessarily at the work site;
- Ensure all vehicles, equipment and machinery are in good working order with a particular attention to motor combustion efficiency and antipollution systems;
- Limit vehicle and machinery speed within the work site to minimize dust generation. Authorized speeds on the work site should be specified and enforced by the contractor;
- Use water bowsers as dust abatement to limit excessive dust emissions from granular material handling and piling, and vehicle movements;
- Ensure trucks transporting fine granular (sand) material and asphalt are equipped with a tarpaulin to cover the material during travel between material site source and work site;
- Drop granular material as close to the ground possible to reduce generation of airborne particles.

SPECIFIC MEASURES:

- Ensure implementing the Traffic management plan as approved by KeNHA, for the transportation of granular material from existing quarries to the work site;
- If ambient air quality-related grievances are received, develop and implement an ambient air quality monitoring program to verify construction-related emission levels, identify the main sources, and develop potential actions for improvement.

DETERMINATION OF RESIDUAL IMPACTS

The Project's residual impacts on ambient air quality at the Pre-Construction and Construction phases, following the implementation of the general and specific mitigation measures recommended above, are assessed in Table 8-2.

Table 8-2 Determination of the Project's Residual Pre-Construction and Construction Phases Impacts on Ambient Air Quality

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures has the capacity to reduce impacts, resulting in the overall lowering of dust and particle emissions within the Project area and by limiting air emissions through proper maintenance and good operating practices of equipment and machinery, therefore minimizing adverse impacts on human health and the environment by minimizing air pollution from project activities as required by IFC PS3. The intensity of the residual impact associated with the project is thus considered low. However, residual impacts will still be felt at the scale of the LAA and for the duration of the Project (medium-term duration). The resulting magnitude of impacts becomes minor.		
Direction	☒ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

An air dispersion assessment was carried out to evaluate the potential impact of the Project's emissions on the surrounding area (see Appendix 8-1 for the modeling report). The modeling conducted for the study included the expected contaminants associated with vehicular traffic. The study modeled 4 scenarios: 2025 (expected beginning of operations) with and without the Project, and 2040 (typical moment during the operation phase) with and without the Project.

When considering the worst-case segment modeled for the A8 (segment 3 at the level in the city of Nakuru), the results show that the emissions of the various air contaminants considered are about the same for the scenario with the Project and the scenario without it for both 2025 and 2040. The main differences are observed with the emission of total suspended particles for which a reduction of 0.5 $\mu g/m^3$ was obtained in 2025 and an increase of 0.7 $\mu g/m^3$ was obtained in 2040 for the scenario with the project versus without the project.

As for the A8 South, when considering the worst-case segment modeled (segment 5 midway between Rironi and Mai Mahiu), the results show a significant decrease in air contaminant emissions for the scenario with the Project comparatively to the scenario without it for both 2025 and 2040. This reduction can be associated with the expected decrease of traffic on the A8 South as a significant transfer of circulation is expected towards the A8. It is important to note that the dispersion model used for the assessment does not have the ability to consider the expected circulation improvements that the project should generate, and which should reduce emissions associated with congestion or poor road maintenance.

The maximum predicted modeled concentrations are above the standards considered, but existing ambient air contaminant concentrations are the main contributors to the concentrations and the results presented are conservative.

As for air dispersion potential, the model shows that receptors located 100 m and more from the highway are not expected to see a significant increase in air emissions as the concentration attributed to the road is greatly reduced (between 60% and 70% on the A8 and between 40% and 50% on the A8 South).

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes activities that may affect ambient air quality during the operation phase:

- motorized traffic on the highway, including light vehicles and heavy goods vehicles that will contribute to the release of various air contaminants;
- operation of mechanical equipment and machinery for routine maintenance that will contribute to the release of various air contaminants.

Based on the results of the modeling summarized above, the Project appears to have both positive and negative effects at the operation phase. Indeed, the Project's effects are **positive** when considering the modelized emission results for the traffic increase with those of the situation without the Project. This is particularly true for the A8 South but also for the A8 when adding the expected emission reduction associated with improvement to fluidity and road surface quality.

However, general operation and maintenance activities will have some **negative** effects on local air quality. Table 8-3 summarizes the pre-mitigation impacts assessment for those activities associated with operating and maintaining the new highways.

Table 8-3 Operation and Maintenance Activities Impact Assessment for Ambient Air Quality

Assessment of Pre-mitigation Impacts	Activities associated with operating and maintaining the new highways will only slightly alter local ambient air quality thus resulting in an overall low intensity. Impacts will occur during routine maintenance and therefore would be characterized as having a short-term duration. The impacts should mainly be felt at the LAA level, that is within the work site and in its immediate surroundings, thus resulting in an impact of minor magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographic Extent	☐ Limited (PDA)	☒ **Local (LAA)**	☐ Regional (RAA)
Duration	☒ **Short-term**	☐ Medium-term	☐ Long-term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

Although the effect of the following measures is expected to be limited, they would at least ensure the magnitude of the impact remains minor.

- Avoid leaving mechanical equipment, machinery, trucks, and vehicles idling unnecessarily at the work site;
- Ensure all vehicles, equipment and machinery are in good working order with a particular attention to motor combustion efficiency and antipollution systems.

DETERMINATION OF RESIDUAL IMPACTS

The implementation of the proposed mitigation measures recommended above will ensure that the Project's residual impacts of operation and maintenance activities on ambient air quality remain minor as they will help reduce further the intensity while the extent and duration remain the same (see Table 8-3). Adverse impacts on human health and the environment will therefore be minimized by minimizing air pollution from project activities as required by IFC PS3.

8.1.1.2 GHG EMISSIONS

GHG emissions will be impacted at the Pre-Construction, Construction and Operation phases. Information relating to the GHG emissions baseline conditions are presented in section 6.1.3 of the Environmental and Social Baseline chapter. The methodology for GHG emissions associated with the Project, including emission factors, can be found in section 5.4.1.3 based on GHG protocol included in Equator Principles and IPCC rules, in accordance with IFC Performance Standard 3 which refers to IPCC methodologies. IFC EHS Guidelines do not refer to any GHG quantification methodology.

Available existing conditions for GHG emissions in Kenya are based on 2018 data obtained from Climate Watch. This information shows that transport activities represented 33% of the energy related GHG emissions and 13% of Kenya's overall GHG emissions. Total Kenyan GHG emissions in 2018 were 71,21 Mt CO_2e and 9,29 Mt CO_2e and were associated with transport activities.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes multiple Pre-Construction and Construction phases activities that may affect GHG emissions:

- The implementation of temporary construction facilities, site preparation, use of borrow pits and quarries, structural work as well as base layer and pavement work will require the operation of mechanical equipment and machinery that will contribute to the emission of GHGs;
- The manufacturing of cement used in concrete for structural work will contribute to the emission of GHGs;
- The transportation and circulation (of materials, equipment and workers) will also contribute to the emission of GHGs;
- The consumption of electricity during construction phase.

Direct emissions associated with the project activities include the gas oil used for all construction activities, including the production of concrete, bituminous mixture and crushed gravel. The total direct GHG emissions calculated for construction activities are 200 kT CO_2e for the whole 3.5 years of estimated construction time that is approximately 57 kT CO_2e per year as shown in table 8-4.

Table 8-4 GHG emission from gas oil used for all construction activities

Type of Vehicles	Unit	Quantity (L)	Emission Factor (g/L)			GHG Emission (tons)			
			CO2	CH4	N2O	CO2	CH4	N2O	CO2e
GASOIL Heavy trucks	L	27 687 760,00	2 837	0,149	0,149	78 558	4,135	4,135	79 770
GASOIL Trucks	L	21 656 130,00	2 837	0,149	0,149	61 445	3,234	3,234	62 392
GASOIL Light trucks	L	3 654 010,00	2 837	0,149	0,149	10 367	0,546	0,546	10 527
GASOIL Generators	L	5 646 810,00	2 837	0,115	0,023	16 022	0,649	0,130	16 074
GASOIL Heating	L	10 887 720,00	2 837	0,115	0,023	30 892	1,251	0,250	30 993
					Total	197 284	9,814	8,294	199 756

The indirect emissions associated with the Project come from the production of cement used for the concrete (scope 3). The estimated quantity of cement for the construction is 286 500 tons of cement. The emission factor is given in section 5 in the GHG methodology (0,507 tons of CO_2 by ton of clinker). Cement is composed at 85 % of clinker[1]. A factor of 0.85 is applied to GHG calculation. Therefore, the GHG indirect emission from cement is equal to 123 kT CO2 (286 500 tons of cement x 0,507 tons of CO2 by ton of clinker x 0,85 / 1000) for the whole 3.5 years of estimated construction time that is approximately 35 kT CO2e per year.

Direct and indirect emissions associated with the Project amount to approximately 92 kT CO_2e per year and will be emitted for 3.5 years. This represents approximately 0.13% of the total Kenyan emissions per year in 2018 and 1% of the country's emissions associated with transport-related activities.

The GHG emissions from electricity (scope 2) are calculated using the emission factor from section 5.4.1.3: 294 g CO_2/kWh. The estimated electrical consumption for construction is 1.2 GWh for 3.5 years. Therefore, the GHG emission from electricity is 352,8 T CO_2e for 3.5 years (100.8 T CO_2e per year).

[1] Web reference: https://civiltoday.com/civil-engineering-materials/cement/109-difference-between-clinker-and-cement

Refer to Table 5-2 for complete list of GHG emissions considered as per types of Scopes (1 to 3) for Construction phase.

Table 8-5 summarizes the anticipated impacts and presents the impact assessment for GHG emissions.

Table 8-5 Pre-Construction and Construction Phases Impact Assessment for GHG Emissions

Assessment of Pre-mitigation Impact	Considering the Project's very small GHG emissions compared to the country's total or transport-related yearly emissions, the intensity of the impact is considered low. The GHG emissions will mostly be emitted in the local area at the work sites or ancillary sites. The impacts will occur during the Pre-Construction and Construction phases (medium-term). The resulting magnitude of impacts is thus minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☒ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

Standard and specific mitigation measures applicable for GHG are included in those proposed for the Pre-Construction and Construction phases for ambient air quality. Although their effect is expected to be limited, they would at least ensure the magnitude of the impact remains minor.

In addition, to have a perceptible effect on GHG emissions, the following mitigation opportunities should be considered by the Project proponents:

- Implement an Eco-driving attitude program that will help better manage heavy equipment and fuel consumption;
- When practically possible, use alternative technologies, energy sources and materials.

DETERMINATION OF RESIDUAL IMPACTS

The implementation of the proposed mitigation measures recommended above will ensure that the Project's residual impacts on GHG emissions remain minor as they will help reduce further the intensity while the extent and duration remain the same (see Table 8-3). The proposed mitigation measures therefore allow to reduce project-related GHG emissions as required by IFC PS3.

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes the following activities that may affect GHG emissions during the operation phase:

- motorized traffic on the highway, including light vehicles and heavy goods vehicles that will contribute to the emission of GHGs.
- operation of mechanical equipment and machinery for routine maintenance and rehabilitation activities that will contribute to GHG emissions.
- The consumption of electricity (maintenance buildings and traffic lights).

Refer to Table 5-2 for complete list of GHG emissions considered as per types of Scopes (1 to 3) for Operation phase.

Table 8-6 presents the results of the modeling for GHG emissions associated with motorized traffic on the A8 and A8 South highways. The modeling was conducted for years 2025 and 2040, "with Project" and "without Project."

Table 8-6 Annual GHG emissions for the A8 and A8 South highways

Scenarios	A8	A8 South	Total
		kT CO_2e	
2025 without project	86	29	115
2025 with project	94	9	103
2040 without project	123	43	166
2040 with project	138	11	149

Globally, the results show a reduction of GHG emissions when comparing the scenarios "with Project" to the scenarios "without Project" for 2025 and 2040. The reductions anticipated compared to the *status quo* are of about 10% for 2025 and 2040. The increase in emissions on the A8 highway for the scenarios "with Project" can be attributed to the redirection of traffic from the A8 South.

The main sources of GHG emissions during the Operation phase are the consumption of diesel by the O&M fleet and the electricity needed to run the O&M center. The GHG emissions associated with the O&M fleet are estimated at 1095 T CO_2e/year for a consumption of 380 000 L of diesel and the ones associated with electricity at 265 T CO_2e/year. The total estimated GHG emissions associated with O&M activities are of 1359 T CO_2e/year as demonstrated in Table 8-7.

Table 8-7 Annual GHG emissions for operation phase

Type of Combustible	Unit	Quantity	Emission Factor (g/L or g/kWh)				GHG Emissions (tons)			
			CO2	CH4	N2O	CO2e	CO2	CH4	N2O	CO2e
Diesel	L	380 000	2 837	0,149	0,149	2 881	1 078	0,06	0,06	1 095
Electricity	kWh	900 000	-	-	-	294	-	-	-	265
									Total	1 359

These emissions are negligible and will be neutralized by the reductions associated with motorized traffic on the highways. Indeed, these emissions represent only 8% of the expected emissions reduction with the project in 2040.

Thus, overall, the Project's impact will have a positive effect on GHG emissions within its road segments. It therefore allows to reduce GHG emissions as required by IFC PS3.

8.1.2 AMBIENT NOISE

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

As mentioned in section 6.1.4, the baseline data collected along the highways (A8 and A8 South) in 2021 cannot be considered as "normal existing conditions" because of the COVID-19 pandemic situation. The survey results were thus used to calibrate the model which was run to determine ambient noise levels along the highways in 2025 that is "year 0," the year prior to start of operation. The effective data used to feed the model were 2017 traffic data (pre-pandemic data) which were actualized to proposed baseline Year 0 set to 2025.

Expected noise levels at highway limits in 2025 ranged between 45 and 70 dBA with most measurements above 55 dBA (IFC criteria for daytime in residential, institutional and educational areas) that is for 35 out of 41 measurements. There are even three measurements showing levels equivalent and above the daytime criteria for industrial and commercial areas.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction phase activities that may affect ambient noise:

- Movement and operation of heavy vehicles and machinery used to implement temporary construction facilities, for site preparation and other construction work requirements;
- Operation of borrow pits and quarries (extraction sites);
- Construction of structural work including bridges, culverts, interchanges, underpasses, foot over-bridges, over passes, viaducts, underpasses and flyover sections.

Table 8-8 summarizes the anticipated impacts and presents the impact assessment for noise.

Table 8-8 Impact Assessment for Ambient Noise

Assessment of Pre-mitigation Impact	Considering that noise levels are already exceeding IFC criteria for the most part of the existing highway because of existing traffic movements, any additional noise sources will result in an impact of high intensity. The noise from the pre-construction and construction works should only be perceptible locally around the highway and extraction sites. Construction noise sources will not be felt for the entire duration of the construction period as they will be constantly moving as construction progresses along the highway. The same for extraction sites which will be in full operation at early stages of construction to supply required granular material but will gradually switch to intermittent activities as the base layer is set and required volumes are made available. Thus, duration of impact is considered short-term. The expected impact magnitude will thus be moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Maintain equipment and machinery including brakes, mufflers, catalyzers and silencers in good running condition, clean (power washed), free of leaks, excess oil and grease;
- Prohibit idling of vehicles on site or near sensitive receptors. Generators and machinery should be shut down when not in use;
- Inform drivers to limit speed in sensitive areas and to limit noise from the rear panel of dumpster truck;
- Drivers should be sensitized on noise reduction measures through an Eco-driving attitude program;
- Equip the compressors and generators used on site with an acoustic enclosure, a noise barrier or placing them in a soundproof box. This is particularly important for such equipment that requires round-the-clock operation in areas with sensitive receptors;
- If blasting is required at quarry sites, ensure noise and vibration mapping has been realised, limit load of explosives accordingly and advise local population in advance to prevent nuisances.

SPECIFIC MEASURES

At this stage of the project, it is difficult to estimate the noise levels that will be perceived in the vicinity of the construction work sites. Indeed, these can vary according to several factors, including the distance between noisy equipment and sensitive areas, the duration of noise emissions, the type and amount of equipment operating simultaneously, etc. In addition, details of the construction methods or equipment and machinery that will be used during the work are not yet known specifically.

Nevertheless, it will be important to respect the noise levels set in the noise permit to be obtained from NEMA when working in the vicinity of sensitive areas including residential, institutional and/or educational components.

Other specific measures include:

- Installation of temporary noise barriers where necessary to meet targets above;
- Implement a regular noise survey program to document, on a regular basis, noise levels on the various work sites;
- If ambient noise-related grievances are received, develop and conduct a specific noise monitoring program to verify existing problems and evaluate additional actions required.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on ambient noise are assessed in Table 8-9.

Table 8-9 Determination of the Project's Residual Impacts on Ambient Noise

Assessment and Justification of Residual Impacts	Considering the implementation of the proposed mitigation measures, the intensity of the residual impact will be medium. As for the extent and duration, they will both remain the same that is respectively local and short-term. The magnitude of the residual impact thus remains moderate. The proposed mitigation measures will allow to minimize adverse impacts on human health and the environment by minimizing noise from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Low	☒ **Moderate**	☐ Major

OPERATION PHASE

A8 SOUTH HIGHWAY

Traffic counts for the A8 South Highway showed a significant decrease in traffic for the year 2040 for the scenario "with project" (4000 vehicles/day) in comparison to the scenario "without project (17 200 vehicles/day) as a large portion of the current traffic is expected to transfer onto the A8 Highway because of the following reasons among others:

- Transfer of most of the truck traffic from the A8 South to the A8;
- Increased capacity on the A8 (four to six lanes);
- Better fluidity on the A8 through improved capacity to overpass slower vehicles (climbing lanes);
- Higher and more constant speed limits.

Taking this into consideration, expectations were that an overall noise reduction could be predicted for the A8 South. Indeed, modelling of ambient noise at the virtual station S2 (located in the Mai Mahiu area, see Map 5-3) for both scenarios show noise levels of 61 dBA without the project and 53.6 dBA with the project. The Project is therefore expected to generate an overall positive impact for the entire A8 South Highway.

A8 HIGHWAY

Before initiating the impact assessment for the operation phase of the A8 Highway, it is important to remind the reader that the vast majority of initial "Year 0" (2025) simulated noise levels at the limit of the Highway already exceeds the IFC daytime standard of 55 dBA by at least 2 to 3 dBA. Because of these results, it was decided not to simply compare modelled noise results of "Year 0" with those of the scenario "with project" of year 2040 (operation phase) since:

- it is evident that exceedance of IFC criteria would be registered, and;
- it would not really show the specific effect of the project but the combination of the effects of traffic increase deemed to occur even without the project and the effect of the traffic increase that could be associated with the new infrastructure.

Therefore, the selected approach to evaluate the project impacts at operation phase was based on a comparison of modelled noise levels in 2040 at 48 virtual stations along the A8 Highway (9 of which were dedicated to the Nakuru crossing segment (CH 123+570 to 128+200) for the scenarios "without project" and "with project". This was done to limit the effects of the natural traffic increases and isolate the effects of the project.

To achieve this, noise-level results at each simulation station for the scenario "without project" were compared to those obtained for the scenario "with project". The difference between the two was the effective increase in noise levels caused by the project. Any resulting increase exceeding 3dBA (increase limit accepted by IFC before interventions are required) was considered to require an intervention to reduce noise level increase. These interventions will be directed at areas where sensitive receptors are present (residential, institutional or educational). The following table summarises the results of the modelling and Map 5-4 shows the location of the main evaluation stations.

Table 8-10 Results of Ambient Noise Modelling for both Scenarios "without the project" and "with the project" for the year 2040 (operation phase)

Highway Section	Evaluation Station	Chainages		Modelled Noise Levels (L_{eq24h}) per Scenario		Difference between Scenarios	Noise level increase above 3 dBA (Project's Impact)
		Start	End	Without Project	With Project		
Section 1	R1	0+000	1+000	53.6	61,2	8	+5
	S1	1+000	6+275	70.7	74,0	3	None
	R2	6+275	9+342	73.3	72.6	-1	Positive
	R3	9+342	12+050	71.9	71,7	0	None
	R4	12+050	30+485	69.5	71,3	2	None
	R5	30+485	32+400	71.1	74.4	3	None
	R6	32+400	33+703	67.7	68,8	1	None
	R7	33+703	47+400	64.0	68,0	4	+1
	S3	47+400	59+377	68.2	70,5	2	None
Section 2	R8	59+377	80+675	73.9	74,6	1	None
	R9	80+675	83+903	55.1	55.9	1	None
	S4	83+903	87+075	76	77.8	2	None
	R10	87+075	88+412	48.9	50.7	2	None

Highway Section	Evaluation Station	Chainages		Modelled Noise Levels (L_{eq24h}) per Scenario		Difference between Scenarios	Noise level increase above 3 dBA (Project's Impact)
		Start	End	Without Project	With Project		
	R11	88+412	90+225	74.3	76	2	None
	R12	90+225	95+979	67.4	67.1	0	None
	S5	95+979	109+575	64.5	67.1	3	None
	R13	109+575	110+044	68.9	70.1	1	None
	R14	110+044	114+348	60.1	61,1	1	None
Section 3	R15	114+348	114+351	63	63.1	0	None
	R16	114+351	114+789	54.9	57.1	2	None
	R17	114+789	115+064	59.9	59.6	0	None
	R18	115+064	116+201	61	63.8	3	None
	R19	116+201	116+648	52.6	53.8	1	None
	S6	116+648	123+000	62	65.3	3	None
	S7a	123+000	123+850	70.9	74.7	4	+1
	S7b	123+850	124+350	74	75.3	1	None
	S7c	124+350	125+000	77.2	77.4	0	None
	S7d	125+000	125+450	74.3	76.6	2	None
	S7	125+450	125+950	70.1	71.4	1	None
	S7e	125+950	126+250	71	73.8	3	None
	S7f	126+250	126+600	70	70.7	1	None
	S8	126+600	127+500	68.5	70.1	2	None
	S7g	127+500	128+200	69.2	67.9	-1	Positive
	S7h	128+200	130+000	64.1	64.5	0	None
Section 4	R20	130+000	130+100	68.5	70.2	2	None
	R21	130+100	131+796	67.7	73,5	6	+3
	R22	131+796	132+274	66.1	64.9	-1	Positive
	R23	132+274	135+550	66.9	71,6	5	+2
	R24	135+550	139+500	68.8	70.9	2	None
	S9	139+500	142+450	67.9	74,0	6	+3
	R25	142+450	144+309	66.6	69.8	3	None
	R26	144+309	145+199	63.5	65,5	2	None
	R27	145+199	157+340	60.9	63,3	2	None
	R28	157+340	160+000	69.2	69.7	1	None
	R29	160+000	160+249	70.5	73.6	3	None
	R30	160+249	163+614	69.2	68.9	0	None
	S10	163+614	174+900	71,6	71,1	-1	Positive
	R31	163+614	174+900	68,2	69,9	2	None

The results for the evaluation stations of Sector 3 (S7 to S7f) corresponding to the Nakuru Crossing (from the railway crossing area to roundabout 3) consider that retaining wall on both sides of the proposed crossing structures include the use of porous concrete to reduce noise reflection. A specific mitigation measure as been propose below in relation to this requirement. Note that for the ramp giving access to the first viaduct (south of Nakuru) the use of porous concrete is only required on the northeast side because of the presence of the Lenana Primary School. This is not required at the level of roundabout 4 as the buildings on both sides are sufficiently distant from the highway and that there are no service lanes in this area.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impact is associated with the use of the Highway. Routine maintenance work could also generate increased noise levels temporarily and in limited areas of the Highway (including for A8 South Highway). The impact analysis will essentially be considering the use of the Highway although mitigation measures will be proposed to help and reduce potential noise increases associated with sporadic routine maintenance work.

For the assessment of impacts associated with the use of the Highway, based on Table 8-10 results, when a reduction was to be expected for the "with project" scenario the impact was considered positive (station R2, S7f, S8, R22 and S10). Variation in increase levels were associated with the impact's intensity as follows:

- a low intensity impact when there was no increase above 3 dBA for the scenario "with project" in comparison to "without project";
- a Medium intensity impact when the results show an increase of 4 dBA for the scenario "with project" in comparison to "without project";
- a High intensity when the results show an increase of 5 dBA and more for the scenario "with project" in comparison to "without project".

Table 8-11 summarizes the anticipated impacts and presents the impact assessment for ambient noise.

Table 8-11 Impact Assessment for Ambient Noise

Assessment of Pre-mitigation Impact	Considering the above results, impact intensity will vary according to stations: – low for stations S1, S3 to S7, S7b to S7f, S7h, S8, S10, R2 to R6, R8 to R20, R22, R24 to R31; – medium for station R7 and S7a; – high for stations R1, R21, R23 and S9. The impact extent is considered to be local for all stations as it will exceed the immediate limits of the Highway's right-of-way. Duration will be long-term at all stations considering that expected noise levels will occur as long as the Highway is in operation. Resulting impact magnitude will be moderate for all stations with a low and medium impact intensity and major for all stations with a high impact intensity.		
Direction	☒ **Positive (for A8 South and some segments of A8)**	☒ **Negative (for A8)**	
Intensity	☒ **Low**	☒ **Medium**	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

ASSOCIATED WITH ROUTINE MAINTENANCE WORK

- Maintain equipment and machinery including brakes, mufflers, catalyzers and silencers in good running condition, clean (power washed), free of leaks, excess oil and grease;
- Prohibit idling of vehicles on site or near sensitive receptors. Generators and machinery should be shut down when not in use;
- Drivers should be sensitized on noise reduction measures through an Eco-driving attitude program.

SPECIFIC MEASURES

ASSOCIATED WITH THE PRESENCE AND USE OF THE HIGHWAY

- For all stations identified with a Low and Medium impact intensity and resulting in a moderate impact magnitude (see above), no specific noise reduction measure is recommended. This is because the current model does not take into consideration the potential noise reduction effect of having a smoother road surface which should induce some noise level improvements. However, it is recommended that a noise survey campaign be conducted in these areas at least twice a year for the first two years of operation to confirm that effective noise levels do not increase more than 3 dBA in comparison with the ”without project” modeled scenario. After two years, the frequency could be revaluated based on the survey results.
- For all stations identified with a high impact intensity resulting in a Major impact magnitude (see above), it is recommended, when relocation cannot be considered or additional speed reduction is insufficient to bring noise levels down to acceptable levels, to implement noise barriers in the specific areas where concentration of sensitive receptors are found adjacent to the Highway’s right-of-way.
- Use techniques minimising noise reflection (i.e. porous concrete or other) for the construction of the retaining walls on both sides of the various structures that will be constructed for the Nakuru crossing between CH 123+570 (ramp to access first viaduct) and CH 126+600 (ramp north of third roundabout) and thus maintain noise at an acceptable level such as presented in Table 8-10 (stations S7 to S7f). For the first ramp starting at CH 123+570, the application of such techniques is only required on its northeastern side because of the presence of the Lenana Primary School.
- If ambient noise-related grievances are received for a section of the Highway where no noise reduction measures have been implemented, develop and conduct a specific noise monitoring program to verify existing problems and evaluate additional actions required.

ASSOCIATED WITH ROUTINE MAINTENANCE WORK

- Respect the noise levels set in the noise permit to be obtained from NEMA when working in the vicinity of sensitive areas including residential, institutional and/or educational components;
- If ambient noise-related grievances are received, develop and conduct a specific noise monitoring program to verify existing problems and evaluate additional actions required.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project’s residual impacts on noise and vibrations are assessed in Table 8-12.

Table 8-12 Determination of the Project's Residual Impacts on Ambient Noise

Assessment and Justification of Residual Impacts	Considering the proposed mitigation measures, impact intensity will become: – low for stations S1, S3 to S7, S7a to S7e, S7g, S7h, S8, S10, R2 to R20, R22, R24 to R31; – medium for stations R1, R21, R23 and S9. The impact extent and duration remain unchanged with respective local and long-term effects. Resulting impact residual magnitude should be moderate for all stations. The proposed mitigation measures will allow to minimize adverse impacts on human health and the environment by minimizing noise from project activities as required by IFC PS3.		
Direction	☒ **Positive (for A8 South and some segments of A8)**	☒ **Negative (for A8)**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Low	☒ **Moderate**	☐ Major

8.1.3 WATER RESOURCES

Assessment of water resources considers four VECs, hydrology, surface water quality, groundwater quality and groundwater quantity.

8.1.3.1 HYDROLOGY

Hydrology will be impacted at the Pre-Construction, Construction and Operation phases. Information relating to the hydrology baseline conditions are presented in section 6.1.5.1 of the Environmental and Social Baseline chapter.

The Project is located entirely within the rift valley basin area, specifically within the sub-catchment areas of lakes Naivasha, Elmentaita and Nakuru. These lakes have national protection status and, for Elmentaita and Nakuru, are also recognized as World heritage Sites. The Project is located approximately 900 to 1 km (A8) away from the Elmentaita lake, 1km (A8 South) to 2.5 km (A8) from Naivasha lake and over 2 km away from Nakuru lake. Lake Bogoria is located 53 km to the North of the Project alignment and has no hydrological connection with watercourses crossed by the project.

The Project crosses most of the watercourses flowing into lake Naivasha from the east and north-east including the Malewa and Gilgil rivers. It also crosses two of the water courses flowing into Lake Elmentaita (Mbaruk and Mereroni). The Project does not intersect Lake Nakuru or the main river feeding into the lake (Njoro). Finally, the project intercepts various tributaries of the Molo River which forms part of the Lake Baringo basin, this Lake is located 83 km to the north of the Project's right-of-way.

As described in section 4.4.14 on surface water management, there are known cases of localised flooding presumably associated with the presence of the existing highway. Part of the problem seems to be related with inefficient drainage systems including inexistent or blocked ditches and undersized culverts.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction phases activities that may affect hydrology:

- The earthworks associated with the implementation of temporary construction facilities and site preparation activities may result in the deposition of materials in watercourses, possibly obstructing them or affecting the water flow. These works may also modify existing surface water run-off patterns;
- The replacement or implementation of new drainage and stormwater management installations may cause the temporary obstruction or encroachment of watercourses.

Table 8-13 summarizes the anticipated impacts and presents the impact assessment for hydrology.

Table 8-13 Impact Assessment for Hydrology

Assessment of Pre-mitigation Impact	Considering the existing hydrological issues in the vicinity of the Project, the sensitivities of some of the watercourses it crosses and the presence of the lakes which have protection status, the intensity of the impact is considered high. It is anticipated that impacts of watercourse obstruction may be felt up to a local extent (LAA). Impacts will occur during specific work and therefore would be characterized as having a short-term duration. Consequently, the magnitude of the impact is considered moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Low	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Define vehicle and machinery movement routes within the work site and ensure they are respected to limit the creation of ruts;
- Where possible, run-off water from the work area and adjacent lands should be captured through ditches and redirected appropriately;
- As much as possible, conduct work that may impact local hydrology during the dry seasons (from January to February and from June to September) to minimize the risks associated with watercourse obstruction or encroachment;
- Ensure adequate water flow during work by diverting flood prone watercourses for the duration of the work if it needs to be done during rain seasons (from March to May and from October to December);
- Except where specifically required (i.e. for bridge construction), avoid storage of granular or any other material within, on the shore of or near (less than 30 m) a water course to limit the risks of such material impeding water flow.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on hydrology are assessed in Table 8-14.

Table 8-14 Determination of the Project's Residual Impacts on Hydrology

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures has the capacity to reduce inadequate water flows within the Project boundaries. The intensity of the residual impact is thus considered medium. Moreover, the mitigation measures should also result in more localized impacts restricted to the PDA. Impacts will still occur during specific work and therefore would be characterized as having a short-term duration. The resulting magnitude of impacts becomes minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impacts that may affect hydrology at operation phase includes:

- The presence of the new highway which should have:
  - On one side, a positive effect on surface water management since overall water management was revised in the Project's design to ensure:
    - efficient capture and redirection of stormwater flowing from the highway toward existing water courses or municipal storm sewers;
    - adequate sizing of culverts to minimise risk of upstream flooding during rain season. Many current culverts were found to be inefficient and their design was revised based on completed hydraulic studies.
  - On the other side, a negative effect as the dualling of the A8 Highway will increase the total catchment area thus increasing the volume of stormwater directed into side ditches and eventually reaching local watercourses.
- Operation and routine maintenance activities which include culverts and drainage network cleaning which should ensure high-level water management over the whole Operation phase.

Overall, the Project is expected to have **a positive impact** on current local hydrology as it will improve management of water flowing through the highways' right-of-way or coming from the highways. During operation of the new highways, known flooding areas associated with existing highways will be surveyed to confirm that adjustments made have solved the problem including with the additional stormwater inflow from the new A8 highway. In addition, the regular maintenance planned within the day-to-day operation and management of the highway will also be beneficial as it will ensure proper functioning of the drainage network and infrastructure.

The negative impacts magnitude analysis for this VEC are summarized in Table 8-15.

Table 8-15 Impact Assessment of Routine Maintenance Activities for Hydrology

Assessment of Pre-mitigation Impact	Considering that the design of the new Highway includes the revision of all water crossing structures to ensure sufficient water transparency, and that routine maintenance includes regular cleaning of these structures, the intensity of the impacts is considered low. Perturbations caused by these activities would be felt locally while duration would be short-term as it would occur only for a limited period of the operation phase. The resulting magnitude of impacts is minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

— Conduct regular inspection and cleaning of culverts to remove encumbrances and maintain the efficiency of the drainage system.

SPECIFIC MEASURES

— Verify efficiency of water management upgrades at the flood-prone areas identified during the public consultation rounds.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on hydrology are **positive** for the presence of the highway and the routine maintenance activities. As for the routine maintenance activities, residual impact assessment is summarized in Table 8-16.

Table 8-16 Determination of the Project's Routine Maintenance Activities Residual Impacts on Hydrology

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures will ensure that the intensity of the operation impacts remains low. Any remaining perturbation would be felt locally while duration would be short-term as it would occur only for a limited period of the operation phase. The resulting magnitude of impacts remains minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Medium	☐ Major

8.1.3.2 SURFACE WATER QUALITY

Surface water quality will be impacted at the Pre-Construction, Construction and Operation phases. Information relating to the surface water quality baseline conditions are presented in section 6.1.5.2 of the Environmental and Social Baseline chapter. Information on baseline conditions for hydrography is also relevant to surface water quality and are presented in section 6.1.5.1 of the Environmental and Social Baseline chapter. A summary is presented hereafter.

When considering hydrography, the Project is located largely within the rift valley basin area, specifically within the sub-catchment areas of lakes Naivasha, Elmentaita and Nakuru. These lakes have national protection status and, for Elmentaita and Nakuru, are also recognized as World heritage Sites. The Project is located approximately 900 to 1 km (A8) away from the Elmentaita lake, 1km (A8 South) to 2.5 km (A8) from Naivasha lake and over 2 km away from Nakuru lake. Lake Bogoria is also part of the Kenya Lake System in the Great Rift Valley World Heritage Site. However, there is no hydrological connection between this Lake and the watercourses crossed by the project. No effects of the project are anticipated on Lake Bogoria. The Project crosses most of the watercourses flowing into lake Naivasha from the east and north-east including the Malewa and Gilgil rivers. Another important component of the Lake Naivasha catchment area is Manguo swamp which is located along the Project in Limuru area and is interconnected with the Lake Naivasha basin through ground water. The A8 Highway crosses two of the water courses flowing into Lake Elmentaita (Mbaruk and Mereroni). The Project does not intersect Lake Nakuru or the main river feeding into the lake (Nioro River).

Existing surface water quality baseline conditions data and data resulting from surveys conducted specifically for this ESIA was analyzed against appropriate guidelines. The IFC EHS Guidelines requires respect of locally applicable criteria or, in their absence, other sources of ambient water quality criteria. Given that no Kenyan criteria exist for ambient water, the standards considered for the assessment of surface water quality (Table 6-19) are those from the Australian and New Zealand Environment and Conservation Council (ANZECC) – Trigger values for freshwater (2013) and the Canadian Council of Ministers of the Environment (CCME) – Freshwater criteria (2021). Although not typically applicable for freshwater data, the Kenya Bureau of Standards (KEBS) - Natural potable water limit (2018). Refer to section 6.2.5.3.

Existing data for the Mereronai River and the Malewa River shows that the parameters are all within criteria and limits used for comparison except for nitrate in Malewa River and turbidity in Mereronai River. Similarly, the lakes Elmentaita, Naivasha and Nakuru all have values recorded above criteria for turbidity as well as total dissolved solids and conductivity for lakes Elmentaita and Nakuru. This data reflects the great presence of sediments and dissolved matter in surface water at the regional level. The three lakes also exhibit concentrations above water reference criteria for either nitrate, s-chloride and/or iron.

As for the results of the surveys conducted for the ESIA, the Malewa River shows parameters exceeding criteria and limits for colour, turbidity, coliforms, aluminium and iron during the rainy season. It exceeds the same parameters during the dry season, but also phenols, nitrate, fluoride and zinc. The Mereronai River shows parameters exceeding criteria and limits for colour, turbidity, nitrate, coliforms, fluoride, aluminium, iron and nickel during the rainy season. It exceeds the same parameters during the dry season except for coliforms and nickel, but also exceeds limits for dissolved oxygen and phenols. The other watercourses sampled also shows similar exceedances.

It is to be noted that criteria for colour, turbidity and coliforms are based on Kenya Bureau of Standards (KEBS) Natural potable water limit although not being the most appropriate reference in the context. Indeed, a low turbidity level criterion for potable water is not necessarily comparable to freshwater criteria designed to assess natural habitats. Nevertheless, KEBS limit values bring an appreciation of relative water quality of watercourses surveyed for parameters where no criteria are provided by the other authorities used as reference.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction phases activities that may directly affect surface water quality:

- The removal of existing vegetation may encourage soil run-off to watercourses, thus affecting the surface water quality;
- Heavy vehicle, equipment, and machinery traffic on the work sites may disturb surface soils that could be carried by surface water run-off to watercourses, contributing to the modification of surface water quality;
- Temporary stockpiling of granular material or soil may result in increased suspended solids in nearby surface water as part of this material may be carried to watercourses by run-off during rainy periods;
- Work conducted in watercourses for installation of culverts or other infrastructure may encourage soil run-off to watercourses and the resuspension of sediments, thus affecting the surface water quality;
- The cleaning of concrete trucks at work sites may cause the release of contaminants that can be carried by surface water run-off to watercourses;
- Wastewater generated by the concrete mixing plant may cause the degradation of surface water quality;
- Accidental spills or leaks of contaminants potentially directly or indirectly (carried by surface water run-off) reaching surface water, resulting from:
  - improper installation of fuel distribution and storage sites;
  - improper installation of storage sites for hazardous products and waste, including storage of cement powder bags;
  - inadequate maintenance of trucks, vehicles, machinery, and motorized equipment;
  - inappropriate fuelling practices and location for vehicles, machinery and other motorized equipment.

Overall, the pre-construction and construction activities could essentially affect water quality through the introduction of suspended particles and some chemical contaminants mainly petroleum based. As mentioned above, water quality in the watercourses crossed by the Project already exceeds parameters for suspended particles related to contamination. This being worse during dry season. No specific problem was detected in association with petroleum-based contaminants.

Taking into consideration these observations, Table 8-17 summarizes the anticipated impacts and presents the impact assessment for surface water quality.

Table 8-17 Impact Assessment for Surface Water Quality

Assessment of Pre-mitigation Impact	Considering the number of pre-construction and construction activities that can affect surface water quality, the sensitivity of many watercourses and wetlands along the Project (namely those reaching Naivasha and Elmentaita Lakes that have protection status) and the fact that surface water quality in the project area already shows exceedance of numerous parameters, the intensity of the impact is considered high. Since contaminants reaching watercourses will be transported by them, the extent of the impact is regional. Generated impacts could be felt during the full construction period (30 months) and therefore would be characterized as having a medium-term duration. Consequently, the magnitude of the impact is major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Low	☐ Medium	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure vehicles, equipment and machinery are in good working order to minimize leak of contaminants;
- Remove existing vegetation as late as possible and revegetate as soon as possible to avoid leaving soils bare for longer than necessary to limit transport of fines in water runoff. This is particularly true on the shores of watercourses crossed by the Project;
- Install terrestrial silt screens, where practically possible, between work areas and water's edge to limit transport of fines in water runoff;
- Keep terrestrial and aquatic spill kits at the work site to accelerate intervention to confine and recuperate any occurring accidental spills or leaks;
- Ensure the development of a strong Environmental Management Plan, including but not limited to, strong measures to improve efficiency in the use of water, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations:
  - Hazardous waste and hazardous material (including cement powder bags) storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release;
  - Store all waste in distinct closed containers to allow for some segregation (recyclables and waste) and adequate confinement;
  - The fuel trucks that will ensure fuelling of machinery at the work sites should carry a spill kit. Except for fixed water works equipment that cannot be moved, all machinery should be moved away from water side before fuelling (at least 30 m). All fuel storage tanks should be equipped with adequate and required confinement capacity;
  - Ensure some of the personnel trained are available to intervene in the event of accidental spills or leaks;
  - Contacts of firms (names and phone numbers) specialized in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone;
  - Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterization prior to use is recommended;

- After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly stored on site in appropriate containers and regularly disposed off-site by certified companies.

SPECIFIC MEASURES

- Use adequate wastewater capture and/or treatment installations for wastewater from concrete production and surface waters from quarries in order to respect selected applicable criteria for release in the environment;
- Ensure dedicating a specific area for the cleaning of concrete trucks. Capture the resulting wastewater and proceed to adequate treatment or disposal;
- Ensure a particularly stringent application of the above standard measures when working at the level of the following surface water components:
  - Manguo Swamp (CH 3+00 to 4+00), located on the east side of the right-of-way;
  - Water courses flowing towards Naivasha lake including Malewa and Gilgil rivers (A8 Highway: approximate CH 42+800 to 43+000, 43+850 to 43+950, 59+650 to 59+750, 64+600 to 64+700 and 76+100 to 76+300; A8 South approximate CH: 47+050 to 47+250);
  - Water courses flowing towards Elmentaita lake including Mereroni and Mbaruk rivers (A8 Highway approximate CH 90+000 to 91+000, 92+250 to 92+450, 95+600 to +850, 99+550 to 99+700, 104+400 to 104+600 and 106+200 to 106+350);
  - Water courses forming the head of the Molo river basin flowing toward lake Baringo (A8 Highway approximate CH 148+800 to 148+900, 149+750 to 149+850, 153+750 to 153+850, 159+050 to 159+125, 169+500 to 169+600, 171+825 to 171+950 and 174+350 to 174+450).
- Develop and conduct a regular surface water quality monitoring program covering all work sites located near high sensitivity sites or hydrologically connected to such sites, such as locations listed in the previous bullets, to verify existing problems and evaluate action requirements;
- Develop and conduct a surface water quality monitoring program to verify existing problems and evaluate action requirements at any other location along the RoW, if surface water contamination-related grievances are received.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on surface water quality are assessed in Table 8-18.

Table 8-18 Determination of the Project's Residual Impacts on Surface Water Quality

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures has the capacity to reduce impacts resulting in the overall lowering of contaminants and soils transported to watercourses or wetlands. Adverse impacts on human health and the environment will therefore be minimized by minimizing surface water pollution from project activities as required by IFC PS3. The intensity of the residual impact is thus considered medium. However, residual impacts will still be felt at the regional scale and for the duration of the Project (medium-term duration). The resulting magnitude of impacts remains moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Low	☒ **Moderate**	☐ Major

OPERATION PHASE

The Project includes various water treatment infrastructures in critical areas where, for example, a permanent river or a wetland is crossed by the highway. Locations of treatment facilities are preliminary and final siting and design of the treatment ponds are upcoming, pending final hydrological study.

The main objective of these facilities is to capture potential contaminants originating from spill or leaks of vehicles using the highway and sediments transported by stormwater. The proposed infrastructures will include scrubbers and oil separators, flat ditches (30 m X 4 m) and retention basins. The type and location of treatment infrastructure are presented in Table 4-13 in chapter 4 (section 4.4.14).

Table 8-19 presents the location of important watercourses and wetlands relative to the Project and identifies the presence of water treatment infrastructure planned in the Project's design in proximity of those critical areas.

Table 8-19 Location of Important Watercourses and Wetlands and Presence of Water Treatment Infrastructure

Highway	Approximate Location (CH)	Watercourse Sampling Site ID	Watercourse Name	Presence of Water Treatment Infrastructure
A8 South	21+070	B3	River draining towards Lake Natron (Tanzania)	Yes
	47+150	B10	Lake Naivasha tributary	No
A8	3+500	N/A	Manguo Swamp	Yes
	42+820	1	Lake Naivasha tributary	Yes
	43+900	2	Lake Naivasha tributary	Yes
	59+700	3	Karate River	Yes
	64+720	4+	Malewa River	Yes
	76+200	5	Morendat River	Yes
	90+900	E5_NP	Lake Elmenteita tributary	Yes
	92+350	6	Lake Elmenteita tributary	Yes
	104+500	7	Mbaruk River	Yes
	106+320	8	Mereronai River	Yes
	148+850	M7_S	Molo River tributary	Yes
	149+730	9	Rongai River	Yes
	153+840	10	Molo River	Yes
	159+000	12	Molo River tributary	Yes
	169+550	13	Molo River tributary	Yes
	171+900	14	Molo River tributary (second level)	Yes
	174+400	15	Molo River tributary	Yes

The B3 watercourse is considered important as it is at the head of the Lake Natron watershed. The Manguo Swamp is a wetland of national interest and is earmarked by WRMA for gazettement due to its importance as a biodiversity hotspot and a major water source for domestic use in the nearby Limuru town. Watercourses 1, 3, 4+ and 5 are all tributaries to Lake Naivasha, and the Malewa River (4+) is of particular importance as it accounts for 80% of the flow to the lake. Watercourses with 6 and 8 are tributaries of Lake Elmentaita. Watercourses with 9, 10, 12, 13, 14 and 15, the Molo River and its tributaries, feed Lake Baringo. These surface water treatment infrastructures will be located in order to adequately prevent downstream impacts to sensitive sites and in particular Manguo pond, Lake Naivasha, Lake Elmenteita and Lake Baringo. No affluent of Lake Nakuru was located along the Project alignment.

Note that in addition to the installation of treatment facilities near these important watercourses, other such facilities are also foreseen at six (6) additional locations along the A8 highway, they are:

- Flat ditches at the following approximate locations: CH 61+ 000, 62+040, 62+720, 63+140 and 63+500, and;
- Treatment ponds at CH 87+870 (approximate).

The full list of the proposed water treatment facilities is presented in Chapter 4, Table 4-16.

Other locations were identified where presence of a watercourse reaching either of the valley lakes is uncertain. No water treatment facilities are currently planned in those locations, however in order to cover adequately sensitive sites, they will be the object of close monitoring during operation to determine whether they turn into a watercourses during heavy rains and reach sensitive sites. In the affirmative, additional water treatment facilities will be built. The associated approximate locations are at CH 38+900; 40+100; 98+100; and 100+800.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project activities that may affect surface water quality during the operation phase are linked with operation and routine maintenance activities, but also with the presence of the new infrastructure and use of the highway by motorized traffic. The main impacts include:

- accidental spills or leaks of contaminants potentially directly or indirectly (carried by surface water run-off) reaching surface water, resulting from:
  - accidents occurring on the highways;
  - inadequate maintenance of vehicles using the highway and of trucks, machinery, and other motorized equipment used during routine maintenance activities.
- temporary perturbation of the bottom and water quality of the watercourses during structures inspections (people walking in the waters) or during their cleaning (removal of material/wastes causing obstruction).

The presence of surface water treatment infrastructure already planned at various sensitive locations already reduces the potential effects of the identified impacts. However, not all sensitive areas are currently adequately covered by these infrastructures. Table 8-20 summarizes the anticipated impacts and presents the impact assessment for surface water quality.

Table 8-20 Impact Assessment for Surface Water Quality

Assessment of Pre-mitigation Impact	Considering that the Project is adding water treatment infrastructures where there is currently none which will greatly reduce the risk of any contamination from the highway reaching the watercourses, the intensity of the impacts is considered low. Although the watercourses and wetlands crossed by the project are tributaries to important lakes or have a regional importance, the water treatment facilities to be implemented should limit the extent of the impacts to the local area. The impacts will occur during the whole Operation phase (medium-term). As for the potential perturbations to water quality associated with inspection and cleaning of the water crossing infrastructures, the intensity of the impact is also considered to be low with a local extent. However, the duration will be short-term as the associated work will be very limited in time. The resulting magnitude of impacts is for both impacts minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure vehicles, equipment and machinery used for maintenance activities are in good working order to minimize leak of contaminants;
- Develop and implement an emergency preparedness and response plan in case of accidental pollution;
- Keep terrestrial and aquatic spill kits on road inspection vehicles to accelerate intervention in the event of a spill due to an accident;
- Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations:
  - Hazardous waste and hazardous material storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release;
  - Store all waste in distinct closed containers to allow for some segregation (recyclables and waste) and adequate confinement;
  - Ensure that some of the personnel trained are available to intervene in the event of accidental spills or leaks;
  - Contacts of firms (names and phone numbers) specialized in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone;
  - Ensure material used for maintenance comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterization prior to use is recommended.
- After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly disposed off-site by certified companies.

SPECIFIC MEASURES

- Monitor presence of run-off water reaching lakes Naivasha and Elmenteita, or effluents thereof. In the affirmative, implement additional water treatment facilities as required. Particular attention shall be given to the project section bordering Lake Elmenteita and surrounding of the following approximate locations: CH 38+900; 40+100; 98+100; and 100+800;
- Regularly verify and maintain as necessary the water treatment infrastructures listed in Table 4-13 and any additional one added.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on surface water quality are assessed in Table 8-21.

Table 8-21 Determination of the Project's Residual Impacts on Surface Water Quality

Assessment and Justification of Residual Impacts	The proposed mitigation measures will ensure that the positive impacts are enhanced and that the negative impact of the Project on surface water quality remains low therefore the intensity remains low. Similarly, the extent of the impacts should only be felt locally and for a short period or the whole of the operation phase (short to medium-term). The magnitude of the impact becomes minor. Adverse impacts on human health and the environment will therefore be minimized by minimizing surface water pollution from project activities as required by IFC PS3.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Medium	☐ Major

8.1.3.3 GROUNDWATER QUALITY

Information relating to the groundwater quality baseline conditions is presented in section 6.1.5.2 of the Description of Baseline Conditions chapter. The following describes the main Project-related sources of impacts, proposed mitigation measures, and resulting residual impacts for this VEC. Groundwater quality will be impacted at the Pre-Construction, Construction and Operation phases.

The Project alignment is located in the drainage areas of Lake Naivasha, Lake Elmentaita and Lake Nakuru.

In the Lake Nakuru basin, any effluent discharges from the road during construction and operation phases will drain easily into the shallow permeable aquifers of this region through storm waters and surface runoff. Moreover, groundwater quality in that area is likely already affected by the Nakuru City due to its important population density and by the Nakuru industrial zone. However, the Nakuru City area is also served with a wastewater catchment network directing wastewater towards two water treatment plants located near Lake Nakuru.

In the Lake Naivasha area, the heavily chemical effluents from the ongoing horticulture and floriculture activities are known to percolate into the shallow groundwater tables in the area, thus potentially contaminating them.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

The proposed Project includes Pre-Construction and Construction activities that may affect groundwater quality:

- The implementation and use of temporary construction facilities (including borrow pits and quarries) and the construction of Project infrastructure may result in accidental spills or leaks of contaminants. These could reach groundwater through soils (when near the surface) through nearby existing wells or through existing natural surface connections (wetlands), thus potentially affecting its quality. The problem may result from accidental spills and leaks over a long period of time coming from:
  - improper installation of fuel distribution and storage sites;
  - improper installation of storage sites for hazardous products and waste, including storage of cement powder bags;
  - inadequate maintenance of trucks, vehicles, machinery, and motorized equipment (e.g., motorized tools).
- The construction of ground water wells may result in accidental spills or leaks of contaminants through inadequate maintenance of drilling equipment which could potentially reach groundwater and affect its quality.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

Table 8-22 summarizes the anticipated impacts and presents the impact assessment for groundwater quality for the Pre-Construction and Construction phases.

Table 8-22 Pre-Construction and Construction Phases Impact Assessment for Groundwater Quality

Assessment of Pre-mitigation Impacts	The shallowness of groundwater tables and aquifers, the high percolation potential and the fact that groundwater is used extensively by local population confer a high intensity to the potential impacts associated with the Project's pre-construction and construction activities. Impacts will be of local (LAA) extent as contaminants entering groundwater are likely to migrate. If contamination reaches groundwater, repercussions may be felt for the full construction phase and longer, thus duration is considered long-term. The overall magnitude of the impact is considered major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographic Extent	☐ Limited (PDA)	☒ **Local (LAA)**	☐ Regional (RAA)
Duration	☐ Short-term	☐ Medium-term	☒ **Long-term**
Magnitude	☐ Minor	☐ Moderate	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure vehicles, equipment and machinery are in good working order to minimize leaks of contaminants;
- Keep terrestrial and aquatic spill kits at the work site to accelerate intervention in the event of a spill or leak during the Pre-Construction activities;
- Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations:
  - Hazardous waste and hazardous material (including cement powder bags) storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release;
  - Store all waste in distinct closed containers to allow for some segregation (recyclables and waste) and adequate confinement;
  - The fuel trucks that will ensure fuelling of machinery at the work sites should carry a spill kit. Except for fixed water works equipment that cannot be moved, all machinery should be moved away from water side before fuelling (at least 30 m). All fuel storage tanks should be equipped with adequate and required confinement capacity;
  - Ensure personnel trained are available to intervene in the event of accidental spills or leaks;
  - Contacts of firms (names and phone numbers) specialized in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone;
  - Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterization prior to use is recommended;
  - After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly disposed off-site by certified companies.

SPECIFIC MEASURES

- Ensure a particularly stringent application of the above standard measures when working at the level of the following surface water components:
  - Manguo Swamp (CH 3+00 to 4+00), located on the east side of the right-of-way;
  - Water courses flowing towards Naivasha lake including Malewa and Gilgil rivers (A8 Highway: approximate CH 42+800 to 43+000, 43+850 to 43+950, 59+650 to 59+750, 64+600 to 64+700 and 76+100 to 76+300; A8 South approximate CH: 47+050 to 47+250);
  - Water courses flowing towards Elmentaita lake including Mereroni and Mbaruk rivers (A8 Highway approximate CH 90+000 to 91+000, 92+250 to 92+450, 95+600 to +850, 99+550 to 99+700, 104+400 to 104+600 and 106+200 to 106+350);
  - Water courses forming the head of the Molo river basin flowing toward lake Baringo (A8 Highway approximate CH 148+800 to 148+900, 149+750 to 149+850, 153+750 to 153+850, 159+050 to 159+125, 169+500 to 169+600, 171+825 to 171+950 and 174+350 to 174+450).
- Develop and conduct a regular groundwater quality monitoring program covering all work sites located near high sensitivity sites, such as locations listed in the previous bullets, to verify existing problems and evaluate action requirements.

— Develop and conduct a groundwater quality monitoring program to verify existing problems and evaluate action requirements at any other location along the RoW, if groundwater contamination-related grievances are received.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on groundwater quality for the Pre-Construction and Construction phases are assessed in Table 8-23.

Table 8-23 Determination of the Project's Residual Pre-Construction and Construction Phases Impacts on Groundwater Quality

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures has the capacity to significantly reduce the risk of contaminants reaching groundwater within the Project area through efficient spills or leaks control. The intensity of the residual impact is thus considered low. However, residual impacts will still be felt at the scale of the LAA and will occur during the full operation period ad longer and therefore would be characterized as having a long-term duration. The resulting magnitude of impacts becomes moderate. Adverse impacts on human health and the environment will therefore be minimized by minimizing groundwater pollution from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

As mentioned in the water quality section, the Project includes the installation of water treatment facilities in key sensitive areas along the highway to intercept and treat storm water coming from the right-of-way. Some of these infrastructures are located within the sensitive area of the Naivasha lake basin (see Tables 4-13 and 8-19). These installations will help reduce the risk of contaminants reaching groundwater. Also, as presented in section 4.6.3.2, one of the operation maintenance tasks is to ensure emergency works and response activities which include interventions to contain and clean spills resulting from accidents.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project activities that may affect groundwater quality during the operation phase is linked with the operation and routine maintenance activities, but also with the presence of the new infrastructure and use of the highway by motorized traffic. The main impacts include:

— accidental spills or leaks of contaminants potentially directly or indirectly (carried by surface water run-off) reaching surface water, resulting from:
  - accidents occurring on the highways;
  - inadequate maintenance of vehicles using the highway and of trucks, machinery, and other motorized equipment used during routine activities.

The presence of surface water treatment infrastructure already planned at various sensitive locations and the fact that maintenance activities include spill intervention activities has a positive outcome as it reduces the potential effects of the identified impacts. However, the potential for negative impact remains and Table 8-24 summarizes these anticipated impacts and presents the impact assessment for groundwater water quality.

Table 8-24 Operation Phase Impact Assessment for Groundwater Quality

Assessment of Pre-mitigation Impacts	Considering that the Project is adding water treatment infrastructures where there are currently none and includes some spill intervention activities thus reducing risks of contamination, the intensity of the impacts is considered medium. Impacts will be of local (LAA) extent as contaminants entering groundwater are likely to spread. Impacts related to the use of the highway will occur sporadically while impacts associated with operation and routine maintenance will occur during specific work and therefore would be characterized as having a short-term duration. These impact characteristics result in an overall impact of moderate magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographic Extent	☐ Limited (PDA)	☒ **Local (LAA)**	☐ Regional (RAA)
Duration	☒ **Short-term**	☐ Medium-term	☐ Long-term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

Recommended mitigation measures concerning groundwater quality for the Operation phase are the same as for the Pre-Construction and Construction phases.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on groundwater quality for the Operation phase are assessed in Table 8-25.

Table 8-25 Determination of the Project's Residual Operation Phase Impacts on Groundwater Quality

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures has the capacity to significantly reduce the risk of contaminants reaching groundwater within the Project area through efficient spills or leaks control. The intensity of the residual impact is thus considered low. However, residual impacts will still be felt at the scale of the LAA and will still occur sporadically therefore would be characterized as having a short-term duration. The resulting magnitude of impacts becomes minor. Adverse impacts on human health and the environment will therefore be minimized by minimizing groundwater pollution from project activities as required by IFC PS3.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-term**	☐ Medium-term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.1.3.4 GROUNDWATER QUANTITY

Information relating to the groundwater quantity baseline conditions are presented in section 6.1.5.2 of the Description of Baseline Conditions chapter. The following describes the main Project-related sources of impacts, proposed mitigation measures, and resulting residual impacts for this VEC. Groundwater quantity will be impacted at the Pre-Construction, Construction and Operation phases.

The Project is located predominantly in the Kenyan Rift Valley basin where the current groundwater use estimates according to the WRA is at 198 Mm^3/a, which is about half of the estimated sustainable groundwater yield (398 M m^3/yr), with the annual groundwater recharge also estimated at approximately 3,168 MCM/yr, and a sustainable annual yield of 398 M m^3/yr. As a result, this makes the ground water a reliable source of water for both industrial and domestic use, especially during dry years and seasons.

However, the project is located within the Nakuru and Naivasha-Elmentaita drainage basins where the groundwater is already extensively used by local communities (including Limuru, Naivasha and Gilgil towns as well as Nakuru City) and by important agricultural and industrial activities.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

The proposed Project includes Pre-Construction and Construction activities that may affect groundwater quantity:

- The use of groundwater wells for construction activities (dust abatement and other requirements) can affect groundwater quantity, which is particularly relevant in the Lake Nakuru and Lake Naivasha-Elmentaita basins for which the groundwater abstraction is already very high and may have repercussions on groundwater availability for other local users (domestic, agricultural, industrial).

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

Table 8-26 summarizes the anticipated impacts and presents the impact assessment for groundwater quantity for the Pre-Construction and Construction phases.

Table 8-26 Pre-Construction and Construction Phases Impact Assessment for Groundwater Quantity

Assessment of Pre-mitigation Impacts	The groundwater requirement for construction activities is elevated with 1 400 00 m^3 but this is for a three-year period and will come from various wells not all located within the same drainage basin. The intensity of the impact is thus considered medium. Water abstraction at each well will be felt locally and for medium-term duration as it will take place during the entire pre-construction/construction activities. The resulting impact magnitude will be moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographic Extent	☐ Limited (PDA)	☒ **Local (LAA)**	☐ Regional (RAA)
Duration	☐ Short-term	☒ **Medium-term**	☐ Long-term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Limit groundwater use to essential needs and aim at continually improve efficiency in the use of groundwater to minimise effect on local availability.
- Regularly inspect all installations associated with groundwater extraction and distribution to eliminate leaks which are wasting the resource.
- Regularly maintain the equipment used to spray water for dust abatement to eliminate leaks and minimise losses.

SPECIFIC MEASURES

- Communicate with the Kenyan Water Resource Authority and any other land management authorities potentially concerned (such as protected area management authorities), before implementing a groundwater well (namely within the Lake Naivasha-Elmentaita basin) to validate best location, local capacity and obtain required permits;
- Consider the installation of systems to collect and store rainwater to minimise dependency on groundwater within the work sites.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on groundwater quantity for the Pre-Construction and Construction phases are assessed in Table 8-27.

Table 8-27 Determination of the Project's Residual Construction Phase Impacts on Groundwater Quantity

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures will only ensure that impact intensity will remain medium. As for intensity, extent and duration are also unaffected by thy proposed measures thus respectively remaining local and medium-term. The resulting magnitude of impacts is moderate. The proposed mitigation measures therefore allow to minimize adverse impacts on human health and the environment by minimizing groundwater consumption from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

The proposed Project includes activities that may affect groundwater quantity during the operation phase as it will require:

- the use of ground water wells to supply water for staff and maintenance activities, which may impact groundwater quantity.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

Table 8-28 summarizes the anticipated impacts and presents the impact assessment for groundwater quantity for the Operation phase.

Table 8-28 Operation Phase Impact Assessment for Groundwater Quantity

Assessment of Pre-mitigation Impacts	The groundwater requirement for operation activities is relatively low with only 15 000 m^3/year from various wells which are not all located within the same drainage basin. The intensity of the impact is thus considered low. Water abstraction at each well will be felt in the immediate vicinity of the well thus resulting in limited extent but for the long-term duration as it will take place during the entire operation phase activities. The resulting impact magnitude will be minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

Recommended mitigation concerning groundwater quality for the Operation phase is the same as for the Pre-Construction and Construction phases.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on groundwater quantity for the Operation phase are assessed in Table 8-29.

Table 8-29 Determination of the Project's Residual Operation Phase Impacts on Groundwater Quantity

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures will only ensure that impact intensity will remain low. As for intensity, extent and duration are also unaffected by thy proposed measures thus respectively remaining limited and long-term. The resulting magnitude of impacts is minor. The proposed mitigation measures therefore allow to minimize adverse impacts on human health and the environment by minimizing groundwater consumption from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.1.4 *SOIL AND SEDIMENTS*

Assessment of soil and sediments considers three VECs, soil stability/erosion, soil quality and sediment quality. The soil and sediments will be impacted at the Pre-Construction and Construction phases.

8.1.4.1 SOIL STABILITY/EROSION

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect soil stability and erosion:

- The implementation of temporary or preliminary site investigations or staging areas may result in the disturbance of vegetation and or the concentration of rainwater runoff, both resulting in potential soil erosion. The problem will typically result from clearing of vegetation for detailed surveys prior to construction.
- Site preparation (e.g., clearing of vegetation).
- Modification of slopes (cut and fill operations).
- Direct and indirect soil disturbance.
- Concentrating rainwater flows prior to adequate stormwater system creation.
- Creation of borrow pits.

Table 8-30 summarizes the anticipated impacts and presents the impact assessment for soil stability/erosion for the Pre-Construction phase.

Table 8-30 Pre-Construction and Construction Impact Assessment for Soil Stability/Erosion

Assessment of Pre-mitigation Impact	Soil erosion and stability impacts are typically irreversible (even if stopped) and as such, high intensity impacts are likely. Activities will remain within the road reserve resulting in limited extents. This combined with a long-term duration results in a moderate magnitude impact.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure the development of a strong Environmental Management Plan, including but not limited to, site assessment requirements prior to disturbances and availability of soil erosion protection systems;
- Detailed slope stability assessments should be done where required for in areas of cut and or fill operations within the final route alignment. Final designs are to include suitable mitigation measures based on the findings of such studies. Soil stability and erosion should be monitored prior to the installation of such final mitigation measures;
- Areas disturbed indirectly as part of construction activities (e.g., temporary access routes, temporary vegetation clearing) should be protected from erosion and returned to a protected state after disturbing activity is removed;
- Temporary runoff and erosion control management plans should be created and implemented during construction phases. This should identify construction stages during which assessments and measures should be applied for each section of road as well as all temporary construction areas.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on soil stability/erosion for the Pre-Construction phase are assessed in Table 8-31.

Table 8-31 Determination of the Project's Residual Pre-Construction Impacts on Soil Stability/Erosion

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures should allow for a substantial reduction of significant impacts related to soil erosion or stability. The intensity of the residual impact is thus considered low. The impacts remains limited and long-term thus resulting in a minor magnitude of impacts.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

There are no anticipated project impacts on soil stability/erosion during the Operation phase under the assumption that the stormwater system is adequately designed, constructed and is well maintained. As a minimum these aspects should be confirmed during an audit during the first rain season after construction and a stormwater maintenance and management plan should be created to reassess the system on a regular basis during the operational stage.

8.1.4.2 SOIL QUALITY

Information relating to the soil quality baseline conditions are presented in section 6..2.6.2 of the Description of Baseline Conditions chapter. The following describes the main Project-related sources of impacts, proposed mitigation measures, and resulting residual impacts for this VEC. Sediment quality will be impacted at the Pre-Construction, Construction and Operation phases.

Shallow soil sampling was conducted at ten targeted locations along the alignments; seven along Highway A8, and three along Highway A8 south, during early March 2021. The targeted locations consisted of positions proximal to inter alia fuel filling stations, fuel pipelines, and truck stops, where it was considered that existing contamination could be more evident. Samples were then analyzed against soil quality criteria compatible with IFC EHS Guidelines. Although hydrocarbon staining and odours were noted at certain positions, the concentrations of the analysed organic contaminants were all below laboratory detection limits and, thus, suggestive of highly localised impacts that are unlikely to be significant in the context of the highway's development. Further, whilst some variability in the concentrations of various metals were recorded, only lead was identified at a concentration of potential concern at three locations. Nonetheless, with consideration of reasonably plausible exposure pathways, the locally elevated lead concentrations were not deemed to represent a significant source of risk.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Construction activities that may affect shallow soil quality include:

- The implementation of temporary construction facilities;
- Site preparation;
- Transportation and circulation of vehicles and machinery;
- Pavement work, and;
- Waste and hazardous materials management.

These activities may result in accidental spills or leaks of contaminants to soils, thus potentially affecting its quality and resulting from:

- improper installation of chemical and/or fuel distribution and storage sites;
- improper installation of storage sites for hazardous products (i.e., cement, bituminous materials) and wastes;
- inadequate maintenance of trucks, vehicles, machinery, and motorised equipment.

Notwithstanding, the potential for these activities to result in disturbances to existing potential sources of contamination outside of the reserve (i.e., fuel filling stations) that, although unlikely, may lead to impacts should be acknowledged.

Table 8-32 summarizes the anticipated impacts and presents the impact assessment for soil quality for the Construction phase.

Table 8-32 Pre-Construction and Construction Impact Assessment for Soil Quality

Assessment of Pre-mitigation Impact	Accidental spills or leaks may alter the quality of shallow soils without completely affecting its integrity thus resulting in a medium intensity. Construction staging areas may be located outside of the highway's right-of-way and, thus, local impacts may occur. Impacts may occur at any time during the entire construction period (medium-term). The resulting impact magnitude will be moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure all vehicles, equipment and machinery are in good working order with a particular attention to fuel/oil pipes, tanks and sumps, hydraulic hoses, etc.;
- Keep spill kits at the work site to accelerate intervention in the event of a spill or leak;
- Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations:
  - Hazardous waste and hazardous material storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release;
  - Store all waste in distinct closed containers to allow for segregation (recyclables and waste) and adequate confinement;
  - The fuel trucks that will ensure fuelling of machinery at the work sites should carry a spill kit. All fuel storage tanks should be equipped with adequate and required confinement capacity;
  - Ensure personnel trained are available to intervene in the event of accidental spills or leaks;
  - Contacts of firms (names and phone numbers) specialised in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone;
  - Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterisation prior to use is recommended.
- After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly disposed off-site by certified companies.

SPECIFIC MEASURES

- If soil contamination-related grievances are received, develop and conduct a quality monitoring program to verify existing problems and evaluate action requirements.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on soil quality for the Pre-Construction phase are assessed in Table 8-33.

Table 8-33 Determination of the Project's Residual Pre-Construction and Construction Impacts on Soil Quality

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures should allow for a substantial reduction or complete avoidance of significant impacts to shallow soils within the Project area by reducing the risks of spills or leaks through proper: – maintenance and good operating practices of equipment and machinery; – waste and hazardous waste and hazardous material management; – emergency response in the event of a spill or leak. The intensity of the residual impact is thus considered low. Given the potential for staging areas outside the reserve, impacts remain local; although, appropriate response will likely result in these being of short-term duration. The resulting magnitude of the residual impacts, therefore, becomes minor. Adverse impacts on human health and the environment will therefore be minimized by minimizing soil pollution from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Medium	☐ High

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project activities that may affect the quality of shallow soils during the operation phase, includes:

- Presence of new infrastructures and use of the highway, including the potential for road traffic accidents to result in localised fuel or other chemical releases/spills;
- Operation and routine maintenance.

These activities may result in accidental spills or leaks of contaminants potentially affecting soil quality. resulting from:

- inadequate maintenance of trucks, vehicles, machinery, and motorised equipment;
- inadequate implementation of routine maintenance procedures;
- car and truck accidents occurring on the highway.

Table 8-34 summarizes the anticipated impacts and presents the impact assessment for soil quality for the Operation phase.

Table 8-34 Operation Impact Assessment for Soil Quality

Assessment of Pre-mitigation Impact	Activities or other incidents may result in localised medium impacts to the quality of shallow soils. Whilst highway-related incidents will occur within the reserve and, thus, only a limited extent impacts may occur. While impacts may occur at any time during operation, these are likely of short-term duration in most cases. The resultant will be a moderate magnitude for the impact.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

Recommended mitigation concerning soil quality for the Operation phase is broadly consistent with those for the Pre-Construction and Construction phases. However, it should be ensured that adequate Emergency Preparedness is in place for reasonably foreseeable incidents-related to traffic accidents that may result in releases/spillages of a vast range of contaminants that could impact soils.

SPECIFIC MEASURES

- Develop an operation procedure to manage accidental soil contamination coming from accidental spills;
- If soil contamination-related grievances are received, or if impacts are suspected following any incidents, develop and conduct a soil quality monitoring program to verify existing problems and evaluate action requirements.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on soil quality for the Operation phase are assessed in Table 8-35.

Table 8-35 Determination of the Project's Residual Operation Impacts on Soil Quality

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures should allow for a substantial reduction or complete avoidance of significant impacts to shallow soils within the Project area by reducing the risks of spills or leaks through proper: – maintenance and good operating practices of equipment and machinery; – waste and hazardous waste and hazardous material management; – emergency response in the event of a spill or leak, including any associated accidents that may occur with the use of the highway. The intensity of the residual impact is thus considered low. Given the potential for maintenance staging areas outside the reserve impacts remains local; although, appropriate response will likely result in these being of short-term duration. The resulting magnitude of impacts, therefore, becomes minor. Adverse impacts on human health and the environment will therefore be minimized by minimizing soil pollution from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.1.4.3 SEDIMENT QUALITY

Information relating to the sediment quality baseline conditions are presented in section 6.1.7.4 of the Description of Baseline Conditions chapter. The following describes the main Project-related sources of impacts, proposed mitigation measures, and resulting residual impacts for this VEC. Sediment quality will be impacted at the Pre-Construction, Construction and Operation phases.

All information available on sediment quality is derived from the survey completed during the current ESIA. Of the watercourses visited, only eight could be sampled as many watercourses presented a substrate of boulders, cobbles and pebbles with very little to no finer material. The sediments were analysed for the presence of oil and grease, polycyclic aromatic hydrocarbons (PAH) and metals. Only metals exceeded the threshold effect level (TEL: adverse effects occasionally occur to benthic organisms) for five of the watercourses and the probable effect level (PEL: adverse effects frequently occur to benthic organisms) for one watercourse. The metals detected included cadmium (TEL), zinc (TEL) and chromium (TEL and PEL). The watercourse where a PEL result was obtained for chromium flows across a major farming installation located upstream from the highway.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction phases activities that may directly affect sediment quality include:

- Accidental spills or leaks of contaminants potentially directly or indirectly (carried by surface water run-off) reaching surface water, resulting from:
  - improper installation of fuel distribution and storage sites;
  - improper installation of storage sites for hazardous products and waste, including storage of cement powder bags;
  - inadequate maintenance of trucks, vehicles, machinery, and motorized equipment;
  - inappropriate fuelling practices and location for vehicles, machinery and other motorized equipment.

Overall, the pre-construction and construction activities could essentially affect sediment quality through the introduction of some chemical contaminants, mainly petroleum-based, in the local watercourses which could then reach sediments by deposition with particulate matters.

Taking into consideration these observations, Table 8-36 summarizes the anticipated impacts and presents the impact assessment for sediment quality.

Table 8-36 Impact Assessment for Sediment Quality

Assessment of Pre-mitigation Impact	Sampled sediments did not show any exceedance of the oil and grease parameters in the area of the various watercourses crossed despite important human activities. This suggests that little petroleum-based contaminant reach the watercourse sediments because these are transported further away by flowing water or the sediments are regularly flushed during intense rain episodes. For these reasons the impact intensity is considered low; its extent is local and the duration is short-term (from one rainy season to the other) for a resulting minor impact magnitude.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure vehicles, equipment and machinery are in good working order to minimize leak of contaminants;
- Keep terrestrial and aquatic spill kits at the work site to accelerate intervention to confine and recuperate any occurring accidental spills or leaks;
- Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations:
  - Hazardous waste and hazardous material (including cement powder bags) storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release;
  - Store all waste in distinct closed containers to allow for some segregation (recyclables and waste) and adequate confinement;
  - The fuel trucks that will ensure fuelling of machinery at the work sites should carry a spill kit. Except for fixed water works equipment that cannot be moved, all machinery should be moved away from water side before fuelling (at least 30 m). All fuel storage tanks should be equipped with adequate and required confinement capacity;
  - Ensure some of the personnel trained are available to intervene in the event of accidental spills or leaks.
  - Contacts of firms (names and phone numbers) specialized in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone;
  - Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterization prior to use is recommended.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on sediment quality are assessed in Table 8-37.

Table 8-37 Determination of the Project's Residual Impacts on Sediment Quality

Assessment and Justification of Residual Impacts	The proposed mitigation measures will ensure that impact intensity remains low. The impact extent and duration also remain respectively local and medium-term. The impact magnitude remains minor. Adverse impacts on human health and the environment will therefore be minimized by minimizing sediment pollution from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

As mentioned in Table 8-19 of the water quality impact assessment during the operation phase, water treatment installations are foreseen for most of the main watercourses crossed by the new highways which reduces the potential of contaminants reaching these watercourses or their sediments.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project activities that may affect sediment quality during the operation phase are linked with operation and routine maintenance activities, but also with the presence of the new infrastructure and use of the highway by motorized traffic. The main impacts include:

- accidental spills or leaks of contaminants potentially directly or indirectly (carried by surface water run-off) reaching surface water, resulting from:
  - accidents occurring on the highways;
  - inadequate maintenance of vehicles using the highway and trucks, machinery, and other motorized equipment used during routine maintenance activities.

The presence of surface water treatment infrastructure planned at various sensitive locations already reduces the potential effects of the identified impacts. However, not all sensitive areas are currently adequately covered by these infrastructures. Table 8-38 summarizes the anticipated impacts and presents the impact assessment for sediment quality.

Table 8-38 Impact Assessment for Sediment Quality

Assessment of Pre-mitigation Impact	Sampled sediments did not show any exceedance of the oil and grease parameters in the area of the various watercourses crossed despite important human activities. This suggests that little petroleum-based contaminants reach the watercourse sediments because these are transported further away by flowing water or sediments are regularly flushed during intense rain episodes. In addition to this, the planned presence of water treatment infrastructures will help reduce or eliminate potential contamination threats. For these reasons the impact intensity is considered low, its extent is local and duration is short-term (from one rainy season to the other) for a resulting minor impact magnitude.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure vehicles, equipment and machinery are in good working order to minimize leak of contaminants;
- Keep terrestrial and aquatic spill kits at the work site to accelerate intervention to confine and recuperate any occurring accidental spills or leaks;
- Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations:
  - Hazardous waste and hazardous material (including cement powder bags) storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release;
  - Store all waste in distinct closed containers to allow for some segregation (recyclables and waste) and adequate confinement;

- Ensure some of the personnel trained are available to intervene in the event of accidental spills or leaks;
- Contacts of firms (names and phone numbers) specialized in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone;
- Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterization prior to use is recommended.

SPECIFIC MEASURES

— Regularly verify and maintain as necessary the water treatment infrastructures listed in Table 4-13 and any additional ones added.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on sediment quality are assessed in Table 8-39.

Table 8-39 Determination of the Project's Residual Impacts on Sediment Quality

Assessment and Justification of Residual Impacts	The proposed mitigation measures will ensure that impact intensity remains low. The impact extent and duration also remain respectively local and medium-term. The impact magnitude remains minor. Adverse impacts on human health and the environment will therefore be minimized by minimizing sediment pollution from project activities as required by IFC PS3.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.2 BIOLOGICAL ENVIRONMENT

This subsection describes the effects on biodiversity VECs.

8.2.1 HABITAT AND FLORA

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impacts on vegetation are:

— Implementation of temporary construction facilities;

— Site preparation;

— Transportation and circulation;

— Use of borrow pits and quarries;

— Waste and hazardous materials management.

The biodiversity Regional Assessment Area (RAA) and Local Assessment Area (LAA) are composed of a mix of natural and modified habitats, as determined in section 6.3.9.1. Some of these habitats also qualify as critical habitats for various biodiversity features. The area of modified, natural and critical habitat within each assessment area is presented in the Table below. The area within the existing road reserve is considered modified habitat.

Table 8-40 Total area of Modified, Natural and Critical Habitat within the Biodiversity LAA and RAA.

Assessment Area	Total Area(ha)	Modified Habitat (ha)	Natural Habitat (ha)	Critical Habitat (ha)
RAA	1,286,852	607,602	679,250	689,527
LAA	88,749	64,270	24,479	50,400

Several Protected Areas and Internationally Recognised Areas are also found along the Project, as well as private conservancies. Table 8-41 below details the areas within the LAA and the distance of these areas from the road reserve. It shows that five of these areas are adjacent or crossed by the road, whereas three are less than 1 km away. Zoomed in maps of these areas are available in Appendix 6-25.

Table 8-41 Distance to Protected Areas, Internationally Recognized Areas and private conservancies from the Road RoW

Road Section	Site	Status and designation	Distance from RoW
3	Lake Nakuru National Park	National Park; IBA; World Heritage Site; Ramsar site; Endangered ecosystem	350 m
4	Mount Londiani	Forest Reserve	the road crossed the site along 5.6 km
2	Lake Elmentaita	National Sanctuary; IBA; World Heritage Site; Ramsar site; Endangered ecosystem	860 m, the road is adjacent to the World Heritage Site's buffer zone along 11.5 km
2 and 6	Lake Naivasha	IBA; Ramsar Site	90 m – Ramsar Site the road is adjacent to the IBA along 11.2 km
6	Mount Longonot National Park	National Park	1.3 km
1	Kinangop Grasslands	IBA	The road crosses the site along 4.5 km
1 and 5	Kikuyu Escarpment Forest	IBA; Forest Reserve	The road crosses the site along 9.2 km – Section 1 and 13.8 km along Section 5
1 and 6	Naivasha Wildlife Training Institute Local Sanctuary (Kenya Wildlife Service Training Institute)	National Sanctuary	The road is adjacent to the site along 3.0 km- section 1, and 1.3 km - section 6 i
2	Soysambu Conservancy	Private conservation area; Endangered ecosystem	The road crosses the site along 7.7 km
2	Marula Estate	Private conservation area; Endangered ecosystem	The road crosses the site along 21.7 km
2	Kigio Wildlife Conservancy	Private conservation area	1.4 km

The site preparation works will involve removal of roadside vegetation and felling of trees present within the existing road reserve. Areas where larger infrastructure is planned, such as overpasses, underpasses and bridges, clearing of vegetation might exceed the existing road reserve. The implementation of temporary construction facilities and new borrow pits and quarries will also lead to vegetation loss within these sites. Soil compaction and sealing of soil surface will also reduce the 'availability' of land for vegetation.

The specific areas where project activities might exceed the road reserve are not yet detailed and the specific location of temporary construction facilities is also unknown for the moment. To ensure impacts on natural habitats and protected areas are avoided and minimized, a clear vegetation clearing procedure will be enforced. The general procedure for location of areas to be cleared will need to be informed by detailed maps of presence of natural habitat, critical habitat and protected areas, and include ground-truthing by walk over surveys, marking off specific areas prior to clearing, and monitoring for compliance.

Overall, the habitat loss is expected to be low as the route is an existing road that runs through already modified or transformed habitat. No direct impacts on protected or internationally designated areas are anticipated, seeing as construction and operation activities will remain within the road reserve and no encroachment is foreseen.

Although not expected to be present within the right-of way, particular attention should be given to trees of conservation interest, notably *Ocotea kenyensis* (VU), *Prunus africana* (VU)), and of use value (timber, trees sources of wild food produce, medicinal or sacred trees – see ecosystem services report in appendix 6-24) that could be present in the road reserve. The felling of these trees should try to be avoided or appropriately compensated.

Lagarosiphon hydrilloides (EN) and *Ethulia schefflera* (EN), known to occur in still or slow-flowing freshwater and on swampy sites along streams, respectively, are two priority plant species that should be given special attention. Although no direct habitat loss for these species is anticipated as they are not thought to be found near the road alignment, potential interaction with the project could arise from pollution, sedimentation or hydrological change to wetlands. The implementation of management measures for water resources will mitigate project impacts on these species.

In the same way, water pollution and sedimentation related to pre-construction and construction works could potentially affect the nearby Kenya Lake System in the Great Rift Valley World Heritage Site, including lakes Nakuru and Elmenteita, as well as the Lake Naivasha RAMSAR site, to varying degrees via some of their affluents crossed by the Project (see section 8.1.3.2 above). The use of groundwater wells for construction activities (dust abatement and other requirements) could also indirectly affect the lake water levels (see section 8.1.3 above). Effects on those lakes depend primarily on their hydrological/hydrogeological connection with the Project, as well as their proximity since impacts tend to dissipate with distance:

- Lake Nakuru: relatively short distance between the Project and the WHS Property Limit (350m) but the lake itself is further away (approx. 2 km at its closest). Water quality effects are unlikely due to the absence of known hydrological connections between the Project and the lake (the Project does not cross any known Lake Nakuru tributaries). Water availability effects are possible;
- Lake Elmenteita: medium distance between the Project and the lake (approx. 860 metres at its closest) and presence of hydrological connections. Potential water quality effects on Lake Elmenteita could occur if its tributaries are impacted by the Project. Water availability effects are possible;
- Lake Naivasha: short distance between the Project and the RAMSAR site boundary (90m) but the lake itself is further away (1150m from the A8 South and 2150m from the A8, at its closest). Potential water quality effects on Lake Naivasha could occur if its tributaries are impacted by the Project. Water availability effects are possible;
- Although outside the RAA and LAA, Lake Bogoria is part of the Kenya Lake System in the Great Rift Valley World Heritage Site: there is no hydrological connection with the watercourses crossed by the project. No effects of the project are anticipated.

Furthermore, the rocky ridges along the highway around Lake Elmentaita in the evergreen and semi-evergreen bushland and thicket habitat type, as well as the calcareous soils along drainage lines in this area, that have been flagged as unique should be avoided by the implementation of temporary construction facilities and new borrow areas. Avoidance should also apply as much as possible to areas identified as high and very high biodiversity sensitivity areas (see section 6.2.7), in respect of the mitigation hierarchy.

Construction traffic, earthworks and management of hazardous waste material can also have an indirect impact on vegetation from dust, particles; oil/fuel. Impacts will be limited to a narrow buffer zone on each side of the road, with short-term impacts envisioned where major construction is required.

Road-building activity can promote the spread of invasive species in a number of ways, e.g., by providing them a foothold in disturbed ground where they tend to flourish, by bringing in seeds or propagules with building materials, or by moving them to new sites through earth-moving operations. The use of earth-moving equipment and other transport vehicles during construction activities can result in the dispersal of alien plant material to other localities. As the project area already exhibits levels of undesirable alien plant species typically associated with disturbance and agriculture, care will need to be taken as alien plant material is not inadvertently transported along with construction equipment, machinery or material.

The project does not require sourcing of primary production as defined in IFC PS6 during the construction phase and thus PS6 requirements for supply chains are unlikely to apply.

Table 8-42 summarizes the anticipated impacts and presents the impact assessment for habitat and flora.

Table 8-42 Impact Assessment for Habitat and Flora

Assessment of Pre-mitigation Impact	Considering the existing degraded condition of vegetation to be affected, the intensity of the impact is considered medium. Since most impact on vegetation will be within the existing road reserve, the geographical extent is considered limited. Vegetation loss will last throughout the project lifetime and is thus long term. Consequently, the magnitude of the impact is considered moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Avoid unnecessary clearance of vegetation;
- Preserve existing vegetation where no construction activity is planned;
- Protect small patches of natural and regenerated habitat located at the limit of the work site, such as clumps of trees, ponds or wetlands . These areas must be designated as sensitive, and staff and contractors must be formally made aware that these areas are not to be destroyed;
- Maximise the use of vegetation resources from areas that are cleared for road construction activities as specified by KeNHA, NEMA or KFS's directives;
- Remove and keep topsoil to be reused in the same area for revegetation needs. Revegetate temporally disturbed areas once the work is completed with indigenous flora species;
- In order to limit the propagation of invasive species, all such invasive species within the corridor of impact and/or right of way shall be removed/cleared and replanted with local species;
- Ensure all road verge replanting and landscaping is done using appropriate indigenous species;
- Inspect construction vehicles and heavy machinery before first mobilization on site to ensure they are free of soil or viable segments of invasive alien species;
- Do not use soils potentially contaminated with invasive alien species as a covering material on site or elsewhere;
- Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan;

— Rehabilitate burrow pits using indigenous vegetation when works are completed, or in accordance with landowner agreement;

— Implement a construction closure plan in which rehabilitation measures are defined and budgeted;

— All construction material and waste must be removed from the construction sites and the area rehabilitated once works are completed;

— Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3).

SPECIFIC MEASURES

— Implement a procedure for vegetation clearing based on detailed maps of presence of natural habitat and critical habitat, pre-construction ground-truthing walkover surveys, marking off specific areas prior to clearing, and monitoring for compliance;

— Avoid placement of any supporting project activities (e.g. camps, laydown yards, topsoil storage etc) within remaining Natural Habitats, including an appropriate buffer;

— The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities to identify the areas of natural habitat and priority plant species (as defined in the BMP). Mark and leave undisturbed to the extent feasible;

— Undertake compensatory plantations either along the project corridor or at places identified by the Kenya Forest Services (KFS), in order to compensate for the trees felled;

— Where possible, plant indigenous trees along the road that will not only act as shade or resource but help create suitable habitat and improve connectivity to other surrounding natural areas by creating an interconnected greenbelt. Trees planted will also act as atmospheric pollution barriers;

— Only indigenous species approved by the KFS shall be used for the plantation;

— Where the road crosses the Forest Reserves (Koibatek and Kinale) and private conservancies (Marula Estate and Soysambu Conservancy) ensure that all temporary works remain within the road reserve and that no encroachment is made on these reserves and conservancies. If encroachment is inevitable, an adequate compensation for lost habitat shall be developed with KFS and the Private Conservancies.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on habitat and flora are assessed in Table 8-43.

Table 8-43 Determination of the Project's Residual Impacts on Habitat and Flora

Assessment and Justification of Residual Impacts	The proposed measures will ensure some indigenous species remain within the road reserve and will limit loss of sensitive habitat, reducing the intensity of the impact to low. The geographical extent is still considered limited. Vegetation loss will last throughout the project lifetime and is thus long term. Consequently, the magnitude of the residual impact on habitat and flora is considered minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impact during the operation phase is the presence of new infrastructures and the use of the highway.

During operation, and in general, periodic maintenance of a road limits the growth of trees within the right-of-way. By modifying the conditions of wind, temperature, humidity and insolation, the presence of the opening created by a road causes an edge effect which results in modifications to the vegetation in the natural habitats along the road and its rights-of-way. Also, the dust generated by automobile traffic can deposit on vegetation and thus affects photosynthesis, respiration, and plant transpiration, resulting in a loss of productivity (Coffin, 2007). Invasive alien plants can also take advantage of the disturbances created by the works and the existence of this dissemination corridor to colonize the road edges.

In the case of this project, the expected direct impacts during the operation phase on habitats and flora are similar to the impacts of the current road.

Lagarosiphon hydrilloides (EN) and *Ethulia schefflera* (EN) are two priority plant species potentially present in the RAA associated to streams and wetlands. Potential interaction with the project during operation could arise from pollution or sedimentation. However, the implementation of management measures for water resources will mitigate project impacts on these species.

In the same way, water pollution and sedimentation related to pre-construction and construction works could potentially affect the nearby Kenya Lake System in the Great Rift Valley World Heritage Site, including lakes Nakuru and Elmenteita, as well as the Lake Naivasha RAMSAR site. Good management practices for hydrology and surface water quality (see section 8.1.3.1 and 8.1.3.2) will mitigate potential effects on these sites and no significant impact is expected.

An indirect impact of the road upgrade is the increased accessibility to the project area, which can spur changes in local land use and lead to the conversion of natural areas to residential areas, pasture or cropland. Opportunities provided by improved road access between Rironi and Mau Summit, will result in increased traffic and settlement opportunities along the road. The influx will further attract traders, their employees and families and the net result will be an increase in the number of people living in the area and of land conversion. The population growth and easier access can further lead to increased pressure on the natural resources of the area, which can cause habitat degradation and depletion of some use-value flora species. This project being an upgrade of an existing sealed road, the impacts of additional loss of habitat through the influx of people to the area is expected to be limited.

The project does not require sourcing of primary production as defined in IFC PS6 during the operation phase and thus PS6 requirements for supply chains are unlikely to apply.

Table 8-44 summarizes the anticipated impacts and presents the impact assessment for habitat and flora.

Table 8-44 Impact Assessment for Habitat and Flora

Assessment of Pre-mitigation Impact	The expected direct impacts during the operation phase on habitats and flora are mainly similar to the impacts of the current road. However, the indirect impacts on habitats are land-use changes and increased pressure on natural resources related to population growth and increased access may have impacts locally around the road development. The intensity is judged medium, although these changes are hard to predict. The duration is throughout the project lifetime, hence long-term. The result will be an impact of moderate magnitude.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement an alien plant control and monitoring programme aimed at removing new populations and preventing them from spreading to other natural areas;
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3.1 and 8.2.3.2).

SPECIFIC MEASURES

- Collaborate with KFS and Kenya Wildlife Services (KWS) to identify protection measures in case degradation of habitats or land-use changes are observed in relation to the road development in forest reserves or protected areas along the Highway.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on habitat and flora are assessed in Table 8-45.

Table 8-45 Determination of the Project's Residual Impacts on Habitat and Flora

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures should allow the reduction of invasive alien species spread during operation and protect sensitive habitats in forest reserves or protected areas. The intensity of the residual impact will be reduced to low and the geographical extent will be limited while duration remains long-term. The resulting impact magnitude will be minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.2.2 FAUNA

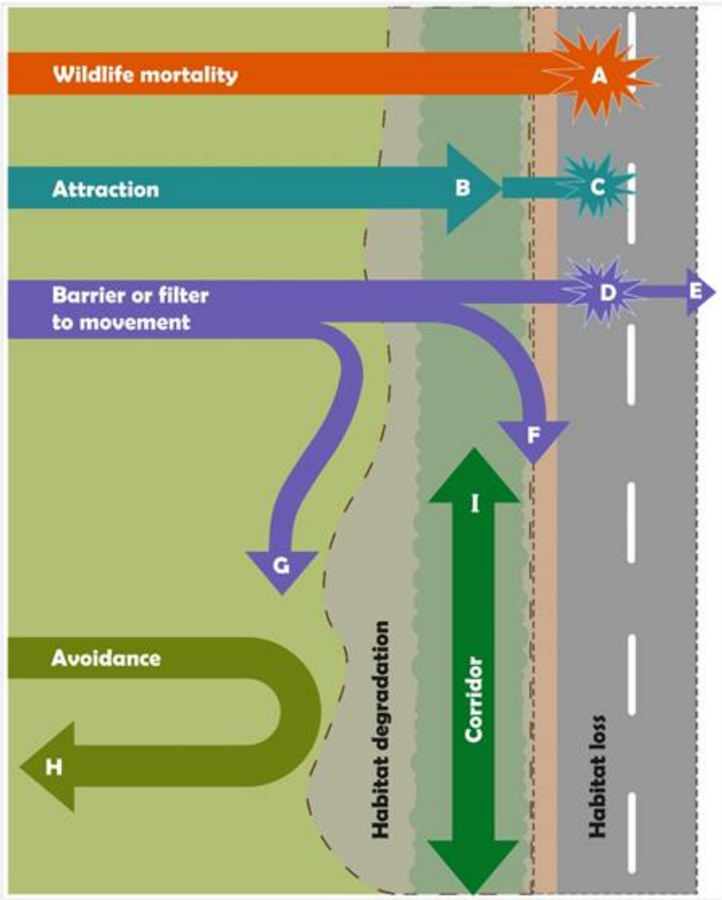
The general impacts of roads and traffic on fauna include (van der Ree et al., 2015):

- barrier or filter to the movement of wildlife, reducing accessibility to food and shelter on a daily basis, and preventing or limiting dispersal and annual migrations of wildlife over longer time frames;
- mortality and injury of wildlife due to wildlife-vehicle collision (WVC);
- loss of habitat due to clearing for road construction and maintenance, and subsequent loss of habitat to clearing beyond the footprint of the road due to facilitated access;
- habitat fragmentation as patches of habitat is divided into smaller patches;
- degradation of habitat due to noise, light and chemical pollution, weed invasion, altered hydrological regimes, etc.

Figure 8-1 illustrates the various impacts a road can have on wildlife: Habitat is lost to build the road and habitat adjacent to the road is degraded. Mortality due to wildlife vehicle collisions (WVC) (A). Some species are attracted to resources (e.g., carrion, spilled grain or heat for basking) on the road or roadside (B) which, depending on the animal's ability to avoid traffic, may result in death due to WVC (C). The barrier or filter effect reduces the movement of animals across the road and a proportion of individuals that attempt to cross are killed due to WVC (D) and some make it across (E), while others are deterred from crossing by the road (F) or degraded roadside habitat (G). Other species actively avoid the road or degraded habitat (H). In contrast, some species use the roadside vegetation as habitat and/or corridor for movement (I).

The amount of habitat being cleared for this project is relatively small because most of the project can be accommodated within the existing road reserve. Some vegetation removal within the road reservation is required, however this is often low-quality regrowth. Some additional clearing outside the road reservation is required for bridges, on and off ramps and quarries for construction materials. Nevertheless, even roadside vegetation can provide habitat for some generalist species of wildlife, and the widening and duplication will have some impact on relatively common and widespread species that are able to persist in the roadside vegetation.

Assessment of fauna considers four VECs, birds, reptiles and amphibians, as well as small and large mammals. The general impacts and mitigation measures for fauna are detailed in the Wildlife Road Mitigation Report in appendix 8-2. Sections below present the detailed assessment of impacts for each fauna VEC.



Source: Zoe Metherel in van der Ree et al. 2015

Figure 8-1 Impacts of roads on wildlife

8.2.2.1 BIRDS

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The sources of impact for bird populations include:

- Implementation of temporary construction facilities;
- Transportation and circulation;
- Site preparation;
- Use of borrow pits and quarries.

The potential impact emanating from the road construction will include:

- Loss of habitat and the potential displacement of bird taxa;
- Habitat degradation due to noise and vibrations, leading to temporary displacement of large terrestrial bird species (e.g., cranes, bustards, ground hornbills and secretarybirds) due to disturbances along the Marula Estates and Soysambu Conservancies;

- Machinery and vehicle collisions with birds during construction, especially ground birds, can occur from vegetation clearing and soil excavation work;
- Changes to the inundation levels and water chemistry at proximal wetland and lake systems due to ineffective stormwater management and or increased surface run-off, thereby resulting in the displacement of congregatory bird species of international importance;
- Increased alien plant encroachment at recently disturbed habitat (after construction), thereby resulting in changes to the floristic structure and composition of natural habitat and ultimately resulting in changes to the bird composition (resulting in the loss of avifaunal richness and increased colonization by generalist bird species).

Because the amount of habitat being cleared for this project is relatively small and the low quality of habitat to be affected, the probable level of bird habitat loss is low. The removal of mature trees with hollows and dead standing trees that could be found within the road reserve could affect hollow-nesting and canopy-nesting birds.

Some "hotspot" areas do occur near the road which is important breeding and roosting habitat for threatened and congregatory bird species, such as Manguo Swamp and Lake Elmentaita. The encroachment in these habitats shall be avoided and special attention given to the continual functioning of these systems without the displacement of the residing bird populations.

Table 8-46 summarizes the anticipated impacts and presents the impact assessment for birds.

Table 8-46 Impact Assessment for Birds

Assessment of Pre-mitigation Impact	The loss of bird habitat from construction is minimal, however, some species will be disturbed by construction noise and vibration and by the degradation of water quality. For this reason, the intensity of impact is medium and the extent is local. The impacts will be mostly limited to the construction period, hence the duration is short-term. Consequently, the magnitude of the impact is considered moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3), such as effective stormwater dissipating systems in order to maintain integrity of habitats important to congregatory species;
- Implement measures identified to mitigate impact on habitat and flora (section 8.2.1;
- No hunting by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted.

SPECIFIC MEASURES

- Implement a procedure for vegetation clearing based on detailed maps of presence of natural habitat and critical habitat, pre-construction ground-truthing walkover surveys, marking off specific areas prior to clearing, and monitoring for compliance;
- The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities shall identify any active nests of hollow-nesting and canopy-nesting birds. If a priority bird species is nesting, consult a local avifauna specialist for guidance on actions to be taken;
- Ensure that the directives of the noise permit to be obtained from NEMA will also be applied in areas of high-quality habitat for birds, in particular along Lake Elmentaita World Heritage Site, near Manguo Pond and in the Kinangop grassland IBA);
- In the area of Manguo Pond, Marula Estate and other wetlands, initiate work prior to the peak of the Grey-crowned cranes' (EN) breeding season, considered to be in December, to encourage the cranes to nest away from work areas. If nesting activities are detected, consult a local avifauna specialist to determine if and what actions should be taken;
- In the area of the Kinangop grasslands IBA (chainage 26+000 to 35+500), initiate work prior to the Sharpe's longclaw's (EN) breeding season which is known to be from March to June, from September to October and in December (Tyler, 2004), to encourage the Sharpe's longclaws to nest away from the work areas. If nesting activities are detected, consult a local avifauna specialist to determine if and what actions should be taken.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on birds are assessed in Table 8-47.

Table 8-47 Determination of the Project's Residual Impacts on Birds

Assessment and Justification of Residual Impacts	The proposed mitigation measures will reduce the level of disturbance of birds during construction and avoid important impacts on breading. The intensity is thus reduced to low, the geographic extent remains local, and the duration is short term, resulting in a minor magnitude of impacts.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts on birds during the operation phase is the:

- Presence of new infrastructures and use of the highway.

During operation, artificial lighting and noise are likely to lead to habitat degradation for birds. A recent study has demonstrated that there is unequivocal evidence that noise is one of the factors responsible for the road-effect zone on birds (McClure, Christopher J. W. et al. 2013). Vehicle noise has been shown to interfere with communication essential for reproduction. An increase in traffic noise may impact the birds' ability to maintain territories, attract mates and maintain pair bonds and possibly lead to a decrease in mating success (Parris and Schneider 2008). The noise impacts of the existing highway are likely high because of the frequent need for vehicles to slow down and rapidly accelerate to overtake slow vehicles. The need for repeated breaking and accelerating will be reduced after duplication.

Artificial light sources may disorient night flying species including birds. The impacts of the proposed highway upgrade from lighting are expected to be minimal because street lighting is not planned in areas where the highway passes through important wildlife habitat.

Bird species are in general highly mobile and therefore less severely impacted by the presence of roads. High mortality caused by ongoing traffic and moving vehicles is more likely to occur at newly constructed roads, and less so on established roads since residing bird populations tend to become accustomed to impacts that are in general deterministic (predictable). Terrestrial bird species, such as the secretarybird or the Southern Ground-hornbill are probably more at risk to vehicle collisions and may suffer more from barrier effect of the road.

Raptor species and other scavengers are often attracted to the carrion left on roadsides, although if sufficiently mobile and able to avoid vehicles, these species may experience a net benefit from increased food availability (Fahrig & Rytwinski, 2009).

Table 8-48 summarizes the anticipated impacts and presents the impact assessment for birds.

Table 8-48 Impact Assessment for Birds

Assessment of Pre-mitigation Impact	The intensity of impacts on birds is deemed medium because although expected impacts on birds during the operation phase including disturbance, habitat avoidance, collision risks are important, the existing road already affects the local bird communities in a similar way. The increased barrier effect will mostly affect terrestrial bird species. The extent of the impact is local and the duration long-term. The magnitude of impacts is moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1).

SPECIFIC MEASURES

- Regularly remove litter and collision carcasses to avoid attracting scavengers to the road;
- Implement proposed Wildlife Crossing Structures, including land bridges and bridge underpasses as provided in the Wildlife Mitigation Report in Appendix 8-2. These types of Wildlife Crossing Structures are likely to be used by birds with strong terrestrial behaviour;
- Implement a roadkill monitoring program and identify adaptive management measures if roadkill hotspots are documented.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on birds are assessed in Table 8-49.

Table 8-49 Determination of the Project's Residual Impacts on Birds

Assessment and Justification of Residual Impacts	The mitigation will further reduce the intensity of the impacts which will be reduced to low. The extent of the impact remains local, and the duration remains long-term. The magnitude of impacts remains moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.2.2.2 REPTILES AND AMPHIBIANS

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impact for reptiles and amphibians include:

- Implementation of temporary construction facilities;
- Transportation and circulation;
- Site preparation;
- Use of borrow pits and quarries;
- Drainage and stormwater management;
- Structural work.

Much of the existing roadside habitat is in a degraded state with little to no ecological value. However, several nodes exist with habitat features that are of some ecological value and currently being utilised by reptiles and amphibians despite being situated immediately adjacent to a high-traffic road. These include roadside rocky ridges, trees, hedges, bush clumps, rivers and streams, flooded terrain that forms seasonal wetlands (e.g., ditches and other excavations), etc. Some of the existing roadside habitat will be lost or transformed during construction work. The loss of these roadside habitat units will impact the existing populations of lizards, snakes and frogs at a local scale.

In addition, road-construction activities can potentially contaminate terrestrial and wetland habitat. Seasonal wetlands in particular are prone to chemical pollution and siltation events. Although most of the amphibian fauna in this region are within the terrestrial guild, their tadpoles are sensitive to wetland contamination or siltation events. Likewise, aquatic pipid frogs (i.e., *Xenopus* spp.) and frogs that associate strongly with wetland fringes (e.g. *Amietia* spp.) are also at risk of chemical contamination events.

Finally, reptiles and amphibians can be killed during the earthwork activities.

Table 8-50 summarizes the anticipated impacts and presents the impact assessment for reptiles and amphibians.

Table 8-50 Impact Assessment for Reptiles and Amphibians

Assessment of Pre-mitigation Impact	Construction work within the road reserve can lead to the permanent and temporary loss of some herpetofauna habitat on the roadsides. Amphibians are sensitive to pollution of wetlands and water contamination that may be caused by construction work. The intensity of the impact is judged Medium and the extent is limited. Although some losses will be permanent, most impacts will be limited to the construction period, hence the duration is medium-term. Consequently, the magnitude of the impact is considered moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1);
- No hunting by the contractor’s crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor’s crew will not be permitted.

SPECIFIC MEASURES

- Implement a procedure for vegetation clearing based on detailed maps of presence of natural habitat and critical habitat, pre-construction ground-truthing walkover surveys, marking off specific areas prior to clearing, and monitoring for compliance;
- The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities shall identify small patches of habitat important to herpetofauna, including roadside rocky ridges, hedges, bush clumps and flooded terrain that forms seasonal wetlands without affecting local stakeholders. These areas to be avoided as much as possible, especially when located at the limit of the road work site. Areas to be preserved must be marked-off and staff and contractors must be formally made aware that these areas are not to be destroyed;
- Establish a wildlife crossing technical committee, to develop a monitoring and evaluation program of the rate of use of crossing structures and their effectiveness at achieving population outcomes for wildlife. The composition as well as the objectives of this committee as well as the monitoring and evaluation program to be develop should align with orientations provided in chapter 6 of Appendix 8-2.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project’s residual impacts on reptiles and amphibians are assessed in Table 8-51.

Table 8-51 Determination of the Project's Residual Impacts on Reptiles and Amphibians

Assessment and Justification of Residual Impacts	The protection of some of the existing herpetofauna habitats within the road reserve will reduce the intensity of the impact to low and limit the geographical extent of impacts on reptiles and amphibians. The duration is still medium-term and the magnitude of the residual impact is thus minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impacts on reptiles and amphibians during the operation phase are the:

- Presence of new infrastructures and use of the highway;
- Routine maintenance activities, particularly those related to inspection and cleaning watercourses crossing and drainage infrastructure, may cause temporary perturbations (people walking in the water or machinery removing material/wastes causing obstruction) may disturb normal reptile and amphibian activities using water courses and drainage ditches.

The most relevant negative impacts of the operational phase are on-road mortalities and barrier effect. The most severe of the negative impacts is mortalities of specimens that are killed by vehicular traffic when trying to cross the highway. The intensity of these mortalities differs between faunal groups and between specific sites. Some reptiles are slow-moving (e.g., tortoises, chameleons, thread snakes) and are thus more susceptible to getting killed when crossing roads. Frog mortalities can be particularly severe in scenarios where breeding individuals make annual migrations to the wetlands and when newly metamorphosed froglets disperse away from the wetlands. The species composition of road-mortality victims differs between day and night, due to the stratification of diurnal and nocturnal species. Amphibians and reptiles may be attracted to warm or wet roads and problems arise when they must cross the road in their annual migration to access different habitats on opposite sides of the road. This group shows the greatest negative effect from roads due to their relative lack of mobility and low car avoidance behaviour.

Intense vehicular traffic can create a deterrent that may dissuade individuals from crossing a road, and thus creating a barrier between populations on each side of the road. The dualling of the A8 Highway is likely to increase habitat fragmentation and reduce connectivity for reptiles and amphibians due to:

- An increase in the number and speed of vehicles, including trucks;
- An increase in the width of the gap between habitat on opposite sides of the road;
- An increase in the levels of noise, light and chemical pollution;
- The inclusion of a physical barrier between the two carriageways, which prevents many small and medium-sized animals from traversing.

Finally, inspection and cleaning of water crossing and drainage infrastructure may affect normal activities or species living in or near water.

Table 8-52 summarizes the anticipated impacts and presents the impact assessment for reptiles and amphibians.

Table 8-52 Impact Assessment for Reptiles and Amphibians

Assessment of Pre-mitigation Impact	The herpetofauna is already affected by barrier effect and on-road mortalities from the existing road. The enlargement of the road and higher traffic will increase the intensity of these impacts. The intensity of this increase is medium. The effects will be felt along the road and in the surrounding habitats, hence the geographical extent is local. The duration is long-term because it will last throughout the project's lifetime and beyond. As for perturbation the impact magnitude is moderate. As for the perturbation of herpetofauna activities due to inspection and cleaning of watercourse and drainage infrastructures, the anticipated impact is low because of the localized interventions. The extent will thus be limited and duration short-term for a minor impact magnitude.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ **Low**	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ **Minor**	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1).

SPECIFIC MEASURES

- Implement proposed Wildlife Crossing Structure, including land bridges, bridge underpasses, dedicated culverts, multi-use culverts and canopy bridges (for arboreal reptiles) as provided in the Wildlife Mitigation Report in Appendix 8-2. All these types of Wildlife Crossing Structures are likely to be used by reptiles and amphibians. Maintain the wildlife crossing technical committee established during the construction phase (see sections above) in operation for a period of five to 10 years to implement the previously developed monitoring and evaluation program of the wildlife crossing structures, as per orientations provided in chapter 6 of Appendix 8-2;
- As part of the BAP, identify habitat features important to herpetofauna to identify likely sensitive crossing locations for priority species;
- Implement a roadkill monitoring program and identify adaptive management measures if roadkill hotspots are documented.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on reptiles and amphibians are assessed in Table 8-53.

Table 8-53 Determination of the Project's Residual Impacts on Reptiles and Amphibians

Assessment and Justification of Residual Impacts	The mitigation measures should reduce barrier effect and collision risks. The intensity of the impact is reduced to low. The geographical extent and duration remain the same. The magnitude of the residual impacts is moderate. As for the magnitude of the impact associated with the inspection and cleaning of the water crossing and drainage structure, it remains minor with a low intensity, limited extent and short-term duration.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

8.2.2.3 SMALL MAMMALS

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impact for small mammals include:

- Implementation of temporary construction facilities;
- Transportation and circulation;
- Site preparation;
- Use of borrow pits and quarries;
- Presence of workers and influx of job seekers.

As mentioned before, much of the existing roadside habitats are in a degraded state with little to no ecological value. However, these can still be used by some common small mammal species. The loss of some roadside habitat by the road enlargement along Highway A8 will potentially affect the existing populations of small mammals in the area. Particular attention should be given to the small mammal species that are limited to the montane forest areas, such as the Kinale and the Koibatek Forests. Any loss or degradation in these habitats could affect these potentially present forest species. (Mount Kenya Wood Mouse (*Hylomyscus endorobae*), Kerbis-Peterhan's Wood Mouse (*Hylomyscus kerbispeterhansi*) and *Sylvisorex granti*.

Small mammals could suffer mortality from construction traffic and earthwork activities. Also, the presence of workers and influx of job seekers may increase hunting pressure on some small mammal species, although this should be limited as hunting is illegal.

Table 8-54 summarizes the anticipated impacts and presents the impact assessment for small mammals.

Table 8-54 Impact Assessment for Small Mammals

Assessment of Pre-mitigation Impact	Construction work within the road reserve can lead to the permanent and temporary loss of some small mammal habitat on the roadsides. The intensity of the impact is judged Medium. The extent is however limited. Although some losses will be permanent, most impacts will be limited to the construction period, hence the duration is medium-term. Consequently, the magnitude of the impact is considered moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1).
- No hunting by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted.

SPECIFIC MEASURES

- Implement a procedure for vegetation clearing based on detailed maps of presence of natural habitat and critical habitat, pre-construction ground-truthing walkover surveys, marking off specific areas prior to clearing, and monitoring for compliance;
- The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities shall identify small patches of habitat important to small mammals, including clumps of trees, hedges and bush clumps. These areas to be avoided as much as possible, especially when located at the limit of the road work site. Areas to be preserved must be marked-off and staff and contractors must be formally made aware that these areas are not to be destroyed;
- Where the road crosses the Forest Reserves (Koibatek and Kinale) ensure that all temporary works remain within the road reserve and that no encroachment is made in the Forest Reserves. If encroachment is inevitable, an adequate compensation for lost habitat shall be developed with KFS.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on small mammals are assessed in Table 8-55.

Table 8-55 Determination of the Project's Residual Impacts on Small Mammals

Assessment and Justification of Residual Impacts	The mitigation measures will avoid some small mammal habitat loss. The intensity of the impact is reduced to low. The extent remains limited and the duration is medium-term. The resulting magnitude of the residual impact is minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts on small mammals during the operation phase is the:

- Presence of new infrastructures and use of the highway

The main anticipated effects on small mammals will be barrier effect and road mortality.

Small mammals are generally less affected by barrier effect than larger mammals, with impacts increasing with size in mammals and size of movement range and depending on whether their predators have been affected (Fahrig & Rytwinski 2009). It has been shown roads can strongly prevent crossing movements of some small mammal species, with wider roads having more negative effects on crossing rates (Rico et *al*., 2007). Studies also demonstrate that small mammals mostly avoid the road itself, and that this is not associated with emissions such as noise from the traffic on the roads. The dualling of the A8 Highway is likely to increase habitat fragmentation and reduce connectivity for small mammals because of :

- An increase in the number and speed of vehicles, including trucks;
- An increase in the width of the gap between habitat on opposite sides of the road;
- An increase in the levels of noise, light and chemical pollution (for some species);
- The inclusion of physical barriers between the two carriageways, which prevents many small and medium-sized animals from traversing.

A risk of mortality also exists for small mammals crossing the road. The higher traffic rates that will come with the Highway can increase small mammal mortality rates.

Finally, the presence of the Highway may lead to population growth in the area. This, in combination with easier access can lead to increased hunting pressure on some small mammal species, although hunting is an illegal activity. The access that the existing highway provides for poaching and hunting is already substantial, and the increased risk of additional hunting pressure is expected to be low.

Table 8-56 summarizes the anticipated impacts and presents the impact assessment for small mammals.

Table 8-56 Impact Assessment for Small Mammals

Assessment of Pre-mitigation Impact	Small mammals are already affected by barrier effect and on-road mortalities from the existing road. The enlargement of the road and higher traffic will increase the intensity of these impacts. The intensity of this increase is medium. The effects will be felt along the road and in the surrounding habitats, hence the geographical extent is local. The duration is long-term because it will last throughout the project's lifetime and beyond. The impact magnitude is moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1).

SPECIFIC MEASURES

- Implement proposed Wildlife Crossing Structure, including land bridges, bridge underpasses, dedicated culverts, multi-use culverts and canopy bridges as provided in the Wildlife Mitigation Report in Appendix 8-2. All these types of Wildlife Crossing Structures are likely to be used by small mammals.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on small mammals are assessed in Table 8-57.

Table 8-57 Determination of the Project's Residual Impacts on Small Mammals

Assessment and Justification of Residual Impacts	The mitigation measures should reduce barrier effect and collision risks for small mammals. The intensity of the impact is reduced to low. The geographical extent and duration remain the same. The magnitude of the residual impacts is moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ Medium-Term	☒ **Long-Term**
Magnitude	☐ **Minor**	☒ **Moderate**	☐ Major

8.2.2.4 LARGE MAMMALS

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impact for large mammals include:

- Implementation of temporary construction facilities;
- Transportation and circulation;
- Site preparation;
- Use of borrow pits and quarries;
- Presence of workers and influx of job seekers.

For large mammals, particular attention should be given to the Marula Estate and Soysambu conservancy, which are crossed by the A8 highway and show high concentration of these large mammals. Any loss or degradation of habitats in these areas could have a significant impact on these species.

Noise and vibration from construction activities will cause some large mammals to flee and avoid the areas near construction work. The noise from road construction can be stressful, eliciting a physiological stress response, with some animals temporarily or permanently moving away from the noise.

Machinery and vehicle collisions with fauna during construction could lead to occasional mortality of mammals, and may occur during vehicle movements within the study area. This is unlikely to be a substantial risk as construction speed limits would be low.

The presence of workers and influx of job seekers may increase hunting pressure on large mammal species, although this should be limited as hunting is illegal.

Table 8-58 summarizes the anticipated impacts and presents the impact assessment for large mammals.

Table 8-58 Impact Assessment for Large Mammals

Assessment of Pre-mitigation Impact	The loss of large mammal habitat from construction is minimal, however, some species will be disturbed by construction noise. For this reason, the intensity of impact is medium and the extent is local. The impacts will be mostly limited to the construction period, hence the duration is short-term. Consequently, the magnitude of the impact is considered moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1);

- No hunting by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted.

SPECIFIC MEASURES

- Establish a wildlife crossing technical committee, to develop a monitoring and evaluation program of the rate of use of crossing structures and their effectiveness at achieving population outcomes for wildlife. The composition as well as the objectives of this committee as well as the monitoring and evaluation program to be develop should align with orientations provided in chapter 6 of Appendix 8-2;
- Ensure fencing is maintained around the road during construction in the Marula Estate and Soysambu Conservancy, to avoid animals being injured by construction activities;
- Ensure that the directives of the noise permit to be obtained from NEMA will also be applied in areas of high-quality habitat for wildlife.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on large mammals are assessed in Table 8-59.

Table 8-59 Determination of the Project's Residual Impacts on Large Mammals

Assessment and Justification of Residual Impacts	The mitigation measures will reduce disturbance of large mammals and protect them from collisions during construction. The intensity of the residual impact will be low. The extent will remain local and the duration short-term. The magnitude of the residual impact is considered minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

Roads and traffic can form a barrier or filter to movement for certain species, particularly those that are sensitive to the noise, light and disturbance caused by vehicles. The existing highway is already both a direct and indirect barrier for large mammals in three ways:

- The traffic on the road is of considerable density and often represents a veritable wall of vehicles making crossing perilous, which constitutes a strong repulsive effect for wildlife, even for those that may have become accustomed;
- On certain sections where doubling of the lanes is already in place, the pavement separating flows of traffic blocks mammals from crossing the road (Molo and Nakuru areas);
- The Soysambu Conservancy and Marula Estates conservation areas are housed by fences (both electrified and not) and thus little movement between these areas is possible.

The severity of the barrier or filter effect is likely to increase significantly due to:

- An increase in the number and speed of vehicles, including trucks;
- An increase in the width of the gap between habitat on opposite sides of the road;
- An increase in the levels of noise, light and chemical pollution;
- The inclusion of physical barriers between the two carriageways, which prevents many small and medium-sized animals from traversing.

The concentration of species and particularly ungulates can be observed in three areas: the two conservation areas of Soysambu Conservancy and Marula Estates as well as on the plateau south of Naivasha. These areas are also key habitat zones for many species listed on the IUCN World Red List of Threatened Species. This increase in the barrier effect of the highway will have significant impacts for many species of large mammals.

However, it is important to note that the existing road is already a significant barrier for many species. Furthermore, current connectivity within and among these habitats is also significantly affected by existing fences and other infrastructure. Human pressure in the RAA is very important and few undeveloped areas with good ecological integrity can be found outside protected areas. Hence, connectivity between wildlife population from the two sides of the road is already largely affected and not directly due to the road, but rather to existing land uses that have progressively disrupted assumed historical migration corridors. The remaining populations of large mammals are fenced in (i.e., Soysambu, Marula) or hemmed in (Nakuru National Park, Hell's gate National Parks).

Injury and mortality of wildlife due to collision from vehicles can result in smaller populations, and animal welfare implications.

The existing road already is the stage of wildlife-vehicle collisions (WVC). Although there does not exist any systematic surveys of WVC along the Project, it's a known fact that the injury and mortality of both wildlife and motorists is a relatively common event and results in high rates for some species and locations. The duplication and safety improvements in the design of the highway will result in an increase in both the speed and the volume of vehicles and the rate of WVC is therefore expected to increase after the project is finished. In summary, the risk of WVC and injury or mortality of wildlife along the project is very high. Due to the large body size of many species, the likelihood of injury and fatality of motorists from WVC is similarly high.

Finally, the presence of the highway may lead to population growth in the area. This in combination with easier access can lead to increased hunting pressure on large mammals, although hunting is an illegal activity. The access that the existing highway provides for poaching and hunting is already substantial, and the increased risk of additional hunting pressure is expected to be low.

Table 8-60 summarizes the anticipated impacts and presents the impact assessment for large mammals.

Table 8-60 Impact Assessment for Large Mammals

Assessment of Pre-mitigation Impact	Large mammals in the project area are already affected by barrier effect and on-road mortalities from the existing road. The enlargement of the road and higher traffic will increase the intensity of these impacts. The intensity of this increase is high. Since large mammals can have large home ranges, the barrier effect can affect connectivity of mammal populations at a regional level. The duration is long-term because it will last throughout the project's lifetime and beyond. The impact magnitude is major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☐ Moderate	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures to reduce Noise and Vibrations (section 8.1.2);
- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1).

SPECIFIC MEASURES

- Implement proposed Wildlife Crossing Structure, including land bridges, bridge underpasses, dedicated culverts, multi-use culverts and canopy bridges as provided in the Wildlife Mitigation Report in Appendix 8-2. All these types of Wildlife Crossing Structures are likely to be used by large mammals. Implement wildlife fencing in Marula Estate, with fence jump out options, and in short lengths at all dedicated wildlife crossing structures (see Wildlife Mitigation Report in Appendix 8-2);
- Construct noise and light screens at wildlife crossings and the approaches to the wildlife crossings. This is particularly important at the high priority crossings to enable more sensitive wildlife species to approach and use the crossing structures;
- Apply wildlife-friendly lighting design principles (see Wildlife Mitigation Report in Appendix 8-2);
- Install signage warning drivers of the risk of WVC along the highway in high quality habitat for wildlife (A8 South: Kikuyu Escarpment forest, and area between Maai Maihu and Longonot; A8: Kikuyu Escarpment forest, KWS Training institute, Marula Estate, Soysambu Conservancy, Koibatek Forest);
- Regularly remove litter and collision carcasses to avoid attracting scavengers to the road;
- Maintain the wildlife crossing technical committee established during the construction phase (see sections above) in operation for a period of five to 10 years to implement the previously developed monitoring and evaluation program of the wildlife crossing structures, as per orientations provided in chapter 6 of Appendix 8-2;
- Implement a roadkill monitoring program and identify adaptive management measures if roadkill hotspots are documented.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on large mammals are assessed in Table 8-61.

Table 8-61 Determination of the Project's Residual Impacts on Large Mammals

Assessment and Justification of Residual Impacts	The implementation of adequate crossing structures and fencing along the road is likely to significantly mitigate barrier effect and collision risks from the Highway. The intensity of the impact is reduced to low. The extent and duration remain the same. Overall, the magnitude of the impact on large mammals will be reduced to moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

8.2.3 FRESHWATER ECOLOGY

Assessment of freshwater ecology considers three VECs, aquatic habitat, macroinvertebrates and fish. Since sources of impacts and effects are similar for these three VECs, the impact assessment is the same for all three and is described below.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

The proposed Project includes Pre-Construction and Construction phase activities that may directly affect surface water quality and hydrology and also sources of impacts on freshwater ecology. These include:

- The earthworks associated with the implementation of temporary construction facilities and site preparation activities may result in the deposition of materials in watercourses, possibly obstructing them or affecting the water flow. These works may also modify existing surface water run-off patterns;
- The replacement or implementation of new drainage and stormwater management installations may cause the temporary obstruction or encroachment of watercourses;
- The removal of existing vegetation may encourage soil run-off to watercourses, thus affecting the surface water quality;
- Heavy vehicle, equipment, and machinery traffic on the work sites may disturb surface soils that could be carried by surface water run-off to watercourses, contributing to the modification of surface water quality;
- Temporary stockpiling of granular material or soil may result in increased suspended solids in nearby surface water as part of this material may be carried to watercourses by run-off during rainy periods;
- Work conducted in watercourses for installation of culverts or other infrastructure may encourage soil run-off to watercourses and the resuspension of sediments, thus affecting the surface water quality;
- The cleaning of concrete trucks at work sites may cause the release of contaminants that can be carried by surface water run-off to watercourses;
- Wastewater generated by the concrete mixing plant may cause the degradation of surface water quality;
- Accidental spills or leaks of contaminants potentially directly or indirectly (carried by surface water run-off) reaching surface water.

The freshwater ecology baseline surveys show that the project area’s aquatic habitats are in a moderately to largely transformed state, with an overall low freshwater sensitivity. All fish species identified in the study area are widespread in the Freshwater Ecoregion, with a large component of the community comprising of exotic species. However, the vulnerable snail *Bulinus permembranaceus* known from the Kinangop plateau is potentially present.

During the construction phase, the main impact is related to the suspension of fine particles in aquatic habitat, which can affect both fish communities and macroinvertebrate communities. The magnitude of this impact will largely depend on the magnitude of the anticipated changes in water quality. As mentioned above, many construction activities, including the removal of the vegetation, leveling and earthwork operations and in-water and shore work will result in an increase of sediment runoff and will thus affect fish and their habitats located downstream of construction sites. If the concentration of suspended particles in the water increases considerably, fish may temporarily avoid the area surrounding the work.

Work in streams and rivers could hinder the free movement of fish upstream and downstream from the road. The wrong choice of structure or inadequate installation can present other limitations to the movement of fish. The noise and vibrations generated during the work can also constitute a source of disturbance and / or interference to the movement of fish during the construction period.

Finally, the presence of workers and influx of job seekers may increase fishing pressure on praised fish species.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

Table 8-62 summarizes the anticipated impacts and presents the impact assessment for fish.

Table 8-62 Impact Assessment for Freshwater Ecology (Aquatic habitats, Fish and Macroinvertebrates)

Assessment of Pre-mitigation Impact	Considering the number of pre-construction and construction activities that can affect surface water quality, the intensity of the impact is considered high. The nature of work would likely have a high impact in the area around the road construction, which will dissipate downstream where the extent is local. Generated impacts could be felt during the full construction period (30 months) and therefore would be characterized as having a medium-term duration. Consequently, the magnitude of the impact is considered major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☐ Moderate	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3);
- No fishing by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted.

SPECIFIC MEASURES

- As much as possible, ensure the maintenance of upstream and downstream connectivity for fish during construction works in streams and rivers;
- Restore shores and riverbeds to their pre-existing condition once works are completed.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on fish are assessed in Table 8-63.

Table 8-63 Determination of the Project's Residual Impacts for Freshwater Ecology (Aquatic habitats, Fish and Macroinvertebrates)

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures will reduce the level of contaminants and soils transported to aquatic habitats. The intensity of the residual impact is thus considered medium. However, residual impacts will still be felt at the local scale and for the duration of the Project (medium-term duration). The resulting magnitude of impacts remains moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The sources of impacts that will affect freshwater ecology during the operation phase are the same as those identified for hydrology and surface water quality:

- presence of the new infrastructure and use of the highway by motorized traffic;
- operation and routine maintenance, namely the inspection and cleaning of water crossing and drainage structures.

The use of the new highway and routine maintenance activities can be the cause of accidental spills or leaks of contaminants which could potentially directly or indirectly (carried by surface water run-off) reach aquatic habitat, resulting from:

- accidents occurring on the highways;
- inadequate maintenance of vehicles using the highway and of trucks, machinery, and other motorized equipment used during routine maintenance activities.

Operation and routine maintenance activities may cause temporary perturbations of the water quality of the watercourses during structures inspections (people walking in the waters) or during their cleaning (removal of material/wastes causing obstruction).

Overall, the Project is expected to have a positive impact on current local hydrology as it will improve management of water flowing through the highways' right-of-way or coming from the highways. The connectivity of aquatic habitats and the free movement of aquatic species from one side of the highway to another should be improved by the adequate sizing culverts and drainage structures.

The presence of surface water treatment infrastructure already planned at various sensitive locations reduces the potential contamination of aquatic habitats.

Finally, the presence of the highway may lead to population growth in the area. This in combination with easier access can lead to increased fishing pressure in the area and depletion of some praised species. The access that the existing highway provides fishing is already substantial, and the increased risk of additional fishing pressure is expected to be low.

Table 8-64 summarizes the anticipated impacts and presents the impact assessment for fish.

Table 8-64 Impact Assessment for Freshwater Ecology (Aquatic habitat, Fish and Macroinvertebrates)

Assessment of Pre-mitigation Impact	Considering that the Project is adding water treatment infrastructures where there is currently none and that better culverts and drainage structures will be put in place, the intensity of the impacts on freshwater ecology is considered low. Although the watercourses and wetlands crossed by the project are tributaries to important lakes or have a regional importance, the water treatment facilities to be implemented should limit the extent of the impacts to the local area. The impacts will occur during the whole Operation phase (medium-term). As for the potential perturbations to water quality associated with inspection and cleaning of the water crossing infrastructures, the intensity of the impact is also considered to be low with a local extent. However, the duration will be short-term as the associated work will be very limited in time. The resulting magnitude of both impacts is minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures identified to mitigate impacts on hydrology and water quality (section 8.1.3).

SPECIFIC MEASURES

- Ensure culvert and drainage structures dimensioning allows for connectivity of aquatic habitat.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on fish are assessed in Table 8-65.

Table 8-65 Determination of the Project's Residual Impacts for Freshwater Ecology (Aquatic habitats, Fish and Macroinvertebrates)

Assessment and Justification of Residual Impacts	The proposed mitigation measures will ensure that the negative impact of the Project on freshwater ecology remains low, therefore the intensity remains low. Similarly, the extent of the impacts should only be felt locally and for short period or the whole of the operation phase (short to medium-term). The magnitude of the impact remains minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.2.4 ECOSYSTEM SERVICES

The Ecosystem services analysis (Appendix 6-24) allowed the identification of the Priority Ecosystem Services (PES) based on the following prioritization criteria:

- Level of dependence on the ES - for affected communities and their well-being (Type I) or for Project performance (Type II);
- Interaction with drivers of change on ES (Type I) or with Project operations (Type II);
- Replaceability / Management potential - accessibility and efficiency of a possible alternative to the affected ES.

Based on this analysis, the identified PES are as follows:

- Agricultural potential and production;
- Livestock and forage resources;
- Traditional medicine;
- Water resources;
- Water regulation and erosion control.

They are mainly PES of Type I associated with the provisioning services, confirming that well-being of local communities is profoundly related to natural resource exploitation. Water regulation and erosion control is a major concern for project operations and is thus considered as a PES of Type II as well.

The ES considered as priority by the local communities are agriculture, livestock and water resources. These ES are all part of the PES identified as part of the ES analysis.

Most of these PES intersect with other VECs identified in for the Project. When this is the case, the impact assessment directly refers to other sections of this chapter.

8.2.4.1 AGRICULTURAL POTENTIAL AND PRODUCTION

Assessment of impacts on agricultural potential and production is covered in section 8.3.4.1 on Land-Based Livelihood activities.

8.2.4.2 LIVESTOCK AND FORAGE RESOURCES

Assessment of impacts on livestock and forage resources is covered in section 8.3.4.1 on Land-Based Livelihood activities.

8.2.4.3 TRADITIONAL MEDICINE

The level of dependence on this ecosystem service by local communities was deemed high as traditional medicine is still used a lot among the residents of the study area. Most communities mentioned the use of traditional versus modern medicine as about 50/50. A total of 51 plant species were recorded as medicinal plants along the sections of the proposed Nairobi – Nakuru – Mau Summit Highway. Traditional practitioners make use of locally harvested medicinal plants.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impacts on traditional medicine are those that can potentially impact vegetation and habitat:

- Implementation of temporary construction facilities;
- Site preparation;
- Transportation and circulation;
- Use of borrow pits and quarries;
- Waste and hazardous materials management.

Distribution of medicinal plants is largely affected by the landscape. These are limited due to land degradation that has seen indigenous tree species disappearing from the cropland. Sources of the medicinal plants are mostly in the protected forests (Kinale and Kijabe forests – in Kikuyu Escarpment Forest, Molo, Eburu, and Koibatek forests) managed by KFS and riverine forests traversing farmlands. Since the project is unlikely to affect these environments, the availability of traditional medicine should not be directly affected by the Project's construction.

If encroachment in forests is planned in areas where clearing of vegetation might exceed the existing road reserve or where temporary construction facilities and new borrow pits and quarries will be implemented, this could potentially affect medicinal plants.

Table 8-66 summarizes the anticipated impacts and presents the impact assessment for ecosystem services.

Table 8-66 Impact Assessment for Traditional Medicine

Assessment of Pre-mitigation Impact	Overall, the loss of traditional medicine resources is expected to be low as the route is an existing road that runs through already modified or transformed habitat. The intensity of the impact is considered low. Since potential impacts will be very localized, in specific sites, the geographical extent is considered limited. The potential loss of plants used for traditional medicine will last throughout the project lifetime and is thus long term. Consequently, the magnitude of the impact is considered minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures identified to mitigate impacts on habitat and flora (section 8.2.1).

SPECIFIC MEASURES

- Where the road crosses the Forest Reserves (Koibatek and Kinale) ensure that all temporary works remain within the road reserve and that no encroachment is made in the Forest Reserves. If encroachment is inevitable, an adequate compensation for lost habitat shall be developed with KFS;
- Conduct a pre-construction walkover tree survey within the road reserve, quarry sites and other temporary construction facilities to determine if trees used in traditional medicine are present. The species most frequently mentioned for their medicinal use are *Prunus africana*. *Warburgia ugandensis*, *Azadirachta indica* and *Aloe* species. Mark and leave undisturbed to the extent feasible;
- If loss of traditional medicine trees is not avoidable, undertake compensatory plantations either along the project corridor or at places identified by the KFS, in order to compensate for the loss of medicinal plants.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on ecosystem services are assessed in Table 8-67.

Table 8-67 Determination of the Project's Residual Impacts on Traditional Medicine

Assessment and Justification of Residual Impacts	The preservation of traditional medicine plants during construction or the compensation plantation of these species will reduce the intensity of the impact. The assessment of residual impact remains the same and the magnitude of impact is minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase is the presence of new infrastructures and the use of the highway.

Medicinal plants will mainly suffer from indirect impact of the road upgrade, which will lead to increased accessibility to the project area and spur changes in local land use. This can lead to the conversion of natural areas to residential areas, pasture or cropland. Opportunities provided by improved road access between Rironi and Mau Summit, will result in increased traffic and settlement opportunities along the road. Additionally, many jobseekers will be attracted to the area together with their families in the hope of finding employment. The influx will further attract traders, their employees and families and the net result will be an increase in the number of people living in the area and of land conversion. The population growth and easier access can further lead to increased pressure on the natural resources of the area, which can cause habitat degradation and depletion of some use-value flora species, such as medicinal plants. The induced access might increase the harvesting pressure on these resources.

Table 8-68 summarizes the anticipated impacts and presents the impact assessment for ecosystem services.

Table 8-68 Impact Assessment for Traditional Medicine

Assessment of Pre-mitigation Impact	Induced access and population growth are indirect impacts of the project that may cause habitat degradation and increase harvesting pressure on medicinal plant species. The intensity is deemed to be medium, and the extent is local. The duration will be long-term which leads to a moderate magnitude.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

SPECIFIC MEASURES

– Collaborate with KFS and KWS to identify protection measures in case degradation of habitats or land-use changes are observed in relation to the road development in forest reserves or protected areas along the Highway.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on ecosystem services are assessed in Table 8-69.

Table 8-69 Determination of the Project's Residual Impacts on Traditional Medicine

Assessment and Justification of Residual Impacts	Implementation of the proposed mitigation measures should help to protect sensitive habitats in forest reserves or protected areas and thus help preserve traditional medicine resources. The intensity of the residual will be reduced to low and the geographical extent will be limited, thus resulting in a minor magnitude of impacts.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.2.4.4 WATER RESOURCES

Assessment of impacts on water resources is covered in section 8.1.3 on water resources.

8.2.4.5 WATER REGULATION AND EROSION CONTROL

Assessment of impacts on water regulation and erosion control are covered in section 8.1.3 on water resources and section 8.1.4 on soil and sediments.

8.3 HUMAN ENVIRONMENT

This subsection describes the effects on the human environment VECs.

8.3.1 LAND DEVELOPMENT, USE AND OCCUPATION

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

The Project, as defined in Chapter 4 of this ESIA, has very little effect on the land development, use and occupation VEC. Indeed, almost all activities associated with the pre-construction and construction will be held inside an existing right-of-way which had already been acquired by KeNHA. They are also in the process of completing the implementation of a resettlement action plan for landowners and those people who were present or using the acquired land.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

Considering the information above and the information presented about the project in Chapters 3 and 4, the main potential sources of impacts for this VEC are associated with:

- Opening of new quarry sites (2) for the supply of the granular material required by the Project. The concerned land will be leased and not acquired. Note that a third quarry will also be used, but it is an existing site already in operation;
- The installation of five work bases including storage areas, office space and some concrete prefabrication activities. Three of these sites will be located within the selected quarry sites and the other two correspond to lease existing commercial or industrial sites.

Ensure that rented land is rehabilitated, after work is completed, as per agreement with owner and, if any, Kenyan regulatory requirements. Although at this time there is no need for any additional land acquisition, any such unforeseen acquisition will be dealt through a direct request from RVH to KeNHA whom will be responsible of managing the requirement through their existing resettlement action plan.

Table 8-70 summarizes the anticipated impacts and presents the impact assessment for population and land tenure.

Table 8-70 Impact Assessment for Land Development, Use and Occupation

Assessment of Pre-mitigation Impact	Considering that only a very limited area of leased land will be required in association with the new quarries, and that they will be located immediately close to the existing Project’s right-of-way, it will be easily compensated and avoid land fragmentation. The anticipated impact intensity is considered low. The extent will be on land around and near the existing right-of-way so it will be local, while duration will be medium-term for leased land. The magnitude of the impact will be minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure that rented land is rehabilitated, after work is completed, as per agreement with owner and, if any, Kenyan regulatory requirements.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on population and land tenure are assessed in Table 8-71.

Table 8-71 Determination of the Project's Residual Impacts on Land Development, Use and Occupation

Assessment and Justification of Residual Impacts	The rehabilitation as per agreement with owner and/or regulatory requirements will ensure the impact intensity remains low. The duration of impact becomes short-term as compensation will have been completed during the acquisition process. The extent will remain local as acquisition occurs outside the project's existing right-of-way. Residual impact magnitude will then be minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

There is no foreseeable impact on the land use and occupation VEC for the operation phase.

8.3.2 COMMUNITY WELL-BEING AND SAFETY

Well-being is an overarching concept that encompasses physical (e.g., food and shelter, health and safety), relational (e.g., community relations and cohesion, ability to participate in decision-making), and subjective aspects (e.g., the degree of choice in one's situation, sense of identity, culture) (McGregor, 2008). As such, it overlaps to a variable degree with all other human environment VECs. To avoid too much repetition, we list these impacts in the analysis below, but refer to the appropriate section for a detailed description and assessment. Impacts on the physical and biological environment will also impact quality of life, but these are not covered as they are assessed in detail in Sections 8.1 and 8.2 respectively. To facilitate the communication of results, we present our analysis in two parts: (1) the impacts on health and safety, and (2) other aspects of community and individual well-being.

8.3.2.1 HEALTH AND SAFETY

The Project in its current configuration is generally considered as a safety hazard by road authorities, community members, and road users (e.g., motorists, herders, pastoralists, and street vendors) (see Section 6.3.3.1 and Chapter 7). The National Transport and Safety Authority (NTSA) has identified the following factors as contributing to a high number of accidents on specific segments of the highways: blind spots, inadequate or non-existent road signs, poor visibility (wet season, bends, trees, etc.), careless driving or overtaking, excessive speed, and drunk driving. Undesignated bus stops, and unsafe highway crossing by pedestrians, livestock and street vendors also increase accident risk.

IFC Performance 4 requires to *anticipate and avoid adverse impacts on the health and safety of the Affected Community during the project life from both routine and non-routine circumstances*. Although one of the Project's core objectives is to increase safety along its corridor, it also carries some health risk for the surrounding population, all of which are presented below. Avoidance and mitigation measures to minimize these health and safety risks are then presented.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes several Pre-Construction and Construction activities that may affect health and safety:

- Construction workers may be exposed to the risk of injury and health problems (covered in Section 8.3.5);
- Dust and contamination generated by pre-construction and construction activities may affect the health of local communities and road users, especially if they are vulnerable to respiratory issues;
- Pre-construction and construction activities will disrupt circulation by diverting traffic when necessary which may make access to certain key destinations for community and individual health more difficult (covered in Section 8.3.3);
- Increased transportation and circulation, traffic management and the presence of temporary construction facilities and construction work sites may represent a safety risk for work site employees and local workers and residents through the following:
  - Jeopardize the safety of pedestrians (civil or employees) and road users;
  - Increase the risk of vehicle collision with wildlife; and
  - Increase the hazardousness of the highways resulting in more frequent and more serious traffic accidents. Traffic safety prevention is an important element to be managed according to IFC EHS Guidelines.
- Earthworks may produce holes where stagnant water can pool, creating an environment conducive to the proliferation of disease-carrying insects, including dengue and malaria. In Kenya, there are an estimated 3.5 million new clinical cases and 10,700 deaths each year, and those living in western Kenya have an especially high risk of malaria. Dengue is endemic to Kenya. Risk is present year-round with peak transmission occurring during the rainy season. The last outbreak was declared in April 2021 with 1,210 cases reported as of August 20, 2021. Vector-borne disease prevention is an element to be managed according to IFC EHS Guidelines.

- The influx of workers and job seekers carries the following risks:
  - Increased crime in surrounding communities either through crimes directly perpetrated by newcomers (e.g., assault, theft, etc.) or indirectly through their engagement in illicit activities such as drug use and prostitution;
  - Increased transmission of sexually transmitted infections (STIs) and HIV/AIDS; and
  - Becoming a source of communicable diseases. Communicable disease prevention is an element to be managed according to IFC EHS Guidelines.

Table 8-72 summarizes the anticipated impacts and presents the impact assessment for community health and safety.

Table 8-72 Impact Assessment for Community Use of the Highway, Well-Being and Safety

Assessment of Pre-mitigation Impact	The hazardous impact of increased transportation and circulation, traffic management and the presence of temporary construction facilities and construction work sites of the A8 and A8 South are considered to be of medium intensity because they may result in accidents. Indeed, while overall speed is likely to be reduced at certain sections, the presence of the work site and activities and diversion of traffic, may cause distractions resulting in accidents (involving either other road users, workers, pedestrians or wildlife). The extent will be limited to the highways and the impact will last for the duration of construction (medium-term). Considering the seriousness and epidemiology of dengue and malaria, the proliferation of disease-carrying insects is considered to be of high intensity and of local extent. While the consequences of an outbreak on community health and resources could be long-term, the increased risk posed by the Project will only last during the construction phase and is thus considered to be medium-term. Respiratory problems caused by increased dust and contaminants could be of medium intensity; these will be of local extent, and last throughout the construction phase (medium-term). Finally, the risk caused by the influx of workers of increased crime, and prevalence of HIV/AIDS and STIs is of high intensity. The risk that workers become a source of communicable diseases is considered to be of medium intensity as they will not be established in worker camps. The extent of these impacts will be regional as workers may interact with communities and individuals throughout the surrounding counties and social and health problems such as crime and HIV/AIDS and STIs are likely to require resources at the County level. These increased risks posed by the Project will last during the construction phase and are thus considered to be medium-term. Overall, the impact magnitude on this VEC will be moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement soil management measures (dust reduction and contamination) as outlined in Section 8.1.4;
- Implement atmospheric environment mitigation measures (dust reduction and contamination) as outlined in Section 8.1.1;
- Implement mitigation measures for large mammals outlined in Section 8.2.2.4 to limit their crossing of the highway;
- Ensure all drivers working for the project have a valid driver's license, are certified for driving the vehicle they are responsible for, and have successfully followed a recognized driving course covering road safety measures and the importance of sharing the road with pedestrians and other types of vehicles;
- Control driver activities to avoid exceeding normal work shifts and to ensure they have enough rest periods;
- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum safety and traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery are present;
  - Develop and implement specific access routes to and within the work site that are optimized to reduce travel distances by vehicles and machinery and ensure all drivers working for the project are aware of the established routes;
  - Ensure implementing the Traffic management plan as approved by KeNHA, for the transportation of granular material from existing quarries to the work site;
  - Verify with the Ministry of Transport the existing authorized load limits on the various sections of the road network to be used, if any, and enforce compliance;
  - Provide safe and convenient pedestrian paths and crossing points along the road alignment and construction areas, including under and over passes;
  - Ensure installation and maintenance of speed control and traffic control systems at pedestrian crossing areas;
  - Ensure installation and maintenance of appropriate road signs, signals, markings, and other traffic regulation devices related to pedestrian facilities and to regular local and regional vehicular traffic;
  - Around work areas where significant interactions with pedestrians are likely, install barriers and buffer zones to deter pedestrian access to the roadway, and reorient them towards designated crossing points and protect them from potential hazards.
- Develop and implement a strong Code of Conduct detailing the guidelines on expected engagement with local communities and penalties for failure to adhere to regulations, and closely monitor its application and effectiveness. The Code of Conduct should include among others:
  - A strict prohibition of GBV (including harassment, exploitation and abuse) and sexual intercourse with partners younger than 18 years of age (underage sex);
  - The requirement to immediately report any suspected case of GBV or underage sex to construction supervising engineer;
  - A strict prohibition for engaging in illicit or criminal activities.

SPECIFIC MEASURES

- If diversion of traffic is necessary, take into account key locations of health and safety services in planning alternate routes;
- Establish partnerships with social and health services at project level;
- The migrant workers should undergo a pre-hiring and annual medical check up and should be supported to find and obtain adequate treatment if sick. They should also be trained on disease prevention and recognition to avoid spreading;
- Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities to facilitate interactions between workers and communities;
- Avoid the formation of open holes, or ensure these are covered as much as possible, especially during the rainy season;
- During construction, signs announcing known animal crossing areas should be installed to alert drivers;
- If possible, design traffic diversion in a way to prevent or limit overtaking in the most hazardous sections of the highways;
- Propose, when appropriate, specific local measures to increase safety for road sections where vehicles interact with sensitive areas (dense urban areas, roadside markets, etc.). For example, implement temporary signalisation, pedestrian crossing lights, by-passes, etc.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on community health and safety are assessed in Table 8-73.

Table 8-73 Determination of the Project's Residual Impacts on Community Health and Safety

Assessment and Justification of Residual Impacts	Mitigation measures addressing pedestrian safety, animal crossing and preventing overtaking in the most dangerous sections of the highways will reduce the risk and seriousness of accidents, resulting in a reduced impact intensity of medium. The extent will remain limited to the highways and the impact will last for the duration of construction (medium-term). The proposed mitigation measures will also greatly reduce the risk of increased crime, of workers becoming a source of communicable diseases, and increased prevalence of STIs and HIV/AIDS. The intensity of the increase of these risks as a result of the Project is thus considered to be medium to low after mitigation. The extent and duration will remain regional and medium-term. Limiting as much as possible the creation of environments conducive to the proliferation of disease-carrying insects will greatly reduce the risk of spreading diseases. The intensity of the increase of this risk as a result of the Project is thus considered to be medium to low after mitigation. The extent and duration will remain local and medium-term. Limiting dust and contamination as much as possible will reduce the intensity of impact to low intensity, with the extent and duration remaining local and medium-term. Overall, the residual magnitude of impact will range from minor to moderate.		
Direction	☒ Positive	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The Project design including, among others, the doubling of the A8, crossing infrastructures for pedestrians and livestock, as well as dedicated space for non-motorised transportation which will greatly enhance the safety of the A8 and A8 South (see Chapter 4).

- Clearing of vegetation using chemicals could affect the health of local communities and road users;
- Vandalism and theft of road furniture such as signs and posts may pose a safety risk for road users;
- The speed and volume of vehicles are expected to increase during operation of the A8. As a result, the rate of accidents may rise (between cars, with pedestrians and with stray fauna) which can endanger road users' and local community members safety. Traffic safety is an important element to be managed according to IFC EHS Guidelines.

Table 8-74 summarizes the anticipated impacts and presents the impact assessment for community health and safety.

Table 8-74 Impact Assessment for Community Health and Safety

Assessment of Pre-mitigation Impact	The operation phase is mostly characterized by positive impacts on road user and local community members' health and safety with the implementation of the new infrastructures. However the likelihood of injury and fatality of road users and local community members remains high, mainly due to the potential increase in accidents associated with the larger vehicular volume. The extent will be limited to the highway. The increase accident risk posed by the Project will last for the duration of operation and is thus considered to be medium-term. Overall the impact magnitude will be moderate. The use of chemicals could have an impact of medium to high intensity depending on the chemical used and decreasing with the level of exposure (i.e., high if individuals come into direct contact with it by touching and lower if the concentration is diluted with distance). The extent is likely to be limited to local. The duration could vary widely. While health issues could be long-term, especially if there is bioaccumulation due to repeated exposures, the exposure created by the Project will last throughout the operation phase and is thus considered to be medium-term The increased safety risk posed by theft and vandalism is considered to be of medium intensity, limited in extent and medium-term.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☒ **High**
Geographical Extent	☒ **Limited**	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures for large mammal crossings during operation outlined in Section 8.2.2.4;
- Avoid as much possible the use of chemicals for clearing vegetation. Favour manual or mechanical clearing methods.

SPECIFIC MEASURES

- Design safety awareness campaign in collaboration with local administrations and governmental agencies aimed at local populations;
- Monitor the use of pedestrian crossings and conduct specific awareness campaign to encourage their use;

- Insert road use topics amongst the subjects to be covered within the stakeholder engagement plan to increase safety awareness;
- Consider, as much as possible, the likelihood of vandalism and theft when designing road furniture, especially in the most hazardous sections of the highways.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on community use of the highway, well-being and safety are assessed in Table 8-75.

Table 8-75 Determination of the Project's Residual Impacts on Community Use of the Highway, Well-Being and Safety

Assessment and Justification of Residual Impacts	Favoring manual and mechanical methods for clearing vegetation, will reduce the risk of human pesticide contamination. By limiting vandalism and theft to road furniture in the most hazardous sections of the highways, the impact intensity on safety will be reduced to low. It will remain limited in extent and medium-term. The implementation of wildlife mitigation measures (i.e., adequate crossing structures and fencing) and of various safety awareness campaigns should help reduce the risk of accidents. Therefore, the intensity of impact is reduced to medium, with the extent and duration remaining limited and medium-term. Overall, the resulting residual impact for the operation will range from minor to moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

8.3.2.2 OTHER WELL-BEING ASPECTS

This section covers all other aspects to health and safety related to physical, relational and subjective well-being. These include impacts on livelihoods, mobility, community relations and cohesion, and social justice (e.g., inequitable distribution of benefits and increased marginalization of vulnerable groups).

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes several Pre-Construction and Construction activities that may affect other well-being aspects:

- Pre-construction and construction activities will affect the community and the individual well-being by positively (creation of jobs) and negatively (affecting some work activities) impacting livelihoods (covered in Section 8.3.4);
- The population in the vicinity of the Project will be negatively affected by nuisance (such as noise, smell, dust, vibrations, and lights) during pre-construction and construction activities.
- Pre-construction and construction activities will disrupt circulation by:
  - Temporarily preventing pedestrians and livestock from crossing the highways at their preferred locations before over and underpasses are completed which will increase travel time;
  - Temporarily slowing down traffic on certain portions of the A8 and on the A8 South which will increase travel time; and by

- Diverting traffic when necessary which may make access to certain key destinations for community and individual physical, relational and subjective well-being more difficult. These include locations essential to:
  - Livelihoods (see Sections 8.3.4, 8.3.6 and 8.3.7),
  - Sociocultural activities (see Section 8.3.3), and
  - identity and culture (see Sections 8.3.4, 8.3.6, and 8.3.9).

— Pre-construction and construction activities will have differentiated impacts on individual well-being and may negatively affect more those considered vulnerable such as women and Indigenous Peoples (covered in Sections 8.3.7 and 8.3.6 respectively).

— Community relations and cohesion may be degraded by:

- Tensions and conflicts over the awarding of jobs and contracts (Section 8.3.5);
- Increased inequities that risk further marginalizing vulnerable groups (Sections 8.3.6 and 8.3.7); and
- Inadequate communication with communities and stakeholders.

— The influx of workers and job seekers carries the following risks:

- Tensions and conflicts with local communities;
- Increased pressure on local natural resources and services (e.g., social, health, etc.).

Table 8-76 Impact Assessment for Community Well-Being

Assessment of Pre-mitigation Impact	Impacts on livelihoods (such as job creation), gender aspects, Indigenous Peoples, and labour conditions are covered in other sections and are therefore not assessed here. The impact intensity of nuisance will vary from medium to high with distance from the source, will be local in extent, and short-term as construction progresses along the highway. Traffic disruptions may affect access to locations that contribute to livelihoods, social relations, identity, and culture. Their impact is considered to be of medium intensity. They will last for the duration of construction and thus will be medium-term and will have a regional extent as they could have repercussions on activities throughout the adjacent counties. Community relations and cohesion are likely to be most impacted by benefit distribution, especially by those related to employment and compensation. Resulting tensions and conflicts could be medium to high, regional in extent and potentially long-term. The intensity of impacts caused by the influx of workers and job seekers will vary. The intensity is considered low for increased pressure on local resources and services, and medium to high for tensions and conflicts with surrounding communities. The extent of these impacts will be regional as workers may interact with communities and individuals throughout the surrounding counties. Social interactions will last throughout the pre-construction and construction phase (medium-term). Overall, the impact magnitude on this VEC will vary from moderate to major.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☒ **High**
Geographical Extent	☐ **Limited**	☒ **Local**	☒ **Regional**
Duration	☒ **Short-Term**	☒ **Medium-Term**	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement mitigation measures on livelihoods (Section 8.3.4), gender aspects (Section 8.3.7), Indigenous Peoples (Section 8.3.6), and labour conditions (Section 8.3.5).
- Regarding nuisance:
  - Implement noise measures outlined in Section 8.1.2;
  - Implement soil management measures (dust reduction and contamination) as outlined in Section 8.1.4;
  - Implement atmospheric environment mitigation measures (dust reduction and contamination) as outlined in Section 8.1.1;
  - Limit work activities to normal work hours (8 h to 18 h) as much as possible;
  - Respect the noise levels set in the noise permit to be obtained from NEMA when working at night;
  - Ensure the development and implementation of a Waste Management Plan that should allow for safe and quick disposal of waste;
  - After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly stored on site in appropriate containers and regularly disposed off-site by certified companies.
- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum safety and traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery is present;
  - Develop and implement specific access routes to and within the work site that are optimized to reduce travel distances by vehicles and machinery and ensure all drivers working for the project are aware of the established routes;
  - Ensure implementing the Traffic management plan as approved by KeNHA, for the transportation of granular material from existing quarries to the work site;
  - Verify with the Ministry of Transport the existing authorized load limits on the various sections of the road network to be used, if any, and enforce compliance;
  - Provide safe and convenient pedestrian paths and crossing points along the road alignment and construction areas, including under and over passes;
  - Ensure installation and maintenance of speed control and traffic control systems at pedestrian crossing areas;
  - Ensure installation and maintenance of appropriate road signs, signals, markings, and other traffic regulation devices related to pedestrian facilities and to regular local and regional vehicular traffic;
  - Around work areas where significant interactions with pedestrians are likely, install barriers and buffer zones to deter pedestrian access to the roadway, and reorient them towards designated crossing points and protect them from potential hazards.
- As required by IFC Performance 1, develop and implement a Stakeholder Engagement Plan (SEP) to keep communities informed of work site evolution, planned activities and any potential risk that may arise from the work site. The SEP should include, among others, the following components:
  - A list of Project stakeholders derived from the present ESIA, the RAP, information from RAP implementation as well as any other relevant information;
  - Analysis of stakeholder engagement to date;

- Identification of methods of communication and information disclosure for specific groups; and
- Action plan for stakeholder information and engagement during project construction.

— Plan and conduct at least one yearly stakeholder engagement session to inform, in one session, all interested and influential stakeholders on the road/highway activities. Subjects to be covered include a summary of activities held during the last year, upcoming projects, ESMP implementation results, HSE aspects, and a discussion pertaining to the main grievances received and how to resolve them. Some time should be allowed for questions and exchanges.

— Develop and implement a strong Code of Conduct detailing the guidelines on expected engagement with local communities and penalties for failure to adhere to regulations, and closely monitor its application and effectiveness. The Code of Conduct should include among others:

  - A strict prohibition of GBV (including harassment, exploitation and abuse) and sexual intercourse with partners younger than 18 years of age (underage sex);
  - The requirement to immediately report any suspected case of GBV or underage sex to construction supervising engineer;
  - A strict prohibition for engaging in illicit or criminal activities.

SPECIFIC MEASURES

— Maximize the hiring of local labour through the following measures:

  - Apply human resource policies favouring local labour;
  - Implement training programs to build local capacity; and
  - Disclose information on newly created business opportunities.

— Establish partnerships with social and health services at project level.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project’s residual impacts on community well-being are assessed in Table 8-77.

Table 8-77 Determination of the Project's Residual Impacts on Community Well-Being

Assessment and Justification of Residual Impacts	Mitigation measures will greatly reduce the probability and intensity of most impacts. The impact intensity of nuisance will be reduced and vary from low to medium. It will remain local in extent and short-term. Traffic mitigation measures will reduce traffic disruptions, but these will most likely remain of medium intensity, especially on the A8 South. The duration of traffic disruptions and extent will remain unchanged, as they will last for the duration of the Project (medium-term) and potentially affect activities throughout the adjacent counties (regional extent). Ensuring equitable distribution of benefits, including favouring local labour, should avoid the creation of many tensions and conflicts within communities and between communities and outsiders. As a result, the intensity of impact will be reduced and could vary from low to medium. The duration could also be potentially reduced to medium-term, but the extent will remain regional. The impact of the influx of workers and job seekers on local resources and services will remain unchanged (low intensity, regional extent, medium-term duration). As a result, the residual magnitude for all impacts will range from minor to moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☒ **Regional**
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Improved motorised and non-motorised mobility will reduce travel time and thus have positive impacts on livelihoods and on access to services and sociocultural locations, thereby improving all well-being dimensions (physical, relational and subjective);
- The Project design which includes, among others, the addition of crossing infrastructures for pedestrians and livestock, as well as dedicated space for non-motorised transportation will improve mobility and reduce economic losses from livestock fatalities;
- Upgraded roads will reduce damage to vehicles, leading to savings in operation and maintenance costs;
- Nuisance for the population (noise, dust, smell, perceptions of health risks), varying according to distance from the source;
- Routine maintenance activities may temporarily disrupt traffic flow, increasing traveling time.

Table 8-78 summarizes the anticipated impacts and presents the impact assessment for community well-being.

Table 8-78 Impact Assessment for Community Well-Being

Assessment of Pre-mitigation Impact	The operation phase is mostly characterized by positive impacts on mobility which will stimulate the economy and greatly enhance the well-being of users and local communities through improvement of safe crossing points for pedestrians and cattle. The impact intensity of nuisance for the population during operation will vary from low to medium. The extent will be local and the duration medium-term. Traffic disruptions during routine maintenance activities will be of low intensity, short-term and may have a local extent, affecting activities in the areas adjacent to the highway.. Overall, these impacts will range from minor to moderate magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Continue favoring local recruitment for job openings;
- Ensure adequate monitoring of noise levels in sensitive areas;
- Follow-up on nuisance related grievance to promptly identify problem sources and design adapted mitigation measures;
- Extend the stakeholder engagement plan into the Operation phase to cover the entire Project lifecycle as required by IFC PS1. Through its application, communicate job opportunities and application process and initiate discussions on the interaction of local communities with the highway;
- Minimise traffic flow interruptions or disturbances during routine maintenance activities through adequate planning and efficient communication and signalisation.

SPECIFIC MEASURES

- Through the implementation of the Stakeholder engagement plan, engage stakeholders on topics such as cohabitation of communities and the highway which could generate potential improvements.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on community well-being are assessed in Table 8-79.

Table 8-79 Determination of the Project's Residual Impacts on Community Well-Being

Assessment and Justification of Residual Impacts	Mitigation measures will reduce nuisance from the Project, resulting in impact intensity varying from low to medium. The extent will remain local and the duration medium-term. By limiting traffic disruption to a minimum during routine maintenance activities, the intensity will be reduced to low and the duration will be short-term. The extent will remain the same, potentially affecting activities in the areas adjacent to the highway. The implementation of mitigation measures for large mammals should greatly reduce the frequency of collisions, reducing the intensity of economic impacts as well as those on traffic to low. The extent and duration will remain limited and medium-term. Overall, the resulting residual impact for the operation will range from minor to moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

8.3.3 LIVING CONDITIONS, SOCIAL AMENITIES AND COMMUNITY ASSETS

This section assesses two VECs: living conditions, and social amenities and community assets.

8.3.3.1 LIVING CONDITIONS

This component relates to the physical capital that people in the Project area have in terms of housing and equipment and access to services. Except for those that may be resettled, the Project will not directly impact housing conditions, but may influence the housing market. Resettlement and compensation of displacement of houses and economic activities affected by the Project are addressed in the Resettlement Action Plan, managed by KeNHA, and excluded from the scope of the ESIA.

PRE-CONSTRUCTION, CONSTRUCTION AND OPERATION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect living conditions:

- The Project may influence the housing market. Houses located very close to the widened highway may see their house value depreciate, while some others, may see their house value increase as a result of improved transport services. These impacts may begin during the pre-construction and construction phase and continue throughout the operation phase;
- The Project may intensify ongoing land and housing speculation.

Table 8-80 summarizes the anticipated impacts and presents the impact assessment for housing conditions.

Table 8-80 Impact Assessment for Housing Conditions

Assessment of Pre-mitigation Impact	Impacts on the housing market can be both positive and negative, depending on the location of houses relative to the Project. The main negative impacts will be associated with the presence of the highway, which could generate nuisances and imply the closing of existing direct access from adjacent properties, essentially along the A8 since the A8 South maintains its current configuration. For pre-construction and construction activities, these impacts are only temporary and should not affect the long-term value of houses. As for the operation phase, the negative impacts should be no more than medium intensity as the existing A104 road is already a major road with important traffic and associated typical nuisances and because potential access limitations was considered in the design whereas service lanes and slip roads are provided for access. The extent will be local as they will only affect houses very close to the highways, and long-term, resulting in a moderate magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement measures for noise reduction as outlined in Section 8.1.2;
- Ensure that access is provided to connect local roads and properties with current direct access to the A104.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on housing conditions are assessed in Table 8-81.

Table 8-81 Determination of the Project's Residual Impacts on Housing Conditions

Assessment and Justification of Residual Impacts	Noise reduction mitigation measures may reduce the depreciation of houses located very close to the highways by reducing nuisance and, depending on the measures applied (i.e., noise barriers), create a separation between the most exposed houses and the highways. The intensity will thus become low for those with protection and remain medium for others. Other parameters will be unchanged: the extent will remain local and the duration long-term. The residual impact therefore remains moderate for both situations.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

8.3.3.2 SOCIAL AMENITIES AND COMMUNITY ASSETS

There are very few community assets located right beside the right-of-way. Indeed, most schools, health centers, and religious and public spaces tend to be located around 200 meters away from the right-of-way.

As highlighted in Section 6.3.4.2, side dirt roads and paths run parallel to the highways. These, along with crossing infrastructures, are particularly important for pedestrians, non-motorised transport and for community members at large. Side roads and paths are often informal and are mainly located along villages crossed by the highways and sometimes within the road reserve (see Project Atlas for their location).

The Project intends to maintain most informal roads and will significantly ease crossing of the highways by improving and/or building crossing infrastructures. As detailed in Section 4.4.12 planned infrastructures include 120 pedestrian passages and 55 cattle underpasses. As described in Section 4.4.7, a total of 125 km of service lanes is planned along Highway A8 and a total of 13 km along the A8 South. Service Lanes will be positioned in urban areas along the Project roads and in rural areas as to maintain access with local roads. In rural areas, an earth shoulder is planned on the outer edge of the service lane. In urban/built-up areas, consistent with the available road reserve and when it will be possible, a larger 3 m cycle track/footpath is planned except along the Nakuru crossing where the footpath width is reduced to 1.5 m to minimise the impact on parcels and buildings.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect social amenities and community assets:

- Some informal roads may be inaccessible during the following pre-construction and construction activities:
  - Implementation of temporary construction facilities;
  - Site preparation;
  - Use of borrow pits and quarries;
  - Structural work;
  - Base layer and pavement work; and
  - Road furniture work.
- Lack of access to informal roads will interfere with non-motorised travel patterns which will affect more vulnerable groups such as women, youth and the poor;
- Lack of access to informal roads and traffic diversions may make access to social amenities located beside or near the highways more difficult.

Table 8-82 summarizes the anticipated impacts and presents the impact assessment for social amenities and community assets.

Table 8-82 Impact Assessment for Social Amenities and Community Assets

Assessment of Pre-mitigation Impact	Lack of access to informal roads has the potential of affecting the travel of users without access to motorised vehicles (who tend to be over-represented by vulnerable groups). As this impact will interfere with their daily activities such as attending school, commuting to work or running errands, the intensity is considered to be medium. However, lack of access to informal roads and traffic diversions may make access to some critical social amenities such as a health center more difficult, in which case the impact intensity would be high. The impact will be felt at the local scale by surrounding communities and will be short-term, occurring only during certain moments of the pre-construction and construction phase. As a result, the impact magnitude is moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery is present;
  - Optimize transport routes to reduce travel distances by vehicles and machinery.

SPECIFIC MEASURES

- Avoid locating borrow pits and quarries in the path of informal roads. If necessary, in those areas, ensure as much as possible a detour for non-motorised vehicles;
- If diversion of traffic is necessary, take into account key location of important social amenities and pay special attention to those used by vulnerable groups (e.g., schools and health centers) in planning alternate routes.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on social amenities and community assets are assessed in Table 8-83.

Table 8-83 Determination of the Project's Residual Impacts on Social Amenities and Community Assets

Assessment and Justification of Residual Impacts	Mitigation measures will ensure that access to important social amenities used by vulnerable groups is maintained and will minimize the interference with non-motorised transportation. As such they will reduce the impact intensity from high to low. The extent will remain local and the duration short-term. The residual impact magnitude is therefore minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impact during the operation phase includes:

- The Project will provide footpath trough the implementation of new service lanes with sideroads, and ease crossing of the highways through numerous pedestrians and cattle passages. This will improve non-motorised transport and access to social amenities located beside or near the Project.
- Routine maintenance activities may temporarily interfere with non-motorised transportation and disrupt traffic flow, increasing traveling time.

Table 8-84 summarizes the anticipated impacts and presents the impact assessment for social amenities and community assets.

Table 8-84 Impact Assessment for Social Amenities and Community Assets

Assessment of Pre-mitigation Impact	Impacts during the operation phase will be mostly positive by improving non-motorised transportation and access to social amenities. Traffic disruptions (motorised and non-motorised) during routine maintenance activities will be of low intensity, short-term and may have a local extent. Together, these impacts will have a moderate magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Minimise traffic flow interruptions or disturbances during routine maintenance activities through adequate planning and efficient communication and signalisation.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project’s residual impacts on social amenities and community assets are assessed in Table 8-85.

Table 8-85 Determination of the Project’s Residual Impacts on Social Amenities and Community Assets

Assessment and Justification of Residual Impacts	Limiting traffic disruption to a minimum during routine maintenance activities will ensure that the impact intensity remains low. The duration will remain short-term and the extent local. The residual impact will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.4 LIVELIHOOD STRATEGIES AND ECONOMIC ACTIVITIES

Assessment of livelihood strategies and economic activities considers six VECs, land-based livelihood activities, self-employed and business-based livelihood, fisheries (water-based livelihoods), industry (large-scale economic activities), transport sector, and tourism and recreational activities.

8.3.4.1 LAND-BASED LIVELIHOOD ACTIVITIES

As described in Section 6.3.5.1, land-based livelihoods comprise subsistence and commercial agriculture (industrial (cash) crops and horticulture crops (food and flower)), livestock, and agroforestry and forest.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect land-based livelihood activities:

- Agricultural crops and livestock near the highways may be negatively affected by dust, particles and pollution generated by the following activities:
  - Implementation of temporary construction facilities;
  - Transportation and circulation;
  - Site preparation;
  - Use of borrow pits and quarries;
  - Structural work;
  - Base layer and pavement work;
  - Waste and hazardous materials management.
- The use of additional land for borrow pits and quarries may reduce the land available for agriculture, livestock, and agroforestry and forests. Land for two additional quarry sites will be leased and not acquired, but the exact area required has not been established at this time. Note that a third quarry will also be used, but it is an existing site already in operation.
- Disruption of traffic by:
  - Temporarily slowing down traffic on certain portions of the A8 and on the A8 South which will increase travel time to sell products; and by
  - Diverting traffic when necessary which may make access to economic outlets such as markets, agro-processing facilities and slaughterhouses more difficult.

Table 8-86 summarizes the anticipated impacts and presents the impact assessment for land-based livelihood activities.

Table 8-86 Impact Assessment for Land-Based Livelihood Activities

Assessment of Pre-mitigation Impact	Impacts related to dust and pollution will likely be of low intensity, limited in extent and short-term, unless there is a major spill. However, the use of borrow pits and quarries and traffic disruptions have the potential to have a medium impact on economic returns of affected people. These impacts will be medium-term as they will last for the duration of construction. Traffic disruptions will have a regional extent as they have the potential to affect economic activities throughout the adjacent counties. As a result, the impact magnitude is moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement soil management measures (dust reduction and contamination) as outlined in Section 8.1.4;
- Implement atmospheric environment mitigation measures (dust reduction and contamination) as outlined in Section 8.1.1;
- Implement surface and groundwater quality mitigation measures (Sections 8.1.3.2 and 8.1.3.3);
- Ensure the development of a strong Environmental Management Plan, including but not limited to, site assessment requirements prior to disturbances, a spill prevention and response plan, and a waste management plan;
- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery are present;
  - Optimize transport routes to reduce travel distances by vehicles and machinery.

SPECIFIC MEASURES

- Avoid locating borrow pits and quarries on agricultural and livestock lands and in forested areas and respect the official agreement with the landowner with regards to site rehabilitation once work is completed;
- If diversion of traffic is necessary, take into account key location of land-based activities and their access to markets and local businesses in planning alternate routes.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on land-based livelihood activities are assessed in Table 8-87.

Table 8-87 Determination of the Project's Residual Impacts on Land-Based Livelihood Activities

Assessment and Justification of Residual Impacts	Mitigation measures will ensure that impacts related to dust and pollution remain of low intensity, limited in extent and short-term. Avoiding locating borrow pits and quarries on agricultural and livestock lands and in forested areas has the potential to eliminate this impact. However, their location is uncertain at this point in time, the risk remains with the same potential impacts (medium intensity, medium-term, local extent). Traffic mitigation measures will reduce traffic disruptions, but these will most likely remain of medium intensity, especially on the A8 South. The duration of traffic disruptions and extent will remain unchanged, as they will last for the duration of the Project and potentially affect economic activities throughout the adjacent counties. As a result, the impact magnitude remains moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Upgraded highways will have positive impacts on land-based livelihood by improving access to agro-processing industries, markets, slaughterhouses and other relevant outlets for local produce;
- As described in section 8.1.1, model results show a reduction in air emissions for both the A8 South and A8 during the operation phase of the Project. Therefore, there are no anticipated impacts on agricultural species;
- Routine maintenance activities may temporarily disrupt traffic flow, increasing commuting time.

Table 8-88 summarizes the anticipated impacts and presents the impact assessment for land-based livelihood activities.

Table 8-88 Impact Assessment for Land-Based Livelihood Activities

Assessment of Pre-mitigation Impact	Impacts during the operation phase will be mostly positive by improving the flow of goods and services on a regional scale for land-based economic activities. Traffic disruptions due to routine maintenance will be of low intensity, short-term and may have a local extent, affecting economic activities in areas adjacent to the highway. Together, these impacts will have a minor magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

No measures are proposed.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on land-based livelihood activities are assessed in Table 8-89.

Table 8-89 Determination of the Project's Residual Impacts on Land-Based Livelihood Activities

Assessment and Justification of Residual Impacts	Limiting traffic disruption to a minimum during routine maintenance activities will ensure that the impact intensity remains low. The duration will remain short-term and the extent local. Together, the resulting impact for the operation phase after mitigation will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.4.2 SELF-EMPLOYED AND BUSINESS-BASED LIVELIHOOD

Self-employed and business-based livelihoods consist of micro, small and medium enterprises (MSMEs). The great majority in the Project area employ fewer than 10 employees (micro size), are unlicensed, and operate in the wholesale and retail sectors. The Project will have the greatest impact on moving and non-moving street vendors selling directly in or encroaching on the RoW, and on shop tenants in the vicinity of the highways. Personal characteristics and data related to the significance of the highway for street vendors and shops are detailed in Section 6.3.5.2.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

Some shops will be displaced by the Project, but their relocation and compensation have already been addressed in the Resettlement Action Plan and thus not covered here. The main impacts of pre-construction and construction activities on self-employed and business-based livelihoods relate to employment opportunities, temporary displacement of street vendors, and disruption to traffic affecting connections to suppliers and the flow of clients to shops.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect self-employed and business-based livelihood:

- Pre-construction and construction activities will provide various employment opportunities which can lower unemployment rates in the region, especially among youth;
- Purchase of materials, goods, and services may create some employment and business opportunities, including for the *Jua Kali* sector;
- The presence of workers and influx of job seekers may increase the sales of local businesses;
- Disruption of traffic by:
  - Temporarily slowing down traffic on certain portions of the A8 and on the A8 South which will increase travel time to obtain and sell products and might discourage motorists from visiting nearby shops; and by
  - Diverting traffic when necessary which may make access to suppliers and economic outlets such as markets more difficult as well as reduce access to shops for highway users.

- Pre-construction and construction activities may temporarily displace street vendors, requiring them to sell further away from their home.

Table 8-90 summarizes the anticipated impacts and presents the impact assessment for self-employed and business-based livelihood.

Table 8-90 Impact Assessment for Self-Employed and Business-Based Livelihood

Assessment of Pre-mitigation Impact	Pre-construction and construction activities have the potential to generate positive impacts in terms of local employment. The influx of workers and job seekers may boost the sales of local businesses, but traffic disruptions (increased travel time and diversion roads) may at the same time reduce sales from motorists which represent a significant proportion of their clients. Traffic disruptions may also affect the connections between suppliers, local businesses, and economic outlets. These impacts on self-employed and business-based livelihoods are likely to have a medium intensity impact on economic returns of affected people. They will be medium-term as they will last for the duration of construction and will have a regional extent as they could affect economic activities throughout the adjacent counties. Temporary displacement of street vendors has the potential to have a high intensity impact on their economic return as most of them rely on this activity as their only source of income and already dedicate significant time to meet their needs (9-12 hours/day, 6-7 days/week). This impact will be short-term and local. The resulting overall magnitude of impacts will range from moderate to major.		
Direction	☒ **Positive**	☒ Negative	
Intensity	☐ Low	☒ **Medium**	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☒ **Regional**
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery is present;
  - Optimize transport routes to reduce travel distances by vehicles and machinery.
- To maximize the project's positive impacts on the creation of jobs, the following enhancement measures are recommended:
  - Apply human resource policies favoring local labour;
  - Implement training programs to build local capacity;
  - Disclose information on newly created business opportunities.

SPECIFIC MEASURES

- If diversion of traffic is necessary, take into account key location of local businesses and their access to suppliers and economic outlets such as markets in planning alternate routes.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on self-employed and business-based livelihood are assessed in Table 8-91.

Table 8-91 Determination of the Project's Residual Impacts on Self-Employed and Business-Based Livelihood

Assessment and Justification of Residual Impacts	Enhancement measures will maximize employment benefits for the local people. Traffic mitigation measures will reduce traffic disruptions, but these will most likely remain of medium intensity, especially on the A8 South. The duration of traffic disruptions and extent will remain unchanged, as they will last for the duration of the Project and potentially affect economic activities throughout the adjacent counties. Minimizing the displacement of street vendors in space and time will ensure that the duration of this local impact remains short-term. It will reduce the intensity from high to medium by limiting additional travel by vendors to their point of sales. As a result, the magnitude of these impacts together will be moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☒ **Regional**
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Upgraded highways will have positive impacts on self-employed and business livelihoods by improving connections between suppliers, local businesses, and relevant outlets for local goods and services;
- Routine maintenance activities may temporarily disrupt traffic flow, increasing commuting time.

Table 8-92 summarizes the anticipated impacts and presents the impact assessment for self-employed and business-based livelihood.

Table 8-92 Impact Assessment for Self-Employed and Business-Based Livelihood

Assessment of Pre-mitigation Impact	Impacts during the operation phase will be mostly positive by improving the flow of goods and services on a regional scale for self-employed and business-based livelihoods. Traffic disruptions will be of low intensity, short-term and may have a local extent, affecting economic activities in areas adjacent to the highway. Together, these impacts will be of moderate magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure to include self-employed and business-based livelihood as part of the stakeholder engagement plan, namely those having a direct interaction with the highway.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on self-employed and business-based livelihood are assessed in Table 8-93.

Table 8-93 Determination of the Project's Residual Impacts on Self-Employed and Business-Based Livelihood

Assessment and Justification of Residual Impacts	Limiting traffic disruption to a minimum during routine maintenance activities will ensure that the impact intensity remains low. The duration will remain short-term and the extent local. The resulting impact for the operation phase after mitigation will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.4.3 FISHERIES (WATER-BASED LIVELIHOOD)

Fisheries is a growing sector in the Project Area and Kiambu, Nyandarua and Nakuru counties are actively promoting fishery development. Fisheries in the Project area comprise subsistence fishing, aquaculture, commercial capture fishing, and sport fishing.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect fisheries (water-based livelihood):

- Impacts on freshwater ecology described in Section 8.3.3 will also affect capture fisheries (subsistence, commercial and sport fishing). The main impacts include:
  - Suspension of fine particles in aquatic habitat can affect fish and their habitats located downstream of construction sites. The magnitude of this impact will largely depend on the magnitude of the anticipated changes in water quality. If the concentration of suspended particles in the water increases considerably, fish may temporarily avoid the affected area, resulting in decreased fishing yields;
  - Work in streams and rivers could hinder the free movement of fish upstream and downstream from the road, resulting in decreased catch at certain locations. The wrong choice of structure or inadequate installation can present other limitations to the movement of fish. Noise and vibrations during construction can also disturb and/or interfere with fish movement.
- Pre-construction and construction activities will disrupt traffic by:
  - Temporarily slowing down traffic on certain portions of the A8 and on the A8 South which will increase travel time to reach fishing and aquaculture sites; and by
  - Diverting traffic when necessary which may make access to suppliers (e.g., fish feed), fishing and aquaculture locations, and economic outlets (e.g., fish markets) more difficult.
- The presence of workers and influx of job seekers may, on the one hand, increase fishing pressure on praised fish species, increasing competition and possibly reducing fishing catch for local people and businesses. On the other hand, workers and job seekers might engage in sports fishing, increasing the client base of those few businesses.

Table 8-94 summarizes the anticipated impacts and presents the impact assessment for fisheries (water-based livelihoods).

Table 8-94 Impact Assessment for Fisheries (Water-Based Livelihoods)

Assessment of Pre-mitigation Impact	Considering that all fish species identified in the study area are widespread in the freshwater ecoregion, the impact of poorer surface water quality on fish is estimated to be medium and local, unless there is a major spill. Traffic disruptions may affect the connections between suppliers, fishing and aquaculture locations, fish processors, and economic outlets and have an impact of medium intensity. This is especially true for locations along the highway such as the fish market in Naivasha. The presence of workers and job seekers will also likely have a low impact on fishing competition and the positive increase in sport fishing is anticipated to be minimal. All these impacts will last for the duration of construction and thus will be medium term. Traffic disruptions will have a regional extent as they could affect economic activities throughout the adjacent counties. The resulting magnitude of impact is therefore moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement the mitigation measure identified for freshwater ecology (i.e., ensure that culverts and drainage structures allow for connectivity of aquatic habitat) (Section 8.2.3);
- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery are present;
  - Optimize transport routes to reduce travel distances by vehicles and machinery.

SPECIFIC MEASURES

- If diversion of traffic is necessary, take into account key location of fishing and aquaculture sites and processors, and their access to suppliers and economic outlets such as fish markets in planning alternate routes.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on fisheries (water-based livelihoods) are assessed in Table 8-95.

Table 8-95 Determination of the Project's Residual Impacts on Fisheries (Water-Based Livelihoods)

Assessment and Justification of Residual Impacts	Freshwater ecology mitigation measures will ensure that the risk to fisheries remains medium and local in extent. Traffic mitigation measures will reduce traffic disruptions, but these will most likely remain of medium intensity, especially on the A8 South. The duration of traffic disruptions and extent will remain unchanged, as they will last for the duration of the Project and potentially affect economic activities throughout the adjacent counties. The impacts of presence of workers and job seekers will be unchanged (low impact on fishing competition and minimal positive increase in sport fishing). The magnitude of the Project's residual impact will thus be moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Impacts on freshwater ecology described in Section 8.3.3 will also affect capture fisheries (subsistence, commercial and sport fishing). The main impacts include:
  - Positive impacts on hydrology through improved management of water flows;
  - Positive impacts on fish movements through enhanced connectivity resulting from improved culverts and drainage structures;
  - Reduced risk of contamination due to planned surface water treatment infrastructures;
  - Temporary obstruction or encroachment of watercourses and temporary suspension of fine particles in aquatic habitat caused by operation and routine maintenance activities;
  - Accidental spills or leaks resulting from vehicle accidents or from inadequate maintenance of vehicles using the highway and trucks, machinery, and other motorised equipment used during routine maintenance activities.
- Upgraded highways will have positive impacts by improving connections between suppliers, aquaculture sites, commercial fishers and processors, and relevant economic outlets;
- Operation and routine maintenance activities may temporarily disrupt traffic flow, increasing traveling time;
- The upgraded highways may stimulate population growth in the Project area which may lead to increased fishing competition.

Table 8-96 summarizes the anticipated impacts and presents the impact assessment for fisheries (water-based livelihoods).

Table 8-96 Impact Assessment for Fisheries (Water-Based Livelihoods)

Assessment of Pre-mitigation Impact	Impacts during the operation phase will be mostly positive by improving access to fishing locations and the flow of goods and services on a regional scale for fisheries. As detailed in Section 8.3.3, due to planned infrastructures and water treatment facilities, the impacts on freshwater ecology are considered to be low, local in extent, occurring during the whole operation phase (medium-term). Traffic disruptions will be of low intensity, short-term and may have a local extent, affecting economic activities in areas adjacent to the highway. Considering that the counties of Kiambu, Nyandarua and Nakuru are actively promoting commercial fishery development, increased fishing competition brought by population growth is expected to be of low intensity. However, duration will be long-term and effects felt regionally. The overall magnitude of these impacts on fisheries will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☒ **Regional**
Duration	☒ **Short-Term**	☒ **Medium-Term**	☒ **Long-Term**
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

— Implement mitigation measures for hydrology and water quality (detailed in Section 8.1.3).

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project’s residual impacts on fisheries (water-based livelihoods) are assessed in Table 8-97.

Table 8-97 Determination of the Project’s Residual Impacts on Fisheries (Water-Based Livelihoods)

Assessment and Justification of Residual Impacts	The proposed mitigation measures for hydrology, water quality and freshwater ecology will ensure that the negative impacts on fish remains low and local. By limiting traffic disruption to a minimum during routine maintenance activities, the intensity will remain low and the duration will be short-term. The extent will remain local, potentially affecting economic activities in areas adjacent to the highway. Impacts caused by potential population growth will remain minimal, although felt regionally and on the long-term. The magnitude of the Project’s residual impact will thus be minor to moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☒ **Regional**
Duration	☒ **Short-Term**	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

8.3.4.4 INDUSTRY (LARGE-SCALE ECONOMIC ACTIVITIES)

There is a wide variety of industries in the Project area. Kiambu County hosts major industries for all sectors of the economy, with a concentration in agro-processing and manufacturing. Agro-processing industries are spread across the county. However, most industries (including the gazetted industrial park) are located further away from the highways in Thika and Ruiru sub-counties. Nyandarua County has an underdeveloped industrial sector and the *Jua Kali* sector remains the most important economic activity in urban and trading centres. The most notable small-scale quarries in Nyandarua are not located close to the highways. Finally, Nakuru County also has a broad range of industries, many of which are in Nakuru City close to the A8 highway. The most important mining site is for diatomite and is located along the A8 at Kariandusi (about 2 km east of Lake Elmentaita). There are multiple quarries (stone, sand and murram) in Gilgil and Naivasha sub-counties. There are proposals to establish an industrial park in Naivasha Sub-county and a Small and Medium Enterprise (SME) Park in Rongai Sub-county.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect industries (large-scale economic activities):

- Purchase of materials, goods, and services may create some employment and business opportunities for local industries, especially for quarries.
- Disruption of traffic by:
  - Temporarily slowing down traffic on certain portions of the A8 and on the A8 South which will increase travel time to reach industries; and by
  - Diverting traffic when necessary which may make access to suppliers, industries (especially those located close to the highway), and economic outlets more difficult.

Table 8-98 summarizes the anticipated impacts and presents the impact assessment for Industry (large-scale economic activities).

Table 8-98 Impact Assessment for Industry (Large-Scale Economic Activities)

Assessment of Pre-mitigation Impact	Pre-construction and construction activities have the potential to generate positive impacts in terms of local employment and business opportunities. Traffic disruptions may affect the connections between suppliers, industry, and economic outlets and have an impact of medium intensity. Traffic disruptions will last for the duration of construction and thus will be medium-term and will have a regional extent as they could affect economic activities throughout the adjacent counties. As a result, the impact magnitude on industry is moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery are present;
  - Optimize transport routes to reduce travel distances by vehicles and machinery.

SPECIFIC MEASURES

- Ensure continued access to industries located along the highways (e.g., the diatomite quarry at Kariandusi);
- If diversion of traffic is necessary, take into account key location of industries and their access to suppliers and economic outlets such as markets in planning alternate routes.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on Industry (large-scale economic activities) are assessed in Table 8-99.

Table 8-99 Determination of the Project's Residual Impacts on Industry (Large-Scale Economic Activities)

Assessment and Justification of Residual Impacts	By ensuring continued access to industries, the proposed mitigation measures will reduce impact intensity from medium to low. Traffic mitigation measures will reduce traffic disruptions, but these will most likely remain of medium intensity, especially on the A8 South. The duration of traffic disruptions and extent will remain unchanged, as they will last for the duration of the Project and potentially affect economic activities throughout the adjacent counties. The magnitude of the Project's residual impact will thus be moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Upgraded highways will have positive impacts by improving connections between suppliers, local industries, and relevant outlets for local goods and services;
- Routine maintenance activities may temporarily disrupt traffic flow, increasing traveling time.

Table 8-100 summarizes the anticipated impacts and presents the impact assessment for Industry (large-scale economic activities).

Table 8-100 Impact Assessment for Industry (Large-Scale Economic Activities)

Assessment of Pre-mitigation Impact	Impacts during the operation phase will be mostly positive by improving the flow of goods and services on a regional scale for industries. Traffic disruptions will be of low intensity, short-term and may have a local extent, affecting economic activities in areas adjacent to the highway. Together, these impacts will be of minor magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

No mitigation measures proposed.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on Industry (large-scale economic activities) are assessed in Table 8-101.

Table 8-101 Determination of the Project's Residual Impacts on Industry (Large-Scale Economic Activities)

Assessment and Justification of Residual Impacts	Limiting traffic disruption to a minimum during routine maintenance activities will ensure that the impact intensity remains low. The duration will remain short-term and the extent local. The resulting impact for the operation phase after mitigation will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.4.5 TRANSPORT SECTOR

As mentioned in section 1.1, the road section affected by the project is part of the Trans-African Highway (Northern Corridor) which is a major axis for the transportation of goods between the Indian Ocean seaport of Mombasa and the landlocked economies of Uganda, Rwanda, Burundi, Southern Sudan and Eastern Democratic Republic of Congo.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect the transport sector:

- Disruption of traffic by:
  - Temporarily slowing down traffic on certain portions of the A8 and on the A8 South which will increase travel time to reach the destination; and by
  - Diverting traffic when necessary which may make access to certain locations more difficult.

Table 8-102 summarizes the anticipated impacts and presents the impact assessment for the transport sector.

Table 8-102 Impact Assessment for Transport Sector

Assessment of Pre-mitigation Impact	Traffic disruptions will increase traveling time which will have a high impact on the transport sector by decreasing the efficiency of transportation of goods along the Northern Corridor. Traffic disruptions will last for the duration of construction and thus will be medium-term and will have a regional extent as delays in transportation of goods could affect economic activities throughout the adjacent counties. As a result, the impact magnitude on the transport sector is major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☐ Moderate	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures:
  - Control access to work areas to ensure that only necessary personnel and machinery are present;
  - Optimize transport routes to reduce travel distances by vehicles and machinery.

SPECIFIC MEASURES

- If diversion of traffic is necessary, take into account key location of major industries, suppliers, and economic outlets in planning alternate routes.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on transport sector are assessed in Table 8-103.

Table 8-103 Determination of the Project's Residual Impacts on Transport Sector

Assessment and Justification of Residual Impacts	As mentioned in section 3.2.2, traffic management on the main axis (A8) will be conducted by maintaining traffic as usual on the existing road while the construction of the other axis will be realized. As for the A8 South, traffic will be maintained at all times by working on one side of the road and diverting traffic to the other or on localised detour. Thus, the intensity of the impact is expected to become medium. As for the duration and extent, they should remain medium-term and regional. The residual impact therefore becomes moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Upgraded highways will have positive impacts by improving connections between suppliers, local industries, and relevant outlets for local goods and services.
- Routine maintenance activities may temporarily disrupt traffic flow, increasing traveling time.

Table 8-104 summarizes the anticipated impacts and presents the impact assessment for the transport sector.

Table 8-104 Impact Assessment for Transport Sector

Assessment of Pre-mitigation Impact	Impacts during the operation phase will be mostly positive by improving circulation fluidity, improving economic productivity on a regional scale. Traffic disruptions will be of low intensity, short-term and may have a local extent, affecting economic activities in areas adjacent to the highway. Together, these impacts will be of minor magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

No mitigation measures proposed.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on transport sector are assessed in Table 8-105.

Table 8-105 Determination of the Project's Residual Impacts on Transport Sector

Assessment and Justification of Residual Impacts	Limiting traffic disruption to a minimum during routine maintenance activities will ensure that the impact intensity remains low. The duration will remain short-term and the extent local. Together, the resulting impact for the operation phase after mitigation will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.4.6 TOURISM AND RECREATIONAL ACTIVITIES

There is an abundance of tourist and recreational sites that are served by the A8 and A8 South in the Project area. These are mostly natural attractions such as National Parks, scenic terrains, waterfalls, rivers and lakes, forests, and caves. There are also some historical sites in Kiambu County. Most visitors in Kiambu and Nyandarua counties are domestic tourists, but Nakuru's National Parks also attracts many international tourists.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes several Pre-Construction and Construction activities that may affect tourism and recreational activities:

- Fauna and flora near the highways may be negatively affected by dust, particles and pollution generated by the following activities:
  - Implementation of temporary construction facilities;
  - Transportation and circulation;
  - Site preparation;
  - Use of borrow pits and quarries;
  - Structural work;
  - Base layer and pavement work;
  - Waste and hazardous materials management.
- Disruption of traffic by:
  - Temporarily slowing down traffic on certain portions of the A8 and on the A8 South which will increase travel time to reach tourism and recreational sites; and by
  - Diverting traffic when necessary which may make access to certain sites more difficult.

Table 8-106 summarizes the anticipated impacts and presents the impact assessment for tourism and recreational activities.

Table 8-106 Impact Assessment for Tourism and Recreational Activities

Assessment of Pre-mitigation Impact	Considering that tourism and recreational activities were hardly hit by the pandemic, this sector is particularly economically vulnerable. Any activity that may negatively affect tourist experience through degrading the environment or increasing travel time has the potential to have a high intensity impact as tourists may opt to visit another location (inside or outside the country). The duration will be medium term as it will last throughout the pre-construction and construction phase while the extent will be regional as these activities could affect the economy throughout the adjacent counties. As a result, the impact magnitude on tourism and recreation is major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☐ Moderate	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

— Implement the following aforementioned mitigation measures to reduce pollution and environmental degradation of touristic natural areas:

- Flora, fauna, and freshwater ecology (Sections 8.2.1, 8.2.2, and 8.2.3);
- Soil management (dust reduction and contamination) (Section 8.1.4.);
- Atmospheric environment (dust reduction and contamination) (Section 8.1.1.); and
- Surface and groundwater quality mitigation measures (Sections 8.1.3.2 and 8.1.3.3).

— Ensure the development of a strong Environmental Management Plan, including but not limited to, site assessment requirements prior to disturbances, a spill prevention and response plan and a waste management plan;

— Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures:

- Control access to work areas to ensure that only necessary personnel and machinery are present;
- Optimize transport routes to reduce travel distances by vehicles and machinery.

SPECIFIC MEASURES

— If diversion of traffic is necessary, take into account key location of major tourism sites in planning alternate routes.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on tourism and recreational activities are assessed in Table 8-107.

Table 8-107 Determination of the Project's Residual Impacts on Tourism and Recreational Activities

Assessment and Justification of Residual Impacts	Mitigation measures will preserve the attractiveness of current natural tourist sites by ensuring that impacts related to dust and pollution remain of low intensity, limited in extent and short-term. By paying special attention to optimizing access to major tourist sites, traffic mitigation measures could reduce the impact intensity of traffic disruptions from high to medium. The duration of traffic disruptions and extent will remain unchanged, as they will last for the duration of the Project and potentially affect economic activities throughout the adjacent counties. The magnitude of the Project's residual impact will thus be moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Upgraded highways will have positive impacts by improving access to tourist and recreational sites;
- Routine maintenance activities may temporarily disrupt traffic flow, increasing traveling time.

Table 8-108 summarizes the anticipated impacts and presents the impact assessment for tourism and recreational activities.

Table 8-108 Impact Assessment for Tourism and Recreational Activities

Assessment of Pre-mitigation Impact	Impacts during the operation phase will be mostly positive by improving access to tourism and recreational sites. Traffic disruptions will be of low intensity, short-term and may have a local extent, affecting the areas adjacent to the highway. Together, these impacts will be of minor magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

No mitigation measures proposed.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on tourism and recreational activities are assessed in Table 8-109.

Table 8-109 Determination of the Project's Residual Impacts on Tourism and Recreational Activities

Assessment and Justification of Residual Impacts	Limiting traffic disruption to a minimum during routine maintenance activities will ensure that the impact intensity remains low. The duration will remain short-term and the extent local. Together, the resulting impact will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.5 LABOUR CONDITIONS

As highlighted in Chapter 7, labour conditions are a key concern for workers, surrounding community members, and the population in general due to the legacy of poor labour conditions in road construction in the region.

PRE-CONSTRUCTION, CONSTRUCTION AND OPERATION PHASES

Most impacts on labour conditions will occur during the pre-construction and construction phases. However, impacts affecting workers and the communities in which they are embedded also apply to the operation phase.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

Based on comments received during public consultations, the Project has the potential to generate the following impacts on labour during pre-construction and construction activities:

- Poor health and safety conditions can create a dangerous work environment that will increase workers' risk of injuries and physical and mental illnesses. Worker health and safety is an important element to be managed according to IFC EHS Guidelines;
- Risk of abuse by contractors hiring underage workers (child labour);
- High levels of casualization (informality) can lead to violation of workers' rights (e.g., in terms of work schedule and conditions);
- Lack of oversight of contractors, subcontractors, and suppliers of goods and services in the supply chain can lead to abuse of workers in those positions, including hiring of underage workers;
- Poor labour conditions can generate insecurity, fatigue, and stress, among others. These can have a ripple effect at the household and community levels, by increasing conflict and potentially act as triggers for social problems such as drug and alcohol abuse and GBV;
- The influx of workers and job seekers may negatively affect the social acceptability of the Project as surrounding communities have high expectations regarding the Project's role in promoting local employment and stimulating the local economy.

However, by introducing more structured and better-defined labour conditions, the Project may also improve existing common labour practices.

Table 8-110 summarizes the anticipated impacts and presents the impact assessment for labour conditions.

Table 8-110 Impact Assessment for Labour Conditions

Assessment of Pre-mitigation Impact	Considering the legacy of poor labour conditions in road construction in the region, the Project has the potential to negatively affect workers' physical and mental health, lead to abuse of workers, and trigger social problems such as drug and alcohol abuse and GBV – all of which are impacts of high intensity. The intensity of impacts created by the influx of workers and job seekers on the social acceptability of the Project is medium. The extent will be local as workers (both local and non-local) will most probably be settled in communities near the highway's right-of-way. Most impacts will last throughout the pre-construction and construction phase (medium-term), but social problems may persist and be long-term. Overall, the impact magnitude on labour conditions will be moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Develop and implement hiring guidelines that meet or exceed relevant national regulations and international standards, as required by IFC Performance Standard 2. As outlined in Chapter 2, these include the following:
  - Occupational Safety and Health Act (Section 2.3.2);
  - Public Health Act (Section 2.3.3);
  - Employment Act (Section 2.3.9);
  - Work Injury Benefits Act (Section 2.3.10); and
  - International Finance Corporation (IFC) Performance Standard 2: Labour and Working Conditions (Section 2.5) and EHS Guidelines.
- Include labour and occupational health and safety criteria in all tendering and procurement documents for prequalification of contractors and subcontractors;
- Contractually require all contractors, subcontractors, and suppliers to adopt and comply with policies and procedures that align with national regulations and international standards and address all aspects of labour standards relevant to the project. Special attention should be paid to ensure no forced labour or child labour is used by the contractors, subcontractors or in the supply chain;
- Ensure regular monitoring of contractors' and subcontractors' compliance and enforcement of labour laws;
- Conduct a proper screening of contractors and subcontractors in terms of possession of necessary licences and qualifications before assigning potentially hazardous work;
- Continuously raise contractors, subcontractors, suppliers, and workers' awareness of labor laws;
- Develop and implement an Emergency Measures Plan;

- Develop and implement a monitoring system for the application of the above plans, regulations, and standards by all levels involved in the Project, including contractors, subcontractors, and suppliers of goods and services;
- Develop and implement a grievance redress mechanism for workers and residents and establish a safe and ethical reporting environment that allows for anonymous reporting;
- Develop a proper grievance handling mechanism for workers to raise workplace concerns;
- Document and communicate all working conditions and terms of employment to all workers;
- Ensure reasonable working hours, wages and other benefits;
- Inform all workers of their rights, including wages and benefits, and their fundamental right under the law to associate freely;
- Provide workers' contracts and periodic clear records of pay calculations in their native language;
- Ensure equality of opportunity and treatment in employment or occupation by prohibiting any distinction, exclusion or preference made based on race, colour, sex, religion, political opinion, national extraction or social origin in recruitment and procurement exercises;
- Ensure all foreign workers recruited, men or women, are in possession of valid residence and work permits;
- Implement a long-term training program throughout the construction phase to ensure adequate training and qualification of all staff employed for the project;
- Provide medical facilities throughout the construction phase for the use of workers where required;
- Provide suitable and safe amenities and sanitation facilities, including available drinking water and latrines;
- Implement measures for supporting the recruitment and retainment of female workers outlined in Section 8.3.7.

SPECIFIC MEASURES

- Maximize the hiring of local labour through the following measures:
  - Apply human resource policies favouring local labour including, but not limited to, local hiring targets;
  - Implement training programs to build local capacity; and
  - Disclose information on newly created business opportunities.
- Establish partnerships with social and health services at project level;
- Prepare a list of relevant medical and social resources and services for workers and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document;
- Provide assistance to workers struggling with physical and mental health issues and substance abuse in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.).

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on labour conditions are assessed in Table 8-111.

Table 8-111 Determination of the Project's Residual Impacts on Labour Conditions

Assessment and Justification of Residual Impacts	By providing good working conditions, the Project will provide positive benefits to workers and surrounding communities and avoid becoming an important trigger to social problems in the area. Mitigation measures will ensure workers' rights are respected, avoid worker abuse, and create a safe working environment that will greatly reduce the number and gravity of injuries and health effects. As such, the intensity of these negative impacts is reduced to low. Maximizing local employment and providing local training will also reduce the intensity of impacts to the social acceptability of the Project to low. The extent will remain local, but the duration will be reduced to medium-term by avoiding the creation of social problems and by supporting struggling workers. The residual impact magnitude on labour conditions is therefore minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.6 VULNERABLE AND MARGINALIZED GROUPS (VMGS)

Consistent with the rest of this report, we use the terms "Indigenous Peoples" and "Vulnerable and Marginalized Groups" interchangeably.

Indigenous Peoples will only be directly affected by work on the A8 South and are essentially represented by people of two Maasai communities. As described in Chapter 4, this portion of the Project entails strengthening the highway within the original road footprint, maintaining its current geometry. The Project will thus have little impact on Indigenous Peoples and no relocation in the vicinity of the A8 South will be required.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main sources of impacts affecting Indigenous Peoples during pre-construction and construction activities are:

- Various unskilled and semi-skilled employment opportunities will provide positive benefits to surrounding communities, especially the youth. Such employment could be for the implementation of temporary construction facilities, site preparation, use of borrow pits and quarries, drainage and stormwater management, and base layer and pavement work.
- Purchases of materials, goods, and services. The Maasai have indicated that they have material (e.g., sand and rock aggregates) available for the Project. Material purchases from Indigenous communities should be considered as it may:
  - Improve Indigenous standard of living and livelihoods by injecting capital into local Indigenous businesses;
  - Benefit socially recognized men at the expense of marginalized groups. While this impact is addressed in the next section (Section 8.3.7), women and youth in patriarchal communities under community land tenure are particularly disadvantaged with regards to land control rights. In the case of cash compensation, women and children can become impoverished if the male household head misuses or

diverts compensation funds meant for restoration of land, housing or any other land-based livelihood streams.

- Implementation of temporary construction facilities, increased circulation and traffic, site preparation, structural work, drainage and stormwater management, and base layer and pavement work may temporarily:
  - Prevent the Maasai from crossing the A8 South at their preferred locations, and
  - Prevent Indigenous peoples, especially women, from selling bead and artwork and traditional clothing close to their village along the A8 South (see Section 6.4.8.1 for more information on the significance of this activity to their livelihood).
- The upgraded highways may exacerbate urban sprawl and land speculation, creating additional pressure on the Maasai to sell their land. This impact may begin during the pre-construction and construction phase but is likely to be stronger during the operation phase. While selling land benefits the title holder, it negatively impacts the Maasai people as a whole (see Section 6.3.7.1). Additional loss of land may result in:
  - Maasai displacement;
  - Permanent loss of rights of access and restricted mobility as new owners opt to fence or cultivate their land;
  - Reduced livelihood options thereby increasing poverty (e.g., due to the inability to sustain pastoralism);
  - Growing loss of culture due to lack of land base. This would include among others:
    - The inability to implement the traditional circular multi-family homestead as a living arrangement option if the community desires to do so
    - Decline in livestock population and pastoralism as a way of life
    - Loss of Indigenous knowledge due to the inability to transmit it to the next generation
  - Erosion of identity and self-determination; and
  - Social problems and heightened vulnerability to abuse and discrimination by the larger society.

  This being said, land issues and associated conflicts are essentially governmental considerations that exceed the Projects' capacity as mitigation will depend on adoption of specific adequate land protection legislation. Thus, this aspect is not further evaluated.
- Presence of workers and influx of job seekers may:
  - Positively impact local Indigenous businesses such as shops selling household goods;
  - Lead to cultural erosion;
  - Rise the prevalence of sexually transmitted infections (STI) and HIV/AIDS; and
  - Increase the risk of gender-based violence (GBV), including sexual abuse. While these are addressed in the next section (Section 8.3.7), because Indigenous women and girls are more vulnerable to GBV due to their marginalization, they are also included here. Such impacts include:
    - Sexual violence. Maasai women are at risk as they walk long distances, especially for fetching water.
    - Statutory rape and pregnancies resulting from relationships between labourers and underage girls. In extreme cases, especially in communities where unwed mothers are taboo, parents have been known to force such children into child marriages. This is known to happen even though parents are likely aware of the risk of imprisonment for such offences as required in Kenya's child protection laws.

Table 8-112 summarizes the anticipated impacts and presents the impact assessment for vulnerable and marginalized groups (VMGs).

Table 8-112 Impact Assessment for Vulnerable and Marginalized Groups (VMGs)

Assessment of Pre-mitigation Impact	Pre-construction and construction activities have the potential to generate positive impacts for VMGs in terms of employment and increase sales of local Indigenous businesses. The intensity of impact of the barrier created by activities will vary. The intensity will be low for herders as it will be of limited extent and can be easily bypassed. However, the intensity could vary from low to high for women depending on the sale of beads, artwork, and traditional clothing for their livelihood and economic independence. The duration will be short-term. The risk brought by the influx of job workers and seekers is reduced by the fact that no worker camps will be implemented in the area and that significant attention has been dedicated to potential impacts of workers in the VMGPF. Nevertheless, considering the history of gender aspects in road infrastructure projects in Kenya and Indigenous women's heightened vulnerability, the Project is likely to significantly increase the risk of GBV, and of STIs and HIV/AIDs. This increased risk is considered to be of high intensity. While the consequences of GBV for victims and for people infected with HIV/AIDs would be long-term, the increase in risk posed by the Project will last only during the construction phase. The duration is therefore considered as medium-term. These impacts will be felt by local communities and will thus be of local extent. Overall, the impact magnitude will range from minor to major.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☒ **High**
Geographical Extent	☐ **Limited**	☒ **Local**	☐ Regional
Duration	☐ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- As detailed in the VMGPF (KeNHA, 2019), develop and implement a strong Code of Conduct (CoC) detailing the guidelines on expected engagement and penalties on issues around the local community, child protection and gender-based violence protection, including sexual exploitation and abuse (SEA). The Code of Conduct should include among others:
  - A strict prohibition of GBV and sexual intercourse with partners younger than 18 years of age (underage sex);
  - The requirement to immediately report any suspected case of GBV or underage sex to the construction supervising engineer.
- Develop a Gender and Social Inclusion (GSI) Policy for the Project's activities;
- Develop and conduct GSI information/ awareness sessions with all staff;
- Develop and implement a Free, Prior, and Informed Consent process in line with the IFC Performance Standard 7;
- Develop and implement an Indigenous Peoples Plan that includes, but is not limited to, the following components:
  - A culturally appropriate Grievance Redress Mechanism developed in partnership with affected Indigenous communities;
  - A participatory monitoring process to evaluate the effectiveness of the FPIC agreement and ongoing consent; and

  - The conditions under which the consent process can be reinitiated and the FPIC agreement renegotiated.

To maximize the project's positive impacts on the creation of jobs, the following enhancement measures are recommended:

- Apply human resource policies favouring local labour;
- Implement training programs to build local capacity;
- Disclose information on newly created business opportunities.

SPECIFIC MEASURES

- Consider, when and if possible, preferred Maasai crossing locations when planning pre-construction and construction activities to minimize detours required by herders;
- Limit, when and if possible, the duration for which stalls and curio shops would not have access to the right of way;
- Support GBV victims through the following measures:
  - Prepare a list of relevant resources and services for GBV victims and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document;
  - Provide assistance to GBV victims in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.).
- Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities (targeting men, women, boys and girls) to facilitate workers and community interactions.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on vulnerable and marginalized groups (VMGs) are assessed in Table 8-113.

Table 8-113 Determination of the Project's Residual Impacts on Vulnerable and Marginalized Groups (VMGs)

Assessment and Justification of Residual Impacts	Enhancement measures will maximize employment benefits for Indigenous Peoples. Taking into consideration Indigenous Peoples' use of the RoW will ensure that impact intensity remains low for herders and limit the intensity range of impacts for women using the right-of-way as a place of business from low to medium instead of low to high. The extent will remain limited and the duration short-term. GBV and discrimination issues are well beyond the scope of any single project. Mitigation measures can contribute to progress on these long-term issues, but will not, on their own, eliminate the risk of such impacts occurring nor the consequences for individual victims. The proposed mitigation measures will greatly reduce the risk of increased GBV and alleviate its consequences (e.g., by facilitating access to psychological support). Nevertheless, there remains a possibility that the influx of workers will increase the risk of GBV and of STIs and HIV/AIDS in surrounding communities. This increased risk after mitigation is considered to be of medium intensity, of local extent and medium-term, lasting for the duration of construction. The development and implementation of a Code of Conduct (CoC) will ensure that risk of cultural erosion is kept at a minimum and is considered to be low and of local extent after mitigation. Overall, the residual impact magnitude will range from minor to moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

OPERATION PHASE

The operation phase is mainly associated with positive impacts for Indigenous Peoples as the Project will improve the A8 South Highway. It is also anticipated that the Project will result in a decrease in traffic on the A8 South as motorists opt to use the expanded A8 highway. However, some routine maintenance work may temporarily and locally affect Indigenous People movement around the work area.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- An upgraded and less congested A8 South will improve Indigenous Peoples' access to markets, slaughterhouses and other economic outlets.
- Operation and routine maintenance may provide some employment opportunities.
- The upgraded A8 South will lead to an increase of vehicle speed which may make crossing of the A8 South by pedestrians more difficult and more dangerous, interfering with herding and transhumance activities and access to services such as schools and healthcare.
- The upgraded highways may exacerbate urban sprawl and land speculation, creating additional pressure on the Maasai to sell their land. While selling land benefits the title holder, it negatively impacts the Maasai people as a whole (see Section 6.3.7.1). Additional loss of land may result in:
  - Maasai displacement;
  - Permanent loss of rights of access and restricted mobility as new owners opt to fence or cultivate their land;
  - Reduced livelihood options thereby increasing poverty (e.g., due to the inability to sustain pastoralism);

  - Growing loss of culture due to lack of land base. This would include among others:
    - The inability to implement the traditional circular multi-family homestead as a living arrangement option if the community desires to do so
    - Decline in livestock population and pastoralism as a way of life
    - Loss of Indigenous knowledge due to the inability to transmit it to the next generation
  - Erosion of identity and self-determination; and
  - Social problems and heightened vulnerability to abuse and discrimination by the larger society.

  This being said, land issues and associated conflicts are essentially of governmental considerations that exceed the project's capacity to mitigate as mitigation will depend on adoption of specific adequate land protection legislation. Thus, this aspect is not further evaluated.

- Operation and routine maintenance activities may temporarily prevent use of certain sections of the A8 South RoW for grazing or selling products;
- While gender-based issues are addressed in the next section (Section 8.3.7), because Indigenous women and girls are more vulnerable to GBV due to their marginalization, these are also covered here. These impacts include the following:
  - Maasai women may experience GBV from workers during maintenance and rehabilitation activities. This can occur in both their communities and while using Project infrastructures. For example, as detailed in Section 6.4.8.1, women have a significant presence in the right-of-way as street vendors and in curio shops;
  - During evenings and nights, use of dark public spaces with no quick exit put women at risk of GBV and assault. These can include footbridges, underpasses and the right-of-way.

Table 8-114 summarizes the anticipated impacts and presents the impact assessment for vulnerable and marginalized groups (VMGS).

Table 8-114 Impact Assessment for Vulnerable and Marginalized Groups (VMGs)

Assessment of Pre-mitigation Impact	The operation phase of the Project will mainly generate benefits for Indigenous Peoples as it will result in improved connection to markets and slaughterhouses, less local traffic, and employment opportunities. While it is anticipated that the Project will result in less traffic volume on the A8 South, increased circulation speed may make crossing of the A8 South by pedestrians more difficult and more dangerous, affecting livelihood activities and access to services such as schools and healthcare. As a result, the intensity of this impact is considered to be medium, limited to the right-of-way and medium-term. Routine maintenance activities may limit access to certain portions of the A8 South which will most likely be easy to bypass, in which case the intensity is considered to be low. Impediments to Maasai women's access to their point of sale would impact their livelihood and economic independence and are therefore considered to be of medium intensity. The extent of this impact is limited to the RoW and the duration short-term. Although greatly reduced, an increase in the risk of GBV and STIs and HIV/AIDS remain during the operation phase due to the presence of workers during maintenance and rehabilitation activities and due to the use of infrastructure that increase women's vulnerability (e.g., dark spaces with no quick exit). The increase in risk is considered to be of medium intensity and would last for the duration of operation (medium-term). These impacts will be felt by local communities and will thus be of local extent. The resulting impact magnitude ranges from minor to moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Ensure the continued implementation of the Code of Conduct (CoC) detailing the guidelines on expected engagement and penalties on issues around the local community, child protection and gender-based violence protection, including sexual exploitation and abuse (SEA). The Code of Conduct should include among others:
  - A strict prohibition of GBV and sexual intercourse with partners younger than 18 years of age (underage sex);
  - The requirement to immediately report any suspected case of GBV or underage sex to the construction supervising engineer.
- Ensure the continued implementation of the Grievance Redress Mechanism developed in partnership with affected Indigenous communities;
- Implement the participatory monitoring process to evaluate the effectiveness of the FPIC agreement and ensure ongoing consent.

To maximize the project's positive impacts on the creation of jobs, the following enhancement measures are recommended:

- Apply human resource policies favoring local labour;
- Implement training programs to build local capacity;
- Disclose information on newly created business opportunities.

SPECIFIC MEASURES

- Include, as much as possible, footbridges and underpasses in preferred locations identified by the Maasai;
- Consider, when and if possible, Indigenous Peoples' use of the RoW (e.g., grazing, stalls and curio shops) when planning routine maintenance activities;
- Increase as much as possible the safety of areas used by Maasai women such as pedestrian crossings and sections adjacent to the right-of-way with curio shops;
- Support GBV victims through the following measures:
  - Prepare a list of relevant and culturally appropriate resources and services for Indigenous GBV victims and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document.
  - Provide assistance to Indigenous GBV victims in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.).
- Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities to facilitate workers and community interactions.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on vulnerable and marginalized groups (VMGs) are assessed in Table 8-115.

Table 8-115 Determination of the Project's Residual Impacts on Vulnerable and Marginalized Groups (VMGs)

Assessment and Justification of Residual Impacts	Enhancement measures will maximize employment benefits for Indigenous Peoples. The inclusion of footbridges and underpasses in the final design will facilitate herding and transhumance and access to services such as schools and healthcare, reducing the intensity to low and maintaining the extent to limited and the duration to medium-term. Taking into consideration Indigenous Peoples' use of the RoW will ensure that impact intensity remains low for herders and reduce the intensity of impacts for women using the right-of-way as a place of business to low as well. The extent will remain limited and the duration short-term. GBV and discrimination issues are well beyond the scope of any single project. Mitigation measures can contribute to progress on these long-term issues, but will not, on their own, eliminate the risk of such impacts occurring nor the consequences for individual victims. Although greatly reduced, an increase in the risk of GBV remains during the operation phase due to the presence of workers during maintenance and rehabilitation activities and due to the use of infrastructure that increase women's vulnerability (e.g., dark spaces with no quick exit). The same is true for the increased risk of STIs and HIV/AIDS in surrounding communities. These increase in risk are considered to be of low intensity and would last for the duration of operation (medium-term). These impacts will be felt by local communities and will thus be of local extent. Overall, the residual impact magnitude will range from minor to moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☒ **Limited**	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

8.3.7 GENDER ASPECTS

Gender-based violence and women economic dependency are major issues of concern in Kenya generally, and in road projects in particular. Acknowledging that road infrastructure projects have been problematic, KeNHA commissioned the consultancy firm GIBB Africa Limited to develop Gender Mainstreaming Guidelines for the Transport Sector in Kenya. The resulting report is comprehensive (GIBB Africa Limited, 2019) and forms the basis of the analysis below. While we include the measures most relevant to the Project, we recommend that decision makers and employers involved in the Project become familiar with the report and implement it at its fullest.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

The Project will require a workforce of approximately 2600 workers for the pre-construction and construction phase. The Project will favor the employment of local labour as much as possible which will reduce the risk of sexual harassment and violence caused by foreigners. However, it is highly probable that most skilled and highly skilled construction workers (800 and 300 workers respectively) and half of the supervisory staff (300 workers in total) will come from outside the Project area and/or outside Kenya. The average workforce and types of jobs required during the construction and operation phases are described in Section 4.10.

The Project's workforce will not be established in "man camps". Rather, workers will be encouraged to settle in the nearby communities. Even though this strategy will encourage integration of workers into communities and avoid concentration of workers in one area, the presence of many newcomers still involves significant risks.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes several Pre-Construction and Construction activities that may affect gender aspects:

- Road infrastructure construction activities provide both short-term and long-term employment opportunities that are mostly taken up by men, despite some deliberate efforts to hire women (e.g., engineers). Such imbalance can contribute to perpetuating women economic dependency and further entrench gender-based roles.
- Land acquisition or leasing (e.g., for borrow pits, quarries, and to accommodate final design of some interchanges) and purchase of natural resources (e.g., sand) may benefit socially recognized men at the expense of marginalized groups including women, especially widows, single mothers and youth. Women and youth in patriarchal communities under community land tenure are particularly disadvantaged with regards to land control rights. In the case of cash compensation, women and children can become impoverished if the male household head misuses or diverts compensation funds meant for restoration of land, housing or any other land-based livelihood streams.
- Large influx of workers and job seekers in infrastructure construction projects increases the risk of gender-based violence and sexual abuse in communities living within the infrastructure area of influence. They include the following:
  - Physical and sexual violence. Women and girls are mostly at risk as they walk to their places of work, school or on other errands in their everyday life. While women and girls in Kenya are more likely to experience sexual violence in general, some data suggests that men are at a higher risk of experiencing sexual violence by employers and strangers. Moreover, men are less likely to seek help when they experience sexual violence.
  - Statutory rape and pregnancies resulting from relationships between labourers and underage girls. In extreme cases, especially in communities where unwed mothers are taboo, parents have been known to force such children into child marriages. This is known to happen even though parents are likely aware of the risk of imprisonment for such offences as required in Kenya's child protection laws.

  - Prostitution of girls, especially those from impoverished families, for cash or food handouts. In the case of road construction sites, these interactions can occur in the road construction work sites as well as in public places after work hours. Child prostitution and defilement in exchange for money are also possible.

  - Increased crime in surrounding communities either through crimes directly perpetrated by newcomers (e.g., assault, theft, etc.) or indirectly through their engagement in illicit activities such as drug use and prostitution.

- Influx of workers and job seekers also increases the following risks:

  - Abandonment of mothers by the fathers of their children after conclusion of construction work. Both male and female children abandoned by their fathers can end up living in impoverished households, especially where the mother was relying on the father for their basic needs.

  - Rising prevalence of sexually transmitted infections (STI) and HIV/AIDS through transactional sex, prostitution (by both men and women) and as a result of the various interactions between project staff and the communities in which they operate.

Table 8-116 summarizes the anticipated impacts and presents the impact assessment for gender aspects.

Table 8-116 Impact Assessment for Gender Aspects

Assessment of Pre-mitigation Impact	The intensity of impacts outlined above can vary widely from one case to another due to the interaction of the Project with other confounding factors. The Project's contribution to perpetuating women's economic dependency, capture of benefits by male elite at the expense of marginalized groups, and increased risk of abandonment of mothers by the father of their children after conclusion of construction work could range from low to medium intensity. The first two impacts would be long-term, but the increased risk of abandonment would last for the duration of the Project (medium-term). Considering the history of gender aspects in road infrastructure projects in Kenya, the Project is likely to significantly increase the risk of GBV and of STIs and HIV/AIDs. This increased risk is considered to be of high intensity. While the consequences of GBV for victims and for people infected with HIV/AIDs would be long-term, the increase in risk posed by the Project will last only during the construction phase. The duration is therefore considered as medium-term. All the impacts listed above will most likely be limited to the communities adjacent to the Project, therefore of local extent. As a result, the impact magnitude ranges from moderate to major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- In the case of compensation to be given in response to expressed grievances, ensure strong representation of women in the process in order to attribute and distribute compensation equitably;

- Ensure proper consideration of gender issues in decision-making processes;

- Fully implement, monitor and enforce legal and regulatory requirements pertaining to non-discrimination interventions/strategies and gender under employment laws of Kenya;

- Encourage the recruitment and retainment of female workers. This can be achieved through the following potential measures:
  - Set targets for women employment;
  - Recruit and train women to be integrated in existing work teams;
  - Offer equal salaries for the same work to all employees with the same level of experience and skills, whether they are men, women or people with a disability;
  - Implement family-friendly measures such as health coverage and time-off for the birth of a new child. Ensure these measures are in line with Kenya's governmental regulation;
  - Provide civic and employee education on sexual harassment in the workplace;
  - Ensure adequate amenities in field-based work such as segregated toilets, adequate waste disposal facilities, water for personal hygiene, etc.;
  - Develop and implement gender and issue sensitive staff grievance redress mechanisms and establish a safe and ethical reporting environment that allows for anonymous reporting.
- Develop a Gender and Social Inclusion (GSI) Policy for the Project's activities;
- Develop and conduct GSI information/ awareness sessions with all staff;
- Develop and implement a strong Code of Conduct that protects women, girls, boys and men from gender-based violence (physical, sexual, and psychological) and closely monitor its application and effectiveness. The Code of Conduct should include among others:
  - A strict prohibition of GBV and sexual intercourse with partners younger than 18 years of age (underage sex);
  - The requirement to immediately report any suspected case of GBV or underage sex to construction supervising engineer.
- Develop and implement internal grievance and support that is accessible to all employees, pays special attention to the different realities of female and male victims of GBV, and includes the possibility of denouncing any form of harassment or intimidation. Ensure proper actions are taken according to the Kenyan legislation in cases of harassment;
- Develop and implement an external gender-sensitive grievance redress mechanism that is accessible to all segments of the general population, pays special attention to the different realities of female and male victims of GBV, and includes the possibility of denouncing any form of harassment or intimidation. Ensure proper actions are taken according to the Kenyan legislation in cases of harassment.

SPECIFIC MEASURES

- Establish partnerships with social protection services at project level.
- Support GBV victims through the following measures:
  - Prepare a list of relevant resources and services for GBV victims and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document;
  - Provide assistance to GBV victims in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.).
- Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities (targeting men, women, boys and girls) to facilitate workers and community interactions.

- Ensure that the Project offers some procurement opportunities for women, youth and persons with disabilities as required by Kenyan policies. This can be facilitated by:
  - Establishing a system for tracking bidders and awardees from women-headed or majority women-owned firms;
  - Setting up a mechanism to promote bid-readiness support for women-owned or majority women-owned small firms and businesses;
  - Maintaining vigilance for opportunities which could be offered to women's groups; and
- Provide, if possible, additional income generating opportunities to women during construction (e.g., provision of catering services, selling local products).

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on gender aspects are assessed in Table 8-117.

Table 8-117 Determination of the Project's Residual Impacts on Gender Aspects

Assessment and Justification of Residual Impacts	GBV and gender issues are well beyond the scope of any single project. Mitigation measures can contribute to progress on these long-term issues, but will not, on their own, eliminate the risk of such impacts occurring nor the consequences for individual victims. The proposed mitigation measures can greatly reduce the risk of the most intense impacts, alleviate the consequences of GBV (e.g., by facilitating access to psychological support), and ensure that land acquisition or leasing does not cause prejudice to marginalized groups. They can even provide benefits by contributing to reducing women's economic dependence by employing them. Nevertheless, there remains a possibility that the influx of workers will increase the risk of GBV and of STIs and HIV/AIDS in surrounding communities. This increased risk after mitigation is considered to be of medium intensity. The residual impact is thus considered to be of medium intensity, local in extent, and medium-term for a resulting moderate impact magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- The impacts on gender are likely to be mostly felt during the pre-construction and construction phase. However, they may also occur, to a lesser degree, during the following activities:
  - Use of the highway;
  - Operation and routine maintenance.
- Road infrastructure operation and maintenance activities provide both short-term and long-term employment opportunities that are mostly taken up by men, despite some deliberate efforts to hire women. Such imbalance can contribute to perpetuating women economic dependency and further entrench gender-based roles;

— The project may favor motorised transport to the detriment of non-motorised transport. Women and girls have different travel patterns than men and tend to walk more to their places of work, school or on other errands in their everyday life;

— Women may experience GBV from workers during maintenance and rehabilitation activities. This can occur in both their communities and while using Project infrastructures. For example, as detailed in Section 6.3.5.2, women have a significant presence in the right-of-way as street vendors;

— During evenings and nights, use of dark public spaces with no quick exit put women at risk of GBV and assault. These can include footbridges, underpasses and the right-of-way.

Table 8-118 summarizes the anticipated impacts and presents the impact assessment for gender aspects.

Table 8-118 Impact Assessment for Gender Aspects

Assessment of Pre-mitigation Impact	The probability of gender impacts is much lower during the operation phase, but certain impacts remain. As for the construction phase, gender imbalance in hiring can contribute to perpetuating women economic dependence. The intensity of this impact could vary between cases from low to medium as it interacts with other confounding societal factors and would be long-term. An increase in the risk of GBV also remains during the operation phase due to the presence of workers during maintenance and rehabilitation activities and due to the use of infrastructure that increase women's vulnerability (i.e., dark spaces with no quick exit). The increase in risk is considered to be of low intensity, would last for the duration of routine maintenance activities (short-term). The Project design currently includes 120 pedestrian crossings on the A8 and 25 on the A8 South (see Section 4.4.12) which should reduce travel patterns and improve safety. Despite the proposed improvement some level of GBV and assault risks may persist. This impact is thus considered to be of medium intensity, of limited extent and medium-term. The impacts above will most likely be limited to the communities adjacent to the Project, therefore of local extent. As a result, the impact magnitude ranges from minor to moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☒ **Long-Term**
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

— Collect gender-segregated data during monitoring and evaluation, and ensure proper consideration of gender issues in decision-making processes;

— Fully implement, monitor and enforce legal and regulatory requirements pertaining to non-discrimination interventions/strategies and gender under employment laws of Kenya;

— Encourage the recruitment of female workers, with equal payment for male and female workers, for equivalent jobs. This can be achieved through the following measures:

  - Set targets for women employment;
  - Implement family-friendly measures such as health coverage and time-off for the birth of a new child. Ensure these measures are in line with Kenya's governmental regulation;
  - Provide civic and employee education on sexual harassment in the workplace;

  - Ensure adequate amenities in field-based work such as segregated toilets, adequate waste disposal facilities, water for personal hygiene, etc.;
  - Develop and implement gender and issue sensitive staff grievance redress mechanisms and establish a safe and ethical reporting environment.
- Develop and implement a strong Code of Conduct that protects women and men from gender-based violence (physical, sexual, and psychological) and closely monitor its application and effectiveness. The Code of Conduct should include among others:
  - A strict prohibition of GBV and sexual intercourse with partners younger than 18 years of age (underage sex);
  - The requirement to immediately report any suspected case of GBV or underage sex to the construction supervising engineer.
- Implement and follow-up on gender-sensitive grievance redress mechanisms, paying special attention to the different realities of female and male victims of GBV.

SPECIFIC MEASURES

- Increase as much as possible the safety of areas used by women such as pedestrian crossings and sections adjacent to the right-of-way with stalls;
- Establish partnerships with social protection services at project level;
- Support GBV victims through the following measures:
  - Prepare a list of relevant resources and services for GBV victims and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document;
  - Provide assistance to GBV victims in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.).
- Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities to facilitate workers and community interactions.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on gender aspects are assessed in Table 8-119.

Table 8-119 Determination of the Project's Residual Impacts on Gender Aspects

Assessment and Justification of Residual Impacts	GBV and gender issues are well beyond the scope of any single project. Mitigation measures can contribute to progress on these long-term issues, but will not, on their own, eliminate the risk of such impacts occurring nor the consequences for individual victims. The proposed mitigation measures can greatly reduce the risk of the most intense impacts, and alleviate the consequences of GBV (e.g., by facilitating access to psychological support). They can even provide benefits by contributing to reducing women's economic dependence by employing them. Nevertheless, there remains a possibility that the presence of workers and use of certain infrastructures will increase the risk of GBV in surrounding communities. This increased risk after mitigation is maintained to a low intensity. Ensuring adequate representation of a wide diversity of women during consultation and considering their requests in the final Project design should properly address their needs in terms of non-motorised travels. As such, the intensity of this impact is considered to be low. The residual impact is thus considered to be of low intensity, local in extent, and medium-term for a resulting minor impact magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.8 PUBLIC INFRASTRUCTURE AND SERVICES

Assessment of public infrastructure and services considers four VECs, roads, railways, electricity and telecommunication, and underground utilities. These are described in Section 6.3.9.

8.3.8.1 ROADS

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

Most construction activities will take place in the right-of-way and will therefore not affect the surrounding road network. As described in Section 4.4.8, the current type of crossing (underpass or overpass) will be maintained and additional crossing facilities will be provided. However, all overpass structures will need to be demolished and rebuilt to accommodate the new highway lanes. As for underpasses, priority will be given to keep the existing structures and to duplicate them for the new lanes. If the existing structure of an underpass does not offer enough horizontal and vertical clearances or if its general condition does not allow for its reuse, the existing structure will be demolished and rebuilt.

The main impacts on roads will therefore come from the transport of heavy material, equipment, and concrete structures, and from work on under and overpasses.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect roads:

- Public Road infrastructures in the vicinity of the Project are likely to be degraded during construction through the increase in vehicle traffic transporting equipment and material. This is especially true for both unpaved roads and those in already poor conditions which can be quickly degraded. The main sources of impacts will be from trucks carrying granular material from quarries and concrete structures from precast sites;
- Construction of different infrastructure crossings for public roads (under and overpasses) will require diverting traffic which may increase pressure on secondary roads.

Table 8-120 summarizes the anticipated impacts and presents the impact assessment for roads.

Table 8-120 Impact Assessment for Roads

Assessment of Pre-mitigation Impact	Selected quarries and precast yard sites are located close to the highway right-of -way and limited length of side roads will have to be used; thus, the intensity is considered medium for this potential impact. As for the potential degradation of local roads through traffic diversion during the demolition and construction of underpasses and overpasses, the impact intensity is considered high. The extent of the impact will be local as only roads in close vicinity to the project will be affected. The impact will be felt throughout the construction phase for the transport of materials (medium-term), but only during specific periods for the demolition and construction of underpasses and overpasses (short-term). Therefore, both impact magnitude will be moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☒ **High**
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Identify transport methods best suited to the existing transport infrastructure;
- Frequently perform inspections on local roads used by construction activities and accesses used for material transport and perform maintenance work and repair where and if necessary;
- Establish adequate signage on roads used by construction activities to ensure road user and pedestrian security;
- Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to minimize road damage flow and that includes, among others, the following measures:
  - Identify roads that can sustain heavy machinery and those that are particularly vulnerable to wear and tear;
  - Control access to work areas to ensure that only necessary personnel and machinery is present;
  - Optimize transport routes to reduce travel distances by vehicles and machinery.

SPECIFIC MEASURES

- Consult the relevant transportation agency (KeNHA, KURA, KeRRA) and County Governments to identify which roads should be taken by trucks transporting heavy material, equipment and structures;
- Impose a speed limit for various vehicles; put a stricter limit on roads in poor conditions;
- In the case unpaved roads need to be used during periods of heavy rainfall, conduct maintenance and repairs as quickly as possible to limit the impact on local circulation.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on roads are assessed in Table 8-121.

Table 8-121 Determination of the Project's Residual Impacts on Roads

Assessment and Justification of Residual Impacts	The proposed mitigation measure will ensure that impact intensity related to movement of material and concrete precast structure will remain medium. This should also help reduce the intensity of the impact associated with the work on underpasses and overpasses to medium. Ensuring regular maintenance and repair on roads used during construction will ensure that the duration of impact is reduced/maintained to short-term for both impacts. The extent will remain unchanged as the effects will mainly be felt locally. The residual impact on roads will thus remain moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

It is anticipated that the upgraded highways will attract more motorists, especially the A8 Highway. Therefore, the impacts on other roads should be positive as more motorists (all types of vehicles) opt to use the more efficient highways to reach their destination. However, some negative impacts may occur during routine maintenance activities as traffic may need to be temporarily redirected towards potentially more sensitive road sections and heavy trucks circulation may increase for the transport of material.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- Reduced pressure on certain portions of the road network due to increased use of the highways;
- Secondary roads connecting to the highways may be damaged by additional pressure created by:
  - Redirection of motorists to surrounding local roads during routine maintenance of some underpasses or overpasses; and
  - Transportation of heavy material, equipment and structures during routine maintenance and rehabilitation activities.

Table 8-122 summarizes the anticipated impacts and presents the impact assessment for roads.

Table 8-122 Impact Assessment for Roads

Assessment of Pre-mitigation Impact	As routine maintenance activities are sporadic and will concern specific sections of the highways, intensity of impact is expected to be low. The extent will be local because of the use of surrounding secondary roads and the duration will be short-term. The resulting impact magnitude is therefore minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Frequently perform road and access inspection work and perform maintenance work and repair if necessary;
- Establish adequate signage in sensitive areas.

SPECIFIC MEASURES

- Consult the relevant transportation agency (KeNHA, KURA, KeRRA) and County Governments to identify which roads should be taken by trucks transporting heavy material, equipment and structures;
- Impose a speed limit for various vehicles; put a stricter limit on roads in poor conditions;
- In the case unpaved roads need to be used during periods of heavy rainfall, conduct maintenance and repairs as quickly as possible to limit the impact on local circulation.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on roads are assessed in Table 8-123.

Table 8-123 Determination of the Project's Residual Impacts on Roads

Assessment and Justification of Residual Impacts	Mitigation measures will ensure that the impact intensity on the road network remains low. Other parameters will be unchanged, leading to a residual impact that will be minor.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

8.3.8.2 RAILWAYS

There are 8 railway crossings in the Project area: 5 on the A8, and 3 on the A8 South. Railway crossing locations can be found in Section 4.4.11.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

Current railway crossing types (underpass or overpass) will be preserved, but railway overpasses will need to be demolished and rebuilt. For underpasses, priority will be given to keep the existing railway structures and to extend them along Highway A8. However, if the existing railway structures do not offer enough horizontal and vertical clearance or if their condition does not allow their reuse, the existing structures will be demolished and rebuilt.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect railways:

- Train traffic on some of the railways may be affected as some construction work may require presence on the railway thus interfering with railway services.

Table 8-124 summarizes the anticipated impacts and presents the impact assessment for railways.

Table 8-124 Impact Assessment for Railways

Assessment of Pre-mitigation Impact	Considering the importance of railways to the Kenyan economy, the impact of temporary interruptions of railway services is considered to be moderate. The extent would be regional as the railway network covers the adjacent counties, connecting the major urban areas and the duration short-term. As a result, the magnitude of impact is moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Contact and maintain communication with the Kenya Railways Corporation to avoid service interruptions by planning construction work around the train schedule;
- In the unlikely case of accidental service interruptions:
  - Coordinate with the Kenya Railways Corporation to minimize the duration of interruption and quickly inform users.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on railways are assessed in Table 8-125.

Table 8-125 Determination of the Project's Residual Impacts on Railways

Assessment and Justification of Residual Impacts	Mitigation measures should help avoid or at least minimise railway service interruptions. Accidental service interruptions, although unlikely, may occur in which case the impact intensity would be low. The extent would remain regional and the duration short-term. The residual impact is therefore minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

There are no anticipated impacts associated with this VEC during the operation phase.

8.3.8.3 ELECTRICITY AND TELECOMMUNICATION

A network of high to low-tension electricity transmission lines is present all along the Project area. High elevation medium and high-tension electrical lines cross the Project at eight locations on the A8 South and at 11 locations on the A8 (see section 6.3.9.3 for crossing locations). There is also a network of distribution lines at lower tension and elevation that crosses the Project's right-of-way. Lines and substations of 132 kV and above are owned and operated by the Kenya Electricity Transmission Company (KETRACO), while those of 66 kV and below are owned and operated by Kenya Power.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

Most electricity and telecommunication lines will not be affected by the Project and those that could be are to be moved under KeNHA's responsibilities during pre-construction phase. However, certain electrical lines that were not initially planned to be moved may have to be during construction activities.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect electricity and telecommunication:

- The moving of certain distribution lines may lead to temporary service disruption, affecting residents and businesses close to the highways.

Table 8-126 summarizes the anticipated impacts and presents the impact assessment for electricity and telecommunication.

Table 8-126 Impact Assessment for Electricity and Telecommunication

Assessment of Pre-mitigation Impact	As certain electric poles for distribution lines will need to be moved, temporary power interruptions during construction will be local in extent, affecting buildings located near the Project. The impact is considered to be of medium intensity as it risks affecting businesses and potentially some industries and the duration is short-term. As a result, the impact magnitude is moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Contact and maintain communication with KETRACO and Kenya Power to minimize impacts from service interruptions by determining:
  - The best time for power interruptions; and
  - Strategies to minimize the duration of power interruptions.
- Inform users of planned service interruptions sufficiently ahead of time for them to put in place strategies to mitigate the consequences of power interruptions;
- Re-establish power as quickly as possible when interruptions are unavoidable.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on electricity and telecommunication are assessed in Table 8-127.

Table 8-127 Determination of the Project's Residual Impacts on Electricity and Telecommunication

Assessment and Justification of Residual Impacts	Coordination with KETRACO and Kenya Power and informing affected users of planned power interruptions ahead of time will reduce the intensity of the impact from medium to low. Coordination with power agencies will also ensure that the duration remains short-term. The extent will remain local. The residual impact will thus become minor.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

There are no anticipated impacts associated with this VEC during the operation phase.

8.3.8.4 UNDERGROUND UTILITIES

Underground utilities comprise, among others, pipes, culverts, and sewage and water distribution networks. These are located outside the right-of-way of the A8 and A8 South and will therefore not be affected by the Project. However, there are liquid hydrocarbon pipelines from the Kenya Pipeline Company (KPC) crossing the Project at three different locations in Nakuru County (detailed in Section 6.3.9.3).

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes several Pre-Construction and Construction activities that may affect underground utilities:

- Pipelines may be damaged by accidental breakage during construction activities. The main impacts include:
  - Spills that will contaminate the environment. None of the pipeline crossings are located near surface water, therefore the impact would be limited to soil, fauna and flora and possibly groundwater contamination;
  - Interruption of liquid hydrocarbon delivery if the pipeline needs to be temporarily shut down.

Table 8-128 summarizes the anticipated impacts and presents the impact assessment for underground utilities.

Table 8-128 Impact Assessment for Underground Utilities

Assessment of Pre-mitigation Impact	Considering the risk of environmental contamination and the importance of liquid hydrocarbons for the region, the impact intensity is considered to be high. Although contamination effects should only be felt locally, the shutdown of hydrocarbon distribution will be felt regionally. Depending on the gravity of an accidental spill, the duration of the effects of local contamination could be medium-term. As a result, the magnitude of impact is major.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☐ Medium	☒ **High**
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☐ Moderate	☒ **Major**

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Install signage clearly indicating the location of pipelines;
- Implement spill prevention and response measures for groundwater quality, soil quality and sediment quality outlined in Section 8.1.3.3, 8.1.4.2 and 8.1.4.3;
- Contact and maintain communication with the KPC to minimize the risk of accidental breakage. Ensure the presence of KPC specialists during key stages of work such as any excavation work.
- In the case of accidental breakage:
  - Rapidly implement the Spill Response Plan;
  - Conduct repairs as quickly as possible in coordination with the KPC; and
  - Inform users of service interruption.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on underground utilities are assessed in Table 8-129.

Table 8-129 Determination of the Project's Residual Impacts on Underground Utilities

Assessment and Justification of Residual Impacts	Mitigation measures will minimise the risk of accidental breakage and limit the gravity of impacts should a spill occur, reducing the impact intensity of environmental contamination to medium and potentially reducing its duration to short-term. Impacts of temporary pipeline shutdown would still have a regional extent. The residual impact will thus be reduced from major to moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☐ Local	☒ **Regional**
Duration	☒ **Short-Term**	☐ Medium-Term	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

OPERATION PHASE

There are no anticipated impacts on this VEC during the operation phase.

8.3.9 ARCHAEOLOGY AND CULTURAL HERITAGE

All archaeology and cultural heritage sites identified during baseline surveys were all found to be located outside and at a certain distance of the Project's right-of-way. However, two of these sites are adjacent to this right-of way:

- the Molo fire victim memorial located between CH161+300 and 161+350 along the southern side of the A8 Highway;
- The Mai Mahiu Catholic Church located at the level of CH 17+700 of the A8 South.

IFC Performance Standard 8 main requirement is to protect cultural heritage from the adverse impacts of project activities and support its preservation. Avoidance and mitigation measures presented below will achieve this goal. The Project will not make use of any cultural heritage artifacts.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes several Pre-Construction and Construction activities that may affect archaeology and cultural heritage:

- All excavation and ground movement activities realized within the Project's right-of-way could destroy artefacts from currently unregistered sites and limit access to existing sites;
- The opening and exploitation of quarry sites could also affect artefacts from currently unregistered sites.

Indeed, these activities may uncover potentially valuable unknown artefacts and excavation work realized along the limit of the memorial and could affect the existing installations or temporarily limit access to the site.

Table 8-130 summarizes the anticipated impacts and presents the impact assessment for archaeology and cultural heritage.

Table 8-130 Impact Assessment for Archaeology and Cultural Heritage

Assessment of Pre-mitigation Impact	Considering that no known archaeological or cultural components are present within the Project's right-of way, the intensity of the impact is considered low. Extent of any chance findings will be limited but any impacts to unregistered components would have a long-term duration. Thus, the magnitude of the impact will be minor.		
Direction	☐ Positive		☒ **Negative**
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- In the event of a suspected chance finding of an unknown or undocumented cultural artefact, the following actions must be taken:
  - Stop the quarrying and excavation work;
  - Contact the (National Museum of Kenya) NMK and request that an NMK representative be sent to evaluate the finding;
  - Work may resume if the suspected artefact does not have cultural interest. Further investigation work must be initiated if the item is of cultural interest;
  - Once the site has been fully investigated and NMK has provided clearance, quarrying or excavation work may resume.

SPECIFIC MEASURES

- Avoid or limit all construction activities, unless necessary, along the projects right-of-way limit at the level of the Molo fire victim memorial;
- Ensure that access to the Molo fire victim memorial and to the Mai Mahiu Catholic Church is permitted and facilitated at all times.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on archaeology and cultural heritage are assessed in Table 8-131.

Table 8-131 Determination of the Project's Residual Impacts on Archaeology and Cultural Heritage

Assessment and Justification of Residual Impacts	Considering the implementation of the above-mentioned mitigation measures, the intensity of the impact remains low. Similarly, the extent remains limited and the duration long-term for a resulting minor residual impact magnitude.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☐ Medium	☐ High
Geographical Extent	☒ **Limited**	☐ Local	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☒ **Minor**	☐ Moderate	☐ Major

OPERATION PHASE

There are no anticipated impacts associated with this VEC during the operation phase.

8.3.10 VISUAL ENVIRONMENT

The Project, as defined in Chapter 4, will have very little effect on the visual environment VEC. Indeed, for most of the Project, the upgrade of existing road infrastructures within their current right-of-way should improve the visual environment. However, for some sections of the crossing of Nakuru City, elevated structures are considered necessary to limit the disruption of city activities. These structures will modify the visual environment of the City's residents.

PRE-CONSTRUCTION AND CONSTRUCTION PHASES

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The proposed Project includes Pre-Construction and Construction activities that may affect visual environment:

- The presence of vehicles and machinery along the highways during pre-construction and construction activities;
- Clearing of vegetation and felling of trees during the following activities:
  - Implementation of temporary construction facilities;
  - Site preparation;
  - Use of borrow pits and quarries; and
  - Structural work.
- The presence of borrow pits and two new quarry sites (location still undefined);
- The construction of the new aerial structure in Nakuru City.

Table 8-132 summarizes the anticipated impacts and presents the impact assessment for visual environment.

Table 8-132 Impact Assessment for Visual Environment

Assessment of Pre-mitigation Impact	As described in Section 8.3.1, the overall habitat loss is expected to be low as the Project is an existing road that runs through already modified or transformed habitat. The impact of the presence of vehicles, machinery, borrow pits and quarries and other construction activities will depend on their location, but are likely to be of medium intensity. It will last for the duration of construction (medium-term) and local in extent, affecting only the Project's footprint and adjacent observers. The magnitude of impact is therefore considered moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

STANDARD MEASURES

- Implement mitigation measures on habitat, especially those targeting vegetation, detailed in Section 8.3.1.

SPECIFIC MEASURES

- Planting of vegetation as proposed in Section 8.2.1 would improve the visual environment along the highway;
- Avoid, when and if possible, locating borrow sites and new quarries in scenic areas.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on visual environment are assessed in Table 8-133.

Table 8-133 Determination of the Project's Residual Impacts on Visual Environment

Assessment and Justification of Residual Impacts	Mitigation measures minimizing the clearing of vegetation during construction and creating a greenbelt along the highway will ensure the impact remains low. To avoid locating borrow pits and quarries in scenic areas will reduce their impact intensity on the visual environment from medium to low. The impact from the presence of vehicles and machinery is unchanged, remaining medium in intensity, medium-term and local in extent. The residual impact will therefore range from minor to moderate.		
Direction	☐ Positive	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☒ **Minor**	☒ **Moderate**	☐ Major

OPERATION PHASE

Considering that the Project on the A8 South entails strengthening the highway within the original road footprint, maintaining its current geometry, no impacts on the visual environment are foreseen on this portion of the Project. The main impacts therefore relate to the presence of new infrastructures and more vehicles on the A8, namely for the section crossing Nakuru City.

MAIN SOURCES OF IMPACTS AND ANTICIPATED EFFECTS

The main source of impacts during the operation phase include:

- The physical presence of noise barriers and infrastructure (e.g., interchanges, overpasses, underpasses, etc.), especially in towns where they will continuously affect the visual environment of more people;
- The presence of the proposed elevated structures to cross some sections of Nakuru City;
- The increase in circulation volume and the doubling of the area used by vehicles on the A8;
- A decrease in traffic on the A8 South will have a positive impact on this portion of the Project.

Table 8-134 summarizes the anticipated impacts and presents the impact assessment for visual environment.

Table 8-134 Impact Assessment for Visual Environment

Assessment of Pre-mitigation Impact	It is anticipated that the Project will lead to a decrease in traffic on the A8 South which will improve the visual environment in that area. The doubling of the A8 will modify some existing land but considering this is occurring along an already existing road, the impact intensity on the visual environment is low. Similarly, the increase in circulation on the already busy A8 is considered to be low. The main impact on the visual environment will be caused by the presence of new elevated structures. Those located in rural area are likely to have a low impact intensity. However, the proposed elevated structures for the crossing of some sections of Nakuru City, has the potential of having a medium impact on the visual environment considering its visibility and commercial and industrial activities which will border the new structure. All impacts will last for the duration of the Project and be local in extent. As a result, the magnitude of the impact on the visual environment is moderate.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☒ **Low**	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☐ Medium-Term	☒ **Long-Term**
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

RECOMMENDED MITIGATION MEASURES

SPECIFIC MEASURES

- Consider as much as possible the impact on the visual environment in designing the portion of the A8 passing through Nakuru City.

DETERMINATION OF RESIDUAL IMPACTS

Considering the recommended mitigation measures, the Project's residual impacts on visual environment are assessed in Table 8-135.

Table 8-135 Determination of the Project's Residual Impacts on Visual Environment

Assessment and Justification of Residual Impacts	Considering the impact on the visual environment when designing major infrastructures in towns will ensure this impact's intensity remains medium. Other parameters will be unchanged. Thus, the residual impact on the visual environment will be local in extent, medium-term and of moderate magnitude.		
Direction	☒ **Positive**	☒ **Negative**	
Intensity	☐ Low	☒ **Medium**	☐ High
Geographical Extent	☐ Limited	☒ **Local**	☐ Regional
Duration	☐ Short-Term	☒ **Medium-Term**	☐ Long-Term
Magnitude	☐ Minor	☒ **Moderate**	☐ Major

8.4 SOCIAL ACCEPTABILITY

As previously mentioned in Chapter 5 (section 5.4.4), social acceptability is a continuous process, evolving through the project's lifetime. Community perceptions about the Project are as important as the facts since they can influence the degree of acceptance and acceptability in the host communities. Therefore, collaboration and dialogue on a regular basis, throughout the different project phases, are key components to social acceptability.

In this perspective, inception mission and consultations took place at different stages of the ESIA (see Chapter 7 for further details). In addition, socioeconomic surveys have been taken as an opportunity to document the perception of the surveyed persons in regard to the project (see Chapter 6). These fieldwork activities were an occasion to gather information on community acceptance toward the project, and to discuss with stakeholders about their expectations and their concerns.

SOCIAL ACCEPTABILITY AND OVERALL STAKEHOLDERS

Globally, the Project has a positive reception among the host communities. The Project is seen as an opportunity to ease the road traffic and to improve safety. Despite the positive feedback toward the Project, concerns have been raised during Consultations (Round 1 and Round 2).

The main concern regards the Project Design. The stakeholders agree with the Project as long as it responds to the needs of the communities that are crossed by the highway. To do so, they mentioned that they must be consulted and actively involved in the decisions regarding the Project Design. They stated the need to be consulted in the siting of infrastructure such as interchanges. They also asserted the interest of communities to contribute to the location of underpasses and footbridges to ensure that they meet their needs. Moreover, issues related to the current highway have been discussed. The stakeholders expect the Project to resolve some problems such as flooding, by installing adequate drainage systems or to build a culvert. Further details regarding their expectations and their demands are provided in Chapter 7.

During the second round of Consultation, specific requests and concerns have been addressed by the stakeholders. Among them, the impacts on environment and biodiversity are an area of concern for the stakeholders who met during Consultations. They expressed their expectations toward the environmental management and rehabilitation, especially for borrow pits. They also raised awareness regarding the ecosystem surrounding the Project area and stated the necessity of environmental mitigation measures for the execution of the project.

Stakeholders and the host communities have specified that the Project must promote local employment and local economy. Employment is an important matter, as job opportunities are rare, especially for young adults. Unemployment rates are high in the area and the host communities are seeing the Project as an opportunity to respond to this situation. The same goes for local economy. Stakeholders expect the project to stimulate the local economy, including encouragement to local businesses as much as possible.

Safety concerns were raised during Consultations as well. There are many, from road safety to an increase of criminality in host communities. Stakeholders suggested ensuring road safety by providing prevention and sensibilization campaigns on the subject. These campaigns should include all the categories of road users such as motorcyclists, pedestrians, or truck drivers. They also suggest that the truck bays should be situated far from schools to ensure the children's security and safety. Regarding criminality, stakeholders apprehend an increase. Unemployment and poverty among the host communities are a prevalent factor. They suggested, among other things, that mitigation measures are implemented to reduce the risk of crime occurring in the project area.

An exhaustive list of concerns raised during the second round of consultation is provided in Chapter 7. These concerns should be addressed throughout the different phases to ensure that the Project maintains its current social acceptability. This is especially important since the Project is seen as a great opportunity for the host communities. Many positive outcomes were highlighted during the social surveys. Respondents seek the Project to improve transportation, access and movement. It has been mentioned previously that traffic is a serious concern. The Project is therefore seen as an opportunity to ease transportation in the area. Greater accessibility and fluidity of transportation are also seen as a positive impact on business activities. Survey respondents see the Project to be an asset to shops and markets along the highway, as long as the Project is designed to accommodate them. The same goes for infrastructures situated along the road. This is seen as a positive outcome of the Project unless the expectations are not fulfilled. Road users expect the Project to improve different infrastructures along the road. This includes bus stops, truck bays or drainage systems. The Project is also perceived to reduce accidents and nuisances that occurred on the current highways. Road hazard is a serious matter that affects safety and cost the lives of many road users in the Project area. Enlargement and improvement of the road are then seen as a positive outcome and an opportunity to decrease road accidents or injuries.

SOCIAL ACCEPTABILITY AND VULNERABLE AND MARGINALIZED GROUPS (VMGS)

As previously explained in Chapter 7, a different consultation approach was undertaken with Maasai and Ogiek people. Despite the different approach, the two rounds of consultations provided insight into the concerns and expectations expressed by the VMGs.

During the first round of Consultation, Maasai and Ogiek Peoples expressed overall agreement to the Project. They expressed expectations regarding the Project Design and the Project impacts. They see the Project as an opportunity to provide various employment opportunities to their peoples. They expect new crossing points for the livestock, and footbridge for pedestrians. They expressed concerns regarding environment such as risk of river contamination or the need to replant trees and rehabilitate borrow pits and quarries. Finally, they expect the Project to reduce traffic, especially on the A8 South, and to enhance safety by providing adequate road signs.

The second round of Consultation was rich in information exchanges. Maasai and Ogiek Peoples have addressed many demands, suggestions and potential mitigation measures. Further information is provided in Chapter 7 and in the Free, Prior and Informed Consent (FPIC) process. Globally, the demands regard the Project Design. Both Maasai and Ogiek Peoples mentioned suggestions to the design such as providing speed bumps for safety, provision of crossing footbridges or livestock underpasses.

Maasai and Ogiek Peoples also specified that they want to be fully represented and involved in the Project. As an example, Maasai People requested community members to be part of road construction committees to represent their interests. Ogiek People suggested to be involved as well, and they would like representatives to be part of the recruitment committees to represent their peoples. As a matter of fact, Maasai and Ogiek Peoples expect their community members to have access to employment opportunities. Both addressed challenges faced by women and girls, and they suggested that initiatives should be provided to promote their empowerment.

Concerns regarding environment were expressed by both Maasai and Ogiek Peoples. They suggested many measures to minimize the risks. Finally, other concerns were raised regarding safety, local economy and water supply. Despite the positive aspects of the Project, Maasai and Ogiek Peoples have numerous concerns and expectations. Their acceptance toward the Project risks to evolve throughout the different phases and constant communication with their representatives will be a key element to social acceptability.

RIFT VALLEY HIGHWAY COMMITMENT TOWARD SOCIAL ACCEPTABILITY

In terms of social acceptability, RVH has demonstrated its willingness to adapt the Project to the needs identified by the stakeholders. They have considered numerous requests regarding the Project Design. The main requests that have been addressed are listed below:

- **Accident black spot**: This concern was raised during Consultations since it represents a safety hazard. The enlargement of the highway (4-lane highway) should substantially reduce black spot areas. RVH also commits to enhance safety, and the necessary adjustment will be made to the Project Design to minimize the risks;
- **Bus bays**: Almost all requests have been accepted. Suggestions were made to add more bus bays or moving already designed ones to more suitable locations for local populations;
- **Climbing lane**: Three of five requests have been approved. Another one is under review;
- **Diversions during construction**: A traffic management plan will be implemented to ensure traffic fluency and safety;
- **Flooding**: All culvert's dimension and design will be reviewed and replaced where needed. A follow-up will be carried out on identified flooding areas to confirm efficiency of existing and new structures;
- **Foot over bridge (FOB)**: There are approximately 30 requests that have been approved. They concern the addition of new FOB or displacement of those already designed to more suitable locations for local populations, especially in sensitive areas (schools, markets and black spots areas);
- **Interchanges**: Most of the requests were already satisfied with the current Project Design. Five requests are under review for additional interchanges or relocation of proposed ones;
- **Lighting**: Lighting is designed according to the applicable regulation and is to be supplied in urban areas. However, existing lights that will be removed during the construction phase will be replaced even if they were not in urban areas. Additional lighting will be installed, following the requests received and accepted. Finally, some requests were about safety issues and the new facilities will greatly improve safety;
- **Equipment accessible to people with disabilities**: Mostly all crossing infrastructures will be accessible for people living with disabilities;
- **Pedestrian underpass and Cattle underpass**: the majority of requests have been approved, and some additional infrastructure will be made. There are also displacements that will be realised, following the requests received;
- **Service lanes**: Additional service lanes will be added responding to six requests deemed relevant;
- **Truck bays**: Eleven requests were accepted. They concerned additional truck bays or displacement of those already planned;
- **U-Turns**: Three of the six requests were accepted. The others concerned facilities that are already planned in a short distance from the initial request;
- **Wildlife crossing**: Specialists have established wildlife crossing points. Their recommendations have been submitted to the Project designers and final numbers and characteristics will be presented in the biodiversity action plan.

This brief summary of concerns and expectations gives an overview of the critical aspects to take into consideration to assure that social acceptability remains among the host communities. It is mandatory to keep expectations realistic towards the Project by defining what can be done or not with stakeholders. Stakeholders clearly stated that they want to be actively involved in the Project design and implementation. There is no strict opposition against the Project, but they would like the Project to respond to their needs and interests. A transparent and continuous communication with stakeholders and host communities should provide social acceptability or at least, social acceptance.

As previously presented in sections 8.1, 8.2 and 8.3, the recommended mitigation measures aim to minimize the impacts of the Project. Through the measures of RVH commitment, this will respond mostly to the concerns of the host communities. Moreover, dialogue is maintained with stakeholders, which was identified as a key element by them for the Project realisation. Thus, RVH remains apprised of the needs or concerns expressed by the host communities.

Finally, during the third round of consultation, changes made to the design to integrate stakeholders' concerns, and main proposed mitigation measures were presented to all stakeholders. This was conducted in a participative way, including all stakeholders from various sub counties concerned with the Project. It resulted in a strong feeling of belonging and acceptability for stakeholders. Most comments expressed during the third round acknowledged the participative work done during the ESIA and welcomed the Project. Details from the consultative activities can be found in Chapter 7 and appendix 7.

8.5 CUMULATIVE IMPACTS

8.5.1 POTENTIAL CUMULATIVE EFFECTS ON VALUED ENVIRONMENTAL AND SOCIAL COMPONENTS

Cumulative impacts are the result of a combination, or even the synergic effect of various past, present or future projects. The evaluation of cumulative impacts first requires that a list of Valued Environmental Components (VECs) be established from the global list of environmental components identified for the impact assessment (see table 5-1). The selection of the VECs was based on their biophysical and/or socioeconomic importance and their capacity to generate cumulative negative effects with other projects in the areas crossed by the proposed Project. A total of 7 VECs have been selected for the current assessment. They are listed below with the indicative aspects that will be considered for the evaluation of cumulative aspects:

- Water resources / Aquatic Habitat. Indicative aspects: surface water quality, groundwater quality and quantity;
- Soils. Indicative aspect: Stability and erosion;
- Nuisances (air quality, noise and vibration). Indicative aspects: increase noise/vibration levels and alteration to local air quality (dust and particulate emissions);
- Terrestrial habitat. Indicative aspects: loss of terrestrial habitat through project construction increase accessibility to land and induced local land use changes;
- Terrestrial fauna (birds, reptiles and amphibians, mammals). Indicative aspects: potential interaction causing injuries or death and movement limitations;
- Physical well-being. Indicative aspects: land tenure, housing conditions, livelihood and economic aspects, mobility, and health and safety (road users, local communities, and workers;
- Community relations and social justice. Indicative aspects: gender aspects, vulnerable and marginalized groups (VMGs), and community tensions and conflicts (equitable distribution of benefits).

The cumulative impact assessment also requires that a realistic area and time period be established within which past, present and future projects are identified. The area considered correspond to a 5 km zone around the project. As for the time period, an extent of two years in the past and five years in the future was retained to match the project's construction period.

The various past, ongoing and upcoming projects potentially generating impacts that could be cumulative with those of the Project, were identified during the public consultation sessions, discussion with local authorities and consultation of Counties and main governmental agencies. They include:

- For Nakuru County:
  - A potential of four toll stations to be inserted at currently unknown locations of the A8 and A8 South Highways. Although no official project schedule available, they are expected to be operational at the same time as the Project itself;
  - Menengai Geothermal Power Projects Phase 1 including the construction of three 35Mw power plants, which will be under construction between 2021 and 2027;
  - Construction of the Nakuru Airport to be completed between 2021 to 2022 in Lanet. The project is realized on the site of an existing military airfield;
  - Mai Mahiu-Suswa Road improvement project. No exact date of start or duration of project available. ESIA was presented to NEMA in June 2020;
  - Naivasha ICD-Longonot railway line project Standard Gauge railway project (24.35 km). Currently under construction parallel to the west of the A8 South and scheduled to be completed in 2022;
  - New Roadside Stations to be installed along the A8 and A8 South at five distinct locations within the sections considered by the Project that is in Mai Maihiu, Naivasha, Kikopey, Salgaa and Mau Summit. Exact location is only available for the Kikopey site (CH 89+050 to 89+400) and no project schedule is available for none of the sites;
  - New mall at the level of CH 51+100 along A8 Highway in southern Naivasha. Project started but seems to be on hold and no schedule available;
  - New shopping mall in Nakuru to the north-east of third roundabout (CH 126+400). No project schedule available;
  - New bus terminal in Nakuru along the north side of the first roundabout (CH 124+000 to 124+200). No project schedule available;
  - Kingdom City Development Project, at the level of the Soysambu Estate (CH 103+250 to 106+200). No project schedule available;
  - Karonga Market located in the Kuresoi North area at the level of A8 CH 173+150 to 173+200. No project schedule available.
- For Kiambu County:
  - One toll station to be inserted at a currently unknown location of the A8 South Highway. Although no official project schedule available, they are expected to be operational at the same time as the Project itself;
  - Mau Road Project located some 4.5 km to the east of the A8 Highway. The project is under construction and scheduled to be completed in 2022.
- For Nyandarua County:
  - Magumu Ward Market and Logistic Center (Residential and Commercial) at CH 29+900 to 30+100). No official construction schedule available.

All the projects with no official schedule available were kept for cumulative impact assessment as they are located adjacent or very near the Project's right-of-way. As the Project unfolds, an effort will be made to maintain contact with the various potentially cumulative projects for which only high-level information was available at the time of completing this ESIA. The objective is to update information and cumulative impact assessment to adjust mitigation measures required in collaboration with the other projects' instigators. A full cumulative impact assessment will be produced as a SLIP document prior to construction, which will include consideration of known additional interconnecting roads projects.

In addition, it must be noted that cumulative impacts associated with the opening of new quarries and borrow sites required for the Project will be considered in the specific environmental assessment to be completed for the obtention of permits as made mandatory by the Kenyan legislation.

Table 8-136 Past, Present and Future Project/Infrastructure that May Have a Potential Effect on VECs

Project/ Infrastructure	Potentially Affected VEC Components						
	Water Resources/ Aquatic Habitat	**Soils**	**Nuisances**	**Terrestrial Habitat**	**Terrestrial fauna**	**Physical Well-being**	**Community Relations & Social Justice**
Toll Stations	None	None	source of nuisance	Potential terrestrial habitat effects	None	None	Gender and VMGs
Menengai Geothermal Project	groundwater	soil stability and erosion	None	Potential terrestrial habitat effects	Potential effects on terrestrial fauna	None	None
Nakuru Airport	surface and groundwater	None	source of nuisances	None	Potential effects on terrestrial fauna	safety and security of local population	None
Mai Mahiu-Suswa Road	surface and groundwater	soil stability and erosion	source of nuisances	Potential terrestrial habitat effects	Potential effects on terrestrial fauna	safety and security, mobility, livelihood	gender and VMGs.
Naivasha ICD-Longonot railway line	surface and groundwater	soil stability and erosion	source of nuisances	Potential terrestrial habitat effects	Potential effects on terrestrial fauna	safety and security, mobility, livelihood	gender and VMGs.
New Roadside Stations, Mai Maihu, Naivasha, Kikopey, Salgaa and Mau Summit	groundwater	None	source of nuisances	Potential terrestrial habitat effects	Potential effects on terrestrial fauna	safety and security, mobility, livelihood	None
New mall, Naivasha (CH 51+100)	None	None	source of nuisances	None	None	safety and security of local population	None
New Shopping Mall, Nakuru (CH 126+400)	None	None	source of nuisances	None	None	safety and security of local population	None
New bus Terminal, Nakuru	None	None	source of nuisances	None	None	safety and security of local population	None
Kingdom City	surface and groundwater	soil stability and erosion	source of nuisances	Potential terrestrial habitat effects	Potential effects on terrestrial fauna	None	None
Karonga Market (CH 173+150 to 173+200)	None	None	source of nuisances	None	None	safety and security of local population	None
Mau Road	Potential effect on surface and groundwater	soil stability and erosion	source of nuisances	Potential terrestrial habitat effects	Potential effects on terrestrial fauna	safety and security, mobility and livelihood	None
Magumu Market and Logistic Center	None	None	source of nuisances	Potential terrestrial habitat effects	None	safety and security and mobility of local population	None

8.5.2 EVALUATION OF CUMULATIVE EFFECTS ON VECS

Evaluation of cumulative effects takes into consideration the potential impacts that could be generated by the Nairobi-Nakuru-Mau Summit Highway Project and adds those generated by identified past, existing and future projects. This evaluation will be realized through the analysis of the various projects' effects on each of the VECs.

8.5.2.1 WATER RESOURCES / AQUATIC HABITAT

Potential impacts of the Nairobi-Nakuru-Mau Summit Highway Project on these VECs are defined by:

- Transport of exposed or disturbed soils towards water courses during rain events;
- Accidental spills and leaks from machinery and vehicle operations or associated with inadequate management of hazardous products and wastes;
- Contamination risk through excavation site exposing groundwater;
- Groundwater extraction for construction and operation requirements.

With the design principles applied and the implementation of the proposed mitigation measures, the resulting residual impacts were evaluated to be moderate to minor.

The various identified projects will affect these VECs as follows:

- The Menengai Geothermal project will essentially affect local groundwater quantity as it will require water intakes for its construction and operation. There are no watercourses which are crossed by the Highway Project that could be affected by the Menengai project;
- All other projects potentially affecting these VECs will have similar effects as with the Highway project, that is: risk of loose soil and contaminant transport towards surface water, potential contamination of groundwater through excavation activities and groundwater extraction for construction and operation activities. For surface water potential effects, only the Kingdom City project crosses a watercourse and is also traversed by the Highway Project. Also, the Mau Mau road project is not located in the same drainage basins as the Highway Project, thus not affecting the same groundwater sources.

Considering that:

- Past, present and future projects are either currently in construction (not in operation) (Menengai geothermal, Mau Mau Road, Naivasha-Longonot railway and Nakuru airport) or to be initiated at an undisclosed date (Mai Mahiu-Suswa Road, Roadside Stations and Kingdom Center);
- These project activities are expected to have similar moderate to minor impacts on these VECs.

Some cumulative effect may be anticipated.

However, with the application of the standard and specific mitigation measures presented in section 8.1, the overall residual cumulative impact should remain moderate to minor.

8.5.2.2 SOILS

Potential impacts of the Nairobi-Nakuru-Mau Summit Highway Project on this VEC are essentially associated with pre-construction and construction activities and are defined by:

- Affecting soil stability in steep areas during land clearing, soil movements and quarry operations which could generate or accentuate existing erosion.

With the design principles applied and the implementation of the proposed mitigation measures, the resulting residual impacts were evaluated to be moderate to minor.

The various identified projects will affect this VEC as follows:

- The Menengai Project is located in an area with a steep slope (Menengai Crater area) and could generate soil instability and erosion. However, this project site is not located close to the Highway project;
- The Naivasha-Longonot railway project is located on fairly flat land. However, it is constructed on an elevated embankment which could be destabilized and generate erosion;
- The Maai Mahiu-Suswa Road project and the Kingdom City project are also located on relatively flat land but may imply work near watercourse crossings thus potentially affecting the slopes of their embankments;
- For the Mau Mau Road project, it is located in steep and mountainous areas, thus may cause soil instability and erosion. However, the location is very far from the Highway Project and will most likely not generate cumulative impacts to interrelated slopes.

Considering that:

- Project potentially affecting existing slopes are not located near the Highway Projects (Menengai and Mau Mau projects);
- The Highway project is not likely to create soil instability or erosion in its section parallel to the Naivasha-Longonot railway project;
- The Mai Mahiu-Suswa Road project is not likely to affect the same watercourse crossings as that of the Highway Projects, and
- The Kingdom City watercourse, the embankment of which could be destabilized by construction activities could also be affected by the Highway Project.

Some cumulative effects could be anticipated but essentially with the Kingdom City project. However, no project schedule is currently available for the Kingdom City project which makes it difficult to confirm effective cumulative effects. Nonetheless, if both schedules eventually combine, it is believed that with the application of the standard measures presented in section 8.1 overall cumulative effect would be no greater than moderate.

8.5.2.3 NUISANCES

The nuisances VEC includes effects on noise as well as on air quality. Potential impacts of the proposed Highway Project on these VECs are defined by:

- Increasing temporarily noise levels, dust emissions and combustion gases emissions during the construction phase;
- Increasing permanently, although moderate, noise levels in close proximity to the operational highways (A8 and A8 South).

With the design principles applied and the implementation of the mitigation measures proposed for the project, the resulting residual impact related to dust emissions was evaluated to be minor for both the construction and operation phases. For noise generation, the resulting residual impact was evaluated to be moderate for the construction phase. Although noise levels will be moderate near the line, it will be present for the life of the infrastructure.

The various identified projects will affect this VEC for the same reasons as for the Highway Project, that is: temporary local noise and dust generation increase during construction activities and permanent noise increase during operation but mainly for the Nakuru airport, the road projects, the railway project, the Roadside Stations and the Bus Terminal of Nakuru.

Considering that:

- All projects considered will have a similar moderate effect on local air quality through dust and particle generation during their construction activities;
- All projects should have minimal to no effect on local air quality (dust and particle generation) at operation phases;
- The airport and linear projects will generate similar impact levels (moderate) for noise as with the Highway Project during construction activities while the toll stations, markets, Roadside Stations, Bus terminal and Kingdom City projects are expected to have a minor effect (as they are shorter in duration, more localized and not necessarily close to sensitive receptors);
- The operation of the airport will be a significant source of noise and vibration for the surrounding land occupants;
- Railway projects will generate elevated noise levels but only intermittently;
- Road projects, being smaller in size and with lesser speed limits, should generate lower noise impacts on surrounding land occupants;
- Toll stations, markets, roadside Station, bus terminals and Kingdom City projects should not generate any significant noise levels during their operation.

Cumulative effects for both air quality and noise are to be expected during construction activities with all the identified projects except for the Mau Mau road project which is located too far from the Highway Project. Note also that cumulative effects with the Mai Mahiu-Suswa road project will occur only for the construction activities of the first kilometers of this project as work will gradually move away from the A8 South. Considering the application of the standard and specific measures presented in section 8.1, it is expected that overall residual cumulative effects will remain respectively minor and moderate for air quality and noise.

At the operation phase of the project, cumulative effects are to be expected essentially for noise and with the Nakuru airport, the Mai Mahiu Road and Naivasha-Longonot Rail projects. All other projects are either too far (Mau Road project) or will not generate significant noise levels at operation phase (toll stations, markets, roadside station, bus terminal and Kingdom City projects). The expected cumulative effect between the Highway project, the railway project and the Mai Mahiu-Suswa road project should be moderate to minor because of the intermittent noise emission associated with the railway and the fact that the large part of the road project is extending perpendicularly from the A8 South. As for the cumulative effect of the Highway project with the Nakuru airport, construction activities of the airport should be completed by the time those of the Highway will be realized in this area, thus the effects should be minor. However, during operation of both infrastructure, there will be some cumulative effects between plane movements and road activities although both already existed. Resulting cumulative effect is expected to be moderate in the area of the airport.

8.5.2.4 TERRESTRIAL HABITAT

Potential impacts of the Nairobi-Nakuru-Mau Summit Highway Project on this VEC are essentially associated with pre-construction and construction activities and are defined by:

- Loss of noncritical terrestrial habitat through development of the road project within the existing right-of-way and implementation of temporary construction facilities and new borrow pits and quarries;
- Potential spread of invasive species and alteration of local conditions that will alter vegetation composition;
- An indirect impact of the presence of the highway is further loss of terrestrial habitat through better access to territory, which favours an increase in land development.

Considering the limited loss of vegetation to be affected within the road reserve and its existing degraded condition, with the implementation of the mitigation measures identified, the magnitude of the residual impact on terrestrial habitat was assessed as minor.

The past, present and future projects identified in the vicinity of the Highway will mostly affect terrestrial habitat by generating further habitat loss in the project area and contributing to additional fragmentation of the terrestrial landscape. Further road infrastructure and developments in the area can also lead to population growth, creating additional land conversions and loss of terrestrial habitat. Most importantly, the Kingdom City development is set in a portion of remaining natural habitat, which used to be part of the Soysambu Conservancy in a patch of natural habitat identified as critical habitat, creating its permanent loss. As for the Roadside stations, only one of the five foreseen in the Project area is localised with precision. This site, located in Kikopey, shows some residual terrestrial habitats mainly close to the A8 Highway. Since the nature of the sites are unknown for the other four stations as well as for the foreseen toll stations, it was considered that they might include some terrestrial habitat.

Considering that:

- Past, present and future projects are expected to cause additional terrestrial habitat loss and fragmentation;
- These projects activities are expected to have variable impacts on these VECs, the Kingdom City development having the most impact on natural habitat with the Roadside station and toll stations at a lower level.

Cumulative effect is anticipated. However, considering the existing level of degradation of terrestrial habitat, the overall residual cumulative impact should be minor.

8.5.2.5 TERRESTRIAL FAUNA

The terrestrial VEC includes effects on avifauna, herpetofauna and small and large mammals within the Project area. Potential impacts of the proposed Highway Project on these VECs are defined by:

- Habitat degradation or modification through construction work and presence of the highway;
- Increase in mortality from vehicle collisions;
- Barrier effect caused by the presence of the Highway;
- Behaviour disturbances because of artificial lighting and noise generation.

The terrestrial fauna is already affected by barrier effect or on-road mortalities from the existing road. Furthermore, it is planned to implement a new dedicated wildlife crossing structure that should overall increase the connectivity of terrestrial fauna habitats. With the mitigation measures, the magnitude of the residual impacts was identified as minor to moderate.

The past, present and future projects identified in the vicinity of the Highway will mostly affect terrestrial habitat by generating further habitat loss in the project area and contributing to additional fragmentation of the terrestrial landscape. Further Road infrastructure and developments in the area can also lead to population growth, creating additional land conversions and loss of terrestrial habitat. Most importantly, the Kingdom City development is set in a portion of remaining natural habitat, which used to be part of the Soysambu Conservancy in a patch of natural habitat identified as critical habitat, creating its permanent loss. As for the Roadside stations, only one of the five foreseen in the Project area is localised with precision. This site, located in Kikopey, shows some terrestrial habitats and thus will affect terrestrial fauna using this area. Since the nature of the sites are unknown for the other four stations, it was considered that they might include some terrestrial habitat, thus potentially affecting terrestrial fauna.

The various identified projects will affect these VECs as follows:

- The Menengai Geothermal Project is set in a Forest Reserve. The construction and operation of this project will mainly cause disturbance to terrestrial fauna by noise and lighting;
- The Nakuru Airport will also generate noise and lighting that can disturb terrestrial fauna during construction and operation;
- The Naivasha ICD-Longonot railway line will create additional fragmentation and barrier effect for terrestrial fauna. The embankment created by the railway will be especially difficult to cross for many large mammals. Running parallel to the A8 South Highway in the Longonot area, road and rail traffic will increase barrier effect and collision risks for fauna;
- New Road developments or improvements, namely the Maai Mahiu-Suswa Road and the Mau Mau Road, will also have their own barrier effect and can increase mortality risks by collision with vehicles;
- The Kingdom City development is set in a portion of remaining natural habitat that used to be part of the Soysambu Conservancy, creating its permanent loss. This area was assessed as critical habitat considering the presence of the Nubian giraffe and the White backed vulture in the area;
- The Roadside station located in Kikopey will be constructed in an area mainly used for agricultural activities with some residual natural habitat near the A8 Highway which could qualify as critical habitat for vultures. It must be noted that it is also completely surrounded by dense agricultural plots and some commercial activities.

Considering that:

- Past, present and future projects are expected to cause additional disturbance on terrestrial fauna; this may cause them to avoid areas where construction works are carried out and areas where there is high air, rail, and road traffic noise;
- The projects will reduce wildlife habitat connectivity in the project area. The intensity of barrier effect and collision risks generated by road and rail projects depend on their width, their configuration and the level of traffic, hence impacts on terrestrial fauna are variable.

Cumulative effect is anticipated. The multiplication of linear infrastructure and increased traffic will likely have significant effect on wildlife. The development of the new railway may combine with the road development and further limit the movement of fauna on a broader scale but equally at a local level. Complementarity of mitigation measures for the different infrastructures is important. Where possible, it should be ensured that the combined infrastructure projects place emphasis on same locations and species for wildlife crossings. Loss of natural habitat related to the Kingdom City development will affect terrestrial fauna. However, the area targeted for the development is less rich in wildlife, which is concentrated on the western side of the road in the Soysambu conservancy. Furthermore, the area surrounding the river remains Soysambu's property, as the conservancy wishes to preserve the riverine forest. As for Roadside stations, they will all be adjacent to the proposed A8 Highway, but apart from the Kikopey site, for which a specific location is known, the other still needs to be located. The Kikopey site implies some habitat loss potentially affecting fauna. Nonetheless, impact of this project on wildlife will be moderate.

8.5.2.6 PHYSICAL WELL-BEING

This VEC includes effects on land tenure, housing conditions, livelihoods and economic activities, mobility, and health and safety. Some impacts are covered in previous sections and are therefore not assessed here. These include:

- Temporary increases in dust, particles, and pollution during pre-construction and construction activities potentially affecting livelihoods (agricultural crops and capture fisheries), and human health (Sections 8.5.2.1 and 8.5.2.3);
- Aquatic habitat degradation and disturbance and/or interference with fish movement (Section 8.5.2.1).

Potential impacts of the proposed Project on physical well-being are defined by:

- Changes in land tenure due to required additional land to accommodate the final design of some interchanges;
- Changes in house value due to the presence of the widened A8 Highway whereby the value of house located very close may depreciate and that of others may increase due to improved services;
- Intensification of urban sprawl and land and housing speculation;
- Reduced available land for agriculture, livestock, and agroforestry and forest resulting from the use of additional land for interchanges, borrow pits and quarries;
- Temporary displacement of street vendors using the right-of-way;
- Increased fishing competition resulting from the influx of workers and of job seekers;
- Increased travel time and more difficult access to health services, key economic activity locations (e.g., access to suppliers, business and major tourism locations, and economic outlets), and sociocultural activity locations caused by traffic disruptions (increased circulation and traffic diversion) during pre-construction and construction activities and during routine maintenance;
- Temporary barrier effect for pedestrians and livestock during construction preventing crossing at their preferred locations, thereby increasing travel time;
- Negative impacts on health and safety including:
  - Increased worker insecurity, fatigue, and stress potentially generated by poor labour conditions and high levels of casualization (informality);
  - Increased risk of injuries and physical and mental illnesses for workers caused by a dangerous work environment as a result of poor health and safety conditions;
  - Increased risk of gender-based violence (including sexual abuse) brought by outside workers and job seekers or by local workers triggered by poor labour conditions;
  - Increased risk of rising prevalence of HIV/AIDS and sexually transmitted infections (STIs) following the influx of workers and job seekers;
  - Increased risk of crime in surrounding communities either through crimes directly perpetrated by newcomers (e.g., assault, theft, etc.) or indirectly through their engagement in illicit activities such as drug use and prostitution;
  - Increased proliferation of disease-carrying insects such as dengue and malaria as a result of stagnant water-filled holes produced by earthworks;
  - Increased hazardousness of the highways caused by increased transportation and circulation and traffic management.

Considering that additional land requirement is only potential and that there is an existing RAP implemented and managed by KeNHA, proper compensation will be proposed if required. Thus, the residual impact magnitude for land tenure was determined to be minor. The residual impact magnitude for housing conditions following noise mitigation measures was evaluated as minor to moderate. Considering the Project will improve motorised and non-motorised traffic and the implementation of the proposed mitigation measures, the residual impact magnitude for livelihoods and mobility was evaluated as minor (during operation) to moderate (during construction). While proposed mitigation measures do not reduce the intensity of health consequences for affected individuals, they greatly reduce the risk posed by the Project of health and safety impacts. As a result, the residual impact magnitude for health and safety was assessed as moderate.

The various identified projects (see Table 8-136) will affect these VECs as follows:

- All projects have the potential to affect the housing market. Those associated with nuisances will affect house value in the same way as the Highway Project, i.e., they will lower the value of houses directly affected by nuisances and potentially increase the value of others. Other projects will likely increase house value and risk accelerating land and housing speculation;
- All projects except the Nakuru Airport have the potential to impact land tenure and livelihoods through the acquisition of land;
- All projects, except the Nakuru Bus Terminal, carry the same risk as the Highway Project with regards to the influx of workers and job seekers in terms of increased fishing competition, GBV, and the transmission risk of HIV/AIDS and STIs;
- All projects carry the same risk as the Highway Project on the labour condition VEC, i.e., poor labour conditions, poor health and safety conditions, and high levels of casualization (informality);
- All projects may accentuate the proliferation of disease-carrying insects during pre-construction and construction activities;
- While the Mau Mau Road Project will improve motorised circulation, it may create a barrier to non-motorised transportation during pre-construction, construction and operation;
- The Mai Mahiu-Suswa Road improvement project will cause traffic disruptions during pre-construction and construction activities;
- The Nakuru Bus Terminal will improve security of travellers who, until now, boarded and descended from the buses amongst dense traffic along the existing highway;
- The Roadside Stations will improve overall safety and security for all Highway users as there will then be safe areas to stop for rest, food, fuel, etc., creating a distance with road traffic, diminishing congestion and nuisances on communities due to erratic truck stops and reducing accident risk due to fatigue with the offer of additional resting areas.

Considering that:

- Past, present and future projects are expected to affect the housing market, land tenure, livelihoods, health and safety and mobility;

Cumulative effect is anticipated. Impacts on the housing market will be location-specific in relation to each project. This cumulative impact is therefore likely to vary from minor to moderate. Implementation of standard and specific labour mitigation measures (Section 8.3.5) by all identified projects should result in a residual cumulative effect of moderate magnitude. The multiplication of construction projects, especially for large infrastructures, will affect land tenure and livelihoods through the acquisition of land. This will intensify the influx of workers and job seekers and aggravate their potential impacts on local communities' health and safety. Complementarity and coherence of mitigation measures between projects is important. It should be ensured that the combined infrastructure projects do not threaten land-based livelihoods by avoiding loss of agriculture, livestock and forest lands and/or offer adequate compensation for long-term effects. With application of these mitigation measures, the residual cumulative impact should be moderate. Where possible, a regional strategy for interaction with and integration of outsiders including, but not limited to, the standard and specific mitigation measures related to the influx of workers presented in Sections 8.3.2, 8.3.6 and 8.3.7 should be developed in partnership with affected counties to minimize impacts. Nevertheless, the magnitude residual cumulative health and safety impacts are likely to remain moderate during construction and operation. Overall, the magnitude of residual cumulative impacts on physical well-being is expected to be moderate.

8.5.2.7 COMMUNITY RELATIONS AND SOCIAL JUSTICE

This VEC includes effects on gender, vulnerable and marginalized groups (VMGs), and community relations. While some impacts in this section intersect with physical well-being, they are also addressed here because they will increase affected peoples' marginalization.

Potential impacts of the proposed Project on community integrity and social justice are essentially associated with pre-construction and construction activities (unless indicated otherwise) and defined by:

- Gender imbalance in employment which contributes to perpetuating women economic dependency and further entrench gender-based roles;
- Land leasing and purchase of natural resources that may benefit socially recognized men at the expense of marginalized groups including women, especially widows, single mothers and youth. These effects are especially acute for women and youth in patriarchal communities under community land tenure;
- Increased gender-based violence (including sexual abuse) brought by outside workers and job seekers or by local workers triggered by poor labour conditions. Indigenous women and girls are especially vulnerable due to their marginalization and the fact that they walk often and on long distances;
- Workers and job seekers fathering children and abandoning mothers after conclusion of construction work;
- Rising prevalence of HIV/AIDS and sexually transmitted infections (STIs) following the influx of workers and job seekers (Section 8.6.2.6);
- Increased crime in surrounding communities either through crimes directly perpetrated by newcomers (e.g., assault, theft, etc.) or indirectly through their engagement in illicit activities such as drug use and prostitution. Increased crime can exacerbate inequities, furthering the marginalization of vulnerable people, and affect local communities' sense of security;
- Barrier effect on A8 South temporarily preventing the free movement of the Maasai which may impact their livelihoods (e.g., herding or accessing locations to sell goods), way of life (semi-nomadic pastoralism), and culture (sociocultural activities, transmission of Indigenous knowledge);
- Indigenous culture erosion brought by increased interactions with outsiders;
- Upgraded highways that may intensify urban sprawl and land speculation creating additional pressure on the Maasai to sell their land. This impact may begin during construction and is likely to extend during the operation phase;
- Land use and compensation disputes (e.g., land resources and power conflict);
- Tensions and conflicts over the awarding of jobs and contracts;
- Increased inequities that risk further marginalizing vulnerable groups; and
- Degraded community relations caused by inadequate communication with communities and stakeholders.

With the implementation of mitigation measures, the magnitude of the residual impact on gender, Indigenous peoples and community relations were assessed as moderate.

All identified projects will have similar effects on this VEC as the Highway Project, except for the barrier effect impacting the Maasai and the introduction of tolling which may increase economic vulnerability of local population including VMGs. Two projects may create an additional barrier to Maasai movement: the Mai Mahiu-Suswa Road and the ICD Naivasha-Longonot railway.

Considering that:

- Past, present and future projects may contribute to perpetuating women economic dependency, increase gender-based violence, heighten the number of single mothers, increase the prevalence of HIV/AIDS and STIs, and cause or exacerbate land use and compensation disputes. In addition, they may trigger community tensions and conflict, degrade community relations, prevent the free movement of the Maasai with implications for livelihoods, way of life and culture, exacerbate pressures on the Maasai to sell their land, and further marginalize vulnerable groups in relation to land control rights and by increasing inequities;
- The introduction of a toll to access the new highways may affect the economically vulnerable part of the local population including the VMGs.

Cumulative effect is anticipated. The application of mitigation measures outlined in Sections 8.3.2, 8.3.6 and 8.3.7. should ensure that most residual cumulative impacts on gender, VMGs, and community relations remain of moderate magnitude. These include a Community Engagement Plan, a Code of Conduct for workers, measures limiting restrictions on Indigenous Peoples' mobility, and measures favouring women, Indigenous, and local employment. Where possible, a regional strategy for interaction with and integration of outsiders including, but not limited to, the standard and specific mitigation measures related to the influx of workers presented in Sections 8.3.2, 8.3.6 and 8.3.7 should be developed in partnership with affected counties to minimize impacts. While the application of the above standard and specific measures will not reduce the consequences for victims of crime and GBV brought by newcomers, they will greatly reduce the risks posed by the different projects. As a result the residual cumulative impact should be of moderate magnitude.

As long as special consideration is given to the economically vulnerable part of the population when fixing the toll for the access to the new highway, overall residual cumulative impact on community relations and social justice is expected to be moderate.

9 CLIMATE CHANGE RISK ASSESSMENT

As a part of the ESIA, a Preliminary Climate Change Risk Assessment (PCCRA) has been conducted as required by IFC Performance 1 (para. 7) to better understand the anticipated consequences of climate change on the people, the economy, and the environment associated with this Project. This chapter aims at:

1 Presenting the relevant climate trends to be retained for this assessment at a regional scale;

2 Identifying climate hazards caused by projected climate change and how they affect all components of road assets within the life span of the Project;

3 Identifying and prioritizing climate risks based on their level; and

4 Proposing mitigation and adaptation measures to:

   a Allow the Project design technical team to improve the highways' final design through identification of climate change adaptations that should be considered in more detail;

   b Support planning future adaptations for the road infrastructure, people and environment.

9.1 METHODOLOGY

9.1.1 OUR APPROACH

The general process followed in this note is based on the ISO 31000 Risk Management Standards (Figure 9-1). These standards are used worldwide and are well recognized in the scientific community. The analysis of climate change trends will consist in the first two phases of this process, namely establishing the climate context and identifying the risks. We will then assess the infrastructure vulnerabilities to climate change and the severity of its impacts as part of the analysis phase and of the evaluation phase, respectively. We will finally propose mitigation and adaptation measures as part of the last phase of the ISO31000 standards.

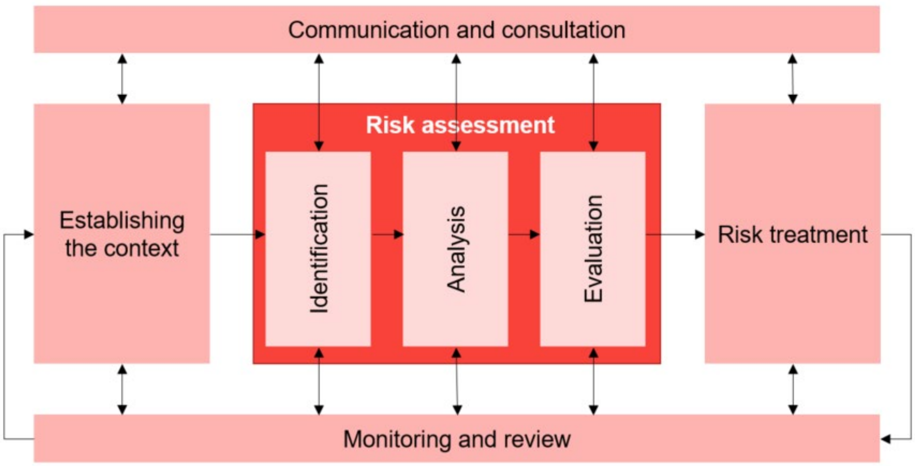
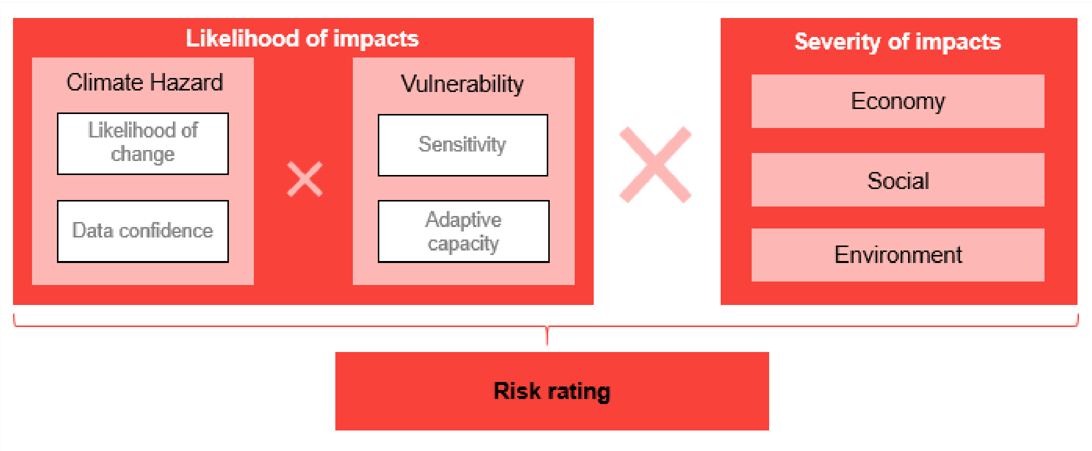


Figure 9-2 presents the framework (based on the definition of risk from the fifth report of the Intergovernmental Panel on Climate Change (IPCC, 2014), as being the product of the probability of observing climate impacts on the Project with the severity of their consequences.



Source: Inspired by IPCC (2014), adapted by WSP

The PCCRA is undertaken to identify the Project’s key climate and weather-related vulnerabilities, identify risks and opportunities associated with the identified climate and weather-related risks, and develop control and adaptation measures that may reduce those risks.

9.1.2 STEP-BY-STEP METHODOLOGY

The first part of the PCCRA consists of a high-level analysis, by identifying project vulnerabilities due to climate change. A list of potential impacts is created based on those vulnerabilities. Finally, the second part identifies potential impacts with a moderate, high or very high vulnerability, which are considered further to complete the assessment and to propose adaptation measures. In more detail, the following steps are undertaken:

— Identification of relevant **climate hazards** for the infrastructure project;

— Likelihood ratings of climate hazards using climate projections leading to the **exposure** assessment;

— Potential impacts are defined for each infrastructure component cross-referenced with each climate hazard;

— **Sensitivity** is then assessed for each potential impact considering infrastructure design and thresholds;

— Assessment of the **adaptive capacity** of the infrastructure components;

— The combination the sensitivity and the adaptive capacity give the **vulnerability** rating for each potential impact (end of Part 1);

— Assessment of the **likelihood** of each potential impact. Impacts with a moderate, high or very high likelihood are considered further;

— Assessment of the **severity** of each impact selected for the time horizon relevant to the Project on an economic, social and environmental point of view;

— The combination of the likelihood and the severity results in a list of **initial risk** ratings;

— Any risks of concern with a moderate, high and very high rating are further investigated to determine existing and possible additional **control and adaptation measures**;

— After consideration of these measures, the final assessment is presented as the **residual risk** ratings.

9.1.2.1 TERMINOLOGY

The ratings of exposure, sensitivity, adaptive capacity, vulnerability, severity and risk have five distinct levels (very low, low, moderate, high and very high), and correspond to the terminology detailed in Table 9-1. The likelihood of climate hazards is balanced by the data confidence scoring. If we have a medium confidence in datasets, a penalty of -0.5 is applied to get the final exposure scoring. If the confidence is low, a penalty of -1 is applied.

Table 9-1 Terminology of the PCCRA

Degree	Exposure		Vulnerability		Severity	Risk
	Likelihood	Confidence	Sensitivity	Adaptive capacity		
1	**Very low**	**Low (-1)**	**Very Low**	**Very High**	**Very Low**	**Very Low**
	- Will not happen before the end of the design life. - Will not have a negative impact before the end of the design life.	- Data source has certain shortcomings and the projections have relatively large uncertainties. - Results come from the scientific literature and the uncertainty ranges are not specified.	The probability the Project will be affected by the climate hazard is minimal.	- Adaptation measures are very easily implemented and effective.	- May or may not slightly affect people's quality of life - May or may not have limited impacts in intensity and spatially or has no impact at all	- Impacts do not require further consideration
2	**Low**		**Low**	**High**	**Low**	**Low**
	- Will likely happen once within 30 to 50 years. - Will likely become critical within 30 to 50 years.		- The probability that the main components of the Project will be affected by the climate hazard is minimal. - There is a small chance that the secondary components will be affected by the climate hazard.	- Adaptation measures are easily implemented and effective.	- May temporarily affect people's quality of life - May lead to localized and reversible economic or environmental impacts	- Control measures likely not required
3	**Moderate**	**Medium (-0.5)**	**Moderate**	**Moderate**	**Moderate**	**Moderate**
	- Will likely happen once within 10 to 30 years. - Will likely become critical within 10 to 30 years.	- Data source is reliable, but the projections have relatively large uncertainties. - Data source has certain shortcomings, but projections have relatively small uncertainties. - Results come directly from the scientific literature.	- There is a low probability that the main components will be affected by the climate hazard. - There is a good chance that the secondary components will be affected by the climate hazard.	- There are adaptation measures, but their cost, the time to implement them or their effectiveness makes their implementation questionable.	- May affect people's quality of life for a long period - May lead to significant, but reversible economic or environmental impacts	- Some control measures required to reduce risks to lower levels
4	**High**		**High**	**Low**	**High**	**High**
	- Will likely happen once in 10 years. - Will likely become critical in 10 years.		- There is a high probability that the Project will be directly affected by the climate hazard.	- The implementation of adaptation measures is long and ineffective. - The cost of implementation is similar to the value of the Project.	- May significantly and irreparably affect the quality life of people - May lead to major or irreversible economic or environmental impacts over the lifespan of the Project	- High priority control measures required
5	**Very High**	**High (-0)**	**Very High**	**Very Low**	**Very High**	**Very High**
	- Will likely happen on a yearly basis or more. - Will likely become a critical/beneficial factor within less than 10 years.	- Data source is reliable. - Enough climate models have been used. - Projections have relatively low uncertainties.	- There is a very high probability that the Project will be directly affected by the climate hazard.	- Adaptation measures are non-existent. - The cost of implementing adaptation measures exceeds the value of the Project.	- May lead to fatalities (direct or indirect) - May lead to major and irreversible economic or environmental impacts for society	- Immediate control measures required
Opportunity	Consistent with categories above	Consistent with categories above	Consistent with categories above	Consistent with categories above	**Positive**	**Opportunity**
					- Increase in quality of life - Economic or environmental opportunity	- Measures to grab the recommended opportunity

Source: Based on Infrastructure Canada (2019), adapted and completed by WSP

The potential impacts are prioritized with a color-coding system, corresponding to the vulnerability ratings. The latter are obtained by the matrix of Table 9-2 cross-referencing the adaptive capacity and the sensitivity.

The terminology of the likelihood of impact is similar to that of the likelihood of climate hazards in Table 9-1, and is defined by cross-referencing the exposure rating with the vulnerability rating (Table 9-3). The severity of the impacts is assessed on an economic, social and environmental point of view separately, following the consequence terminology illustrated in Appendix 9-1. The final severity of impacts is the maximum rating among the three sectors. The initial risk rating is obtained by cross-referencing the likelihood and the severity of each impact (Table 9-4).

The risks are then prioritized with the same scaling system:

- Very High Risk: immediate control required;
- High Risk: high priority control measures required;
- Moderate Risk: some control required to reduce risks to lower levels;
- Low Risk: control likely not required;
- Very Low Risk: risk events do not require further consideration;
- Positive Impact/Opportunity: Climate change may equally have a positive effect.

Table 9-2 Matrix for Vulnerability Ratings

Vulnerability		Sensitivity Rating				
		Very Low	Low	Moderate	High	Very High
Adaptive Capacity Rating	Very Low	Very Low	Low	Moderate	High	Very High
	Low	Very Low	Low	Moderate	High	High
	Moderate	Very Low	Low	Low	Moderate	High
	High	Very Low	Very Low	Low	Moderate	Moderate
	Very High	Very Low	Very Low	Low	Low	Moderate

Table 9-3 Matrix for the Likelihood of Impact

Likelihood of Impact		Vulnerability Rating				
		Very Low	Low	Moderate	High	Very High
Exposure Rating	Very High	Low	Moderate	High	Very High	Very High
	High	Low	Moderate	High	High	Very High
	Moderate	Low	Low	Moderate	High	High
	Low	Very Low	Low	Low	Moderate	Moderate
	Very Low	Very Low	Very Low	Low	Low	Moderate

Table 9-4 Risk Rating Matrix

Initial Risk Rating		Severity of Impact				
		Very Low	Low	Moderate	High	Very High
Likelihood of Impact	Very High	**Low**	**Moderate**	**High**	**Very High**	**Very High**
	High	Low	Moderate	High	High	Very High
	Moderate	Low	Low	Moderate	High	High
	Low	Very Low	Low	Low	Moderate	Moderate
	Very Low	Very Low	Very Low	Low	Low	Moderate

9.1.3 CONTEXT AND RISK IDENTIFICATION

All available information available on the Project and the characteristics of the natural and human environment adjacent to the asset was gathered. This was done to identify components vulnerable to climate risks and select a collection of climate hazards following their relevance.

9.1.4 ANALYSIS OF CLIMATE OBSERVATIONS AND PROJECTIONS

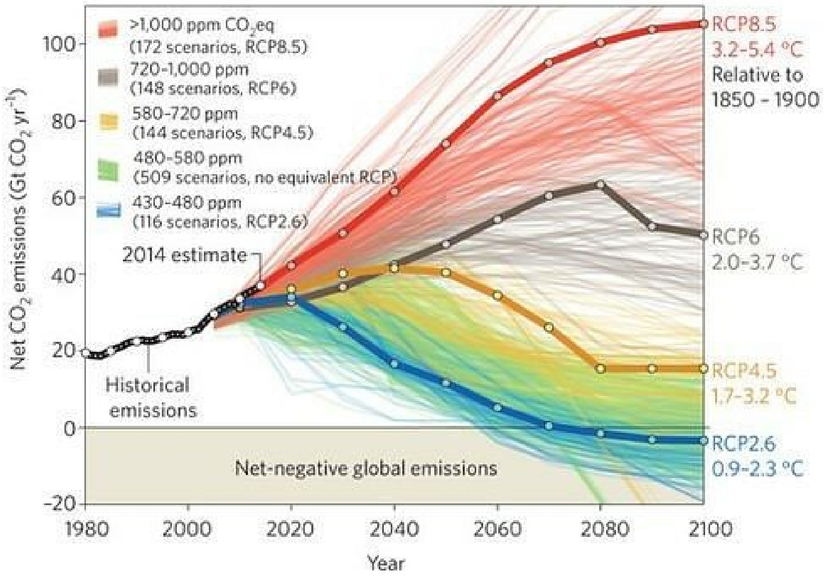
To complete the exposure assessment, climate data for the region of Nairobi, Nakuru and Mau Summit were obtained from two main sources:

- Historical observations are provided through the reanalysis dataset of ERA5 (ECMWF, 2020);
- Climate projections are gathered from the World Bank's *Climate Change Knowledge Portal* (CCKP; The World Bank Group, 2021).

The ERA5 dataset consists of a reanalysis dataset of observation data. In other words, forecast models and data assimilation systems are used to 'reanalyse' archived observations, creating global datasets describing the recent history of the atmosphere, land surface, and oceans. This dataset provides hourly estimates of a large number of atmospheric, land and oceanic climate variables on a 30 km spatial grid. This dataset is used to define the baseline period from 1986 to 2005 with temperature, precipitation, evaporation and wind statistics.

The CCKP is an online database that provides scientific information related to climate change and disaster risk, helping decision makers evaluate climate-related vulnerabilities and risks related to specific projects and regions. Climate data from the CCKP is processed by the National Center for Atmospheric Research, the International Research Institute of Columbia University, and the European Space Agency.

Understanding changes in climate exposure requires analysis of a range of climate projections over the course of the life span of the proposed infrastructure. The analysis presented here draws strongly from the CMIP5 (Climate Model Intercomparison Project) downscaled models, provided through the CCKP, and for which projections have been made for 39 climate indicators. These projections are based on four scenarios of future greenhouse gas (GHG) atmospheric concentrations – low (RCP2.6), medium-low (RCP4.5), medium-high (RCP6.0) and high (RCP8.5). They are available for four different future time periods (2020-2039, 2040-2059, 2060-2079, 2080-2099), with comparison to the baseline data for the 1986-2005 reference period.



Source: Fuss *et al.* (2014)

Figure 9-3 Net CO_2 Emissions for each RCP Scenario until 2100

Projections for the Nairobi-Nakuru-Mau Summit Highway are presented under the RCP4.5 and RCP8.5 scenarios (Figure 9-3). RCP8.5 corresponds to a high-range 'business-as-usual' scenario that does not include any mitigation measures (hereafter, the high-carbon scenario). On the other hand, the RCP4.5 is a moderate mitigation scenario aimed at minimizing costs of inaction to achieve a significant reduction in emissions (hereafter, the low-carbon scenario; Van Vuuren *et al.*, 2011). The time horizon selected is 2060-2079, as the expected service life of the Nairobi-Nakuru-Mau Summit Highway infrastructure is set by default to 50 years. The CCKP data was used to underpin the findings of the Fifth Assessment Report (AR5) of the Intergovernmental Panel of Climate change (IPCC). The analysis of future climate change is also supplemented by a literature review.

Due to the nature of the Project, the infrastructure under study is linear, and thus will be constructed over an extended region experiencing different climate conditions. This PCCRA then considers climate data from three different locations to ensure inclusion of all climate types (Figure 9-4). This option has been selected to better represent climate conditions along the entire Project area:

- Location 1 (1.279°S, 36.717°E): close to Nairobi with a relatively low altitude, located to the south of the road infrastructure;
- Location 2 (0.711°S, 36.421°E): close to Naivasha with a relatively low altitude, approximately at the middle point of the road infrastructure;
- Location 3 (0.171°S, 25.625°E): close to Mau Summit with a relatively high altitude, located at the extreme north part of the road infrastructure.

These locations are similar to those selected for the air quality study (see section 6.1.2) to ensure consistence among all chapters of the ESIA.

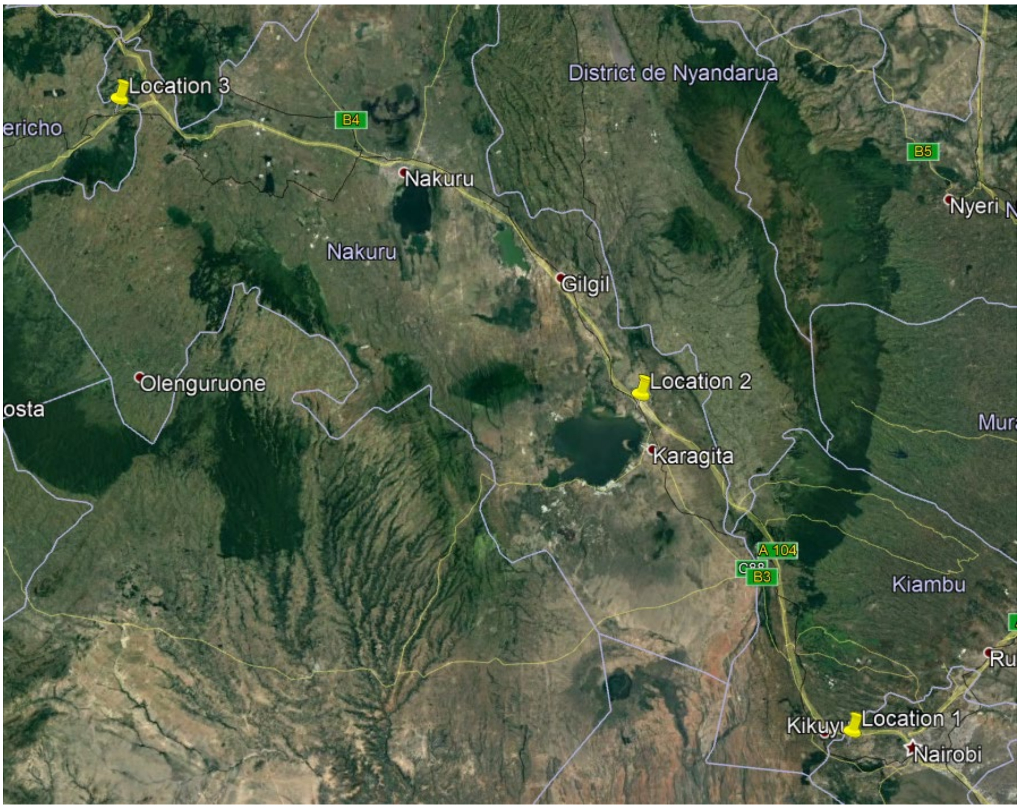


Figure 9-4 Locations Used as References for Climate Data

9.2 RISK IDENTIFICATION

This Section summarizes the main characteristics of the Project and presents the climate hazards that may have an influence on its components. Depending on the climate projections available for the time horizon corresponding to the design life of the infrastructure, an exposure assessment is presented in the last part of this section.

9.2.1 CONTEXT OF THE PROJECT

9.2.1.1 PROJECT OVERVIEW

The Project, which is part of the Kenyan Government's engagement to expand its road infrastructure, consists in the dualling of a 175 km portion of the A8 Highway between Rironi and Mau Summit into a four-lane dual carriageway. In addition, this includes strengthening of approximately 58 km of the A8-South Highway between Rironi and Naivasha, with operation and maintenance for both. The A8-South Highway is situated in Nakuru and Kiambu Counties, while the A8 Highway is located mainly in Kiambu and Nakuru Counties, with a small portion in Nyandarua and Baringo Counties (Figure 9-5). These highways are part of the busiest and most important transport corridors in East and Central Africa, yet their original design, combined with increased traffic, leads to congestion problems and many accidents involving people, livestock and wildlife. Thus, there is the need to expand the capacity and to improve the quality of the road.

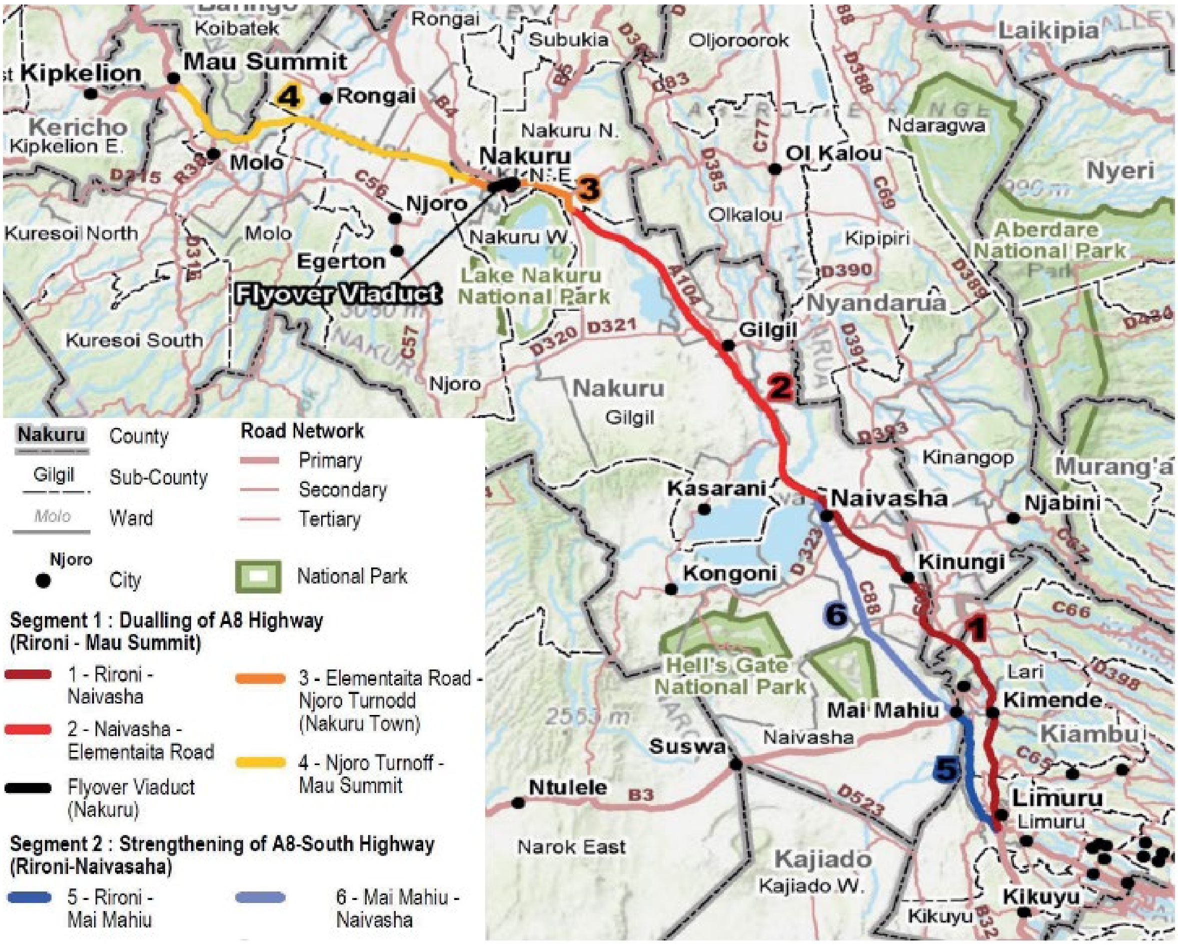


Figure 9-5 Location of the Nairobi-Nakuru-Mau Summit Highway Project

9.2.1.2 PROJECT COMPONENTS

In addition to the road infrastructure, many auxiliary features are included in the Project, listed in Table 9-5 according to the Project component categories that are used for this risk assessment.

Table 9-5 Components of the Nairobi-Nakuru-Mau Summit Highway Project

Category	Feature
Pavement structures	– Dualling of A8 Highway between Rironi and Mau Summit – Strengthening of A8-South Highway between Rironi and Naivasha – Improvement of major and minor roads junctions – Service lanes near towns and urban stretches to connect minor roads on A8 – Climbing lane at steep gradient locations – Construction of new U-turn facilities and upgrades to existing U-Turn facilities – Truck lay-byes
Engineering structures	– Flyover viaduct in Nakuru City – Bridges – Culverts – Underpasses (trains, vehicles, pedestrians) – Overpasses (trains, vehicles, pedestrians) – Wildlife and livestock crossing points – Retaining structures
Additional road equipment	– Bus bays and shelters – Gantries – Street lighting – High mast lighting – Road furniture (delineators, guideposts, nested rails, safety barrier systems, etc.) – Landscaping – Pedestrian facilities
Temporary construction facilities	– Construction sites – Material sites – Workers' accommodation camps
Surroundings	– Nearby communities – Surrounding environment (fauna and flora)

Key activities during construction will include site clearance and topsoil stripping, earthworks, drainage and culvert works, bridge works, subgrade, asphalt paving, and installation of road furniture. During the operation phase of the Project, the completed highway will require routine maintenance. This includes patch repair, crack sealing, edge repair, cleaning of roadside drains/cross drainage structures, repairing of shoulders, painting of road signs and kilometer stones, turfing, road markings, removal of litter and debris, replacement of damaged signs, and maintenance of culverts, among others. Periodic maintenance should also be conducted, such as pavement and structure maintenance, emergency works, environmental maintenance, traffic services maintenance, property management as well as network and assets management.

9.2.1.3 PROJECT TIMELINE AND DESIGN LIFE

According to the current Project timeline, construction is scheduled to take place from 2022 to 2025. Work on the different sections of the A8 and A8-South Highways will be conducted in parallel. The pavement structure has been designed to carry the projected traffic for an estimated 38 years. It is assumed that during this period, only ordinary maintenance work will be carried out. Such work includes maintenance of the shoulder and drainage systems, erosion monitoring, vegetation control, localized patching, and periodic resealing in the form of surface dressing or thin asphalt concrete, as per pavement surface conditions. The lifespan for all engineering structures (bridges, underpasses, viaducts) is approximately 100 years. For other road equipment (lighting, gantries, etc.) the lifespan varies from 3 to 30 years.

Based on this, the time horizon selected for the assessment is 2060-2079 (i.e. time horizon available on data portals and corresponding to the end of design life of the project). This takes into consideration the maintenance work carried out over the years and corresponds to the period during which the pavement structure will likely reach the end of its service life.

9.2.2 IDENTIFICATION OF CLIMATE HAZARDS

A hazard is defined as "the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources" (Lavell *et al*., 2012). A climate hazard is therefore a hazard at least partly linked to one or more climate variables. Some characteristics such as intensity, probability of occurrence, frequency as well as spatial location allows the identification of hazards likely to have an impact in each context. Based on the type of infrastructure and the geographical context of the Project, climate hazards considered in this assessment are:

— Heat waves;

— Droughts;

— Extreme precipitation and pluvial flooding;

— High winds and storm activity; and

— Landslides.

Although landslides are associated with geomorphological rather than climate risks, they are still likely to be affected by climate change. The triggering or aggravating factors of landslides include extreme precipitation and the increase in total annual precipitation (MTQ, 2018). River and lake flooding have been initially considered but have finally been rejected. Indeed, although considered a major hazard in African countries like Kenya, riverine flooding remains very unlikely to have a direct impact on the infrastructure assets because the road is located at least 10 meters above watercourses along the entire pathway.

In the following sections, climate trends are presented for climate indicators relevant for each climate hazard identified.

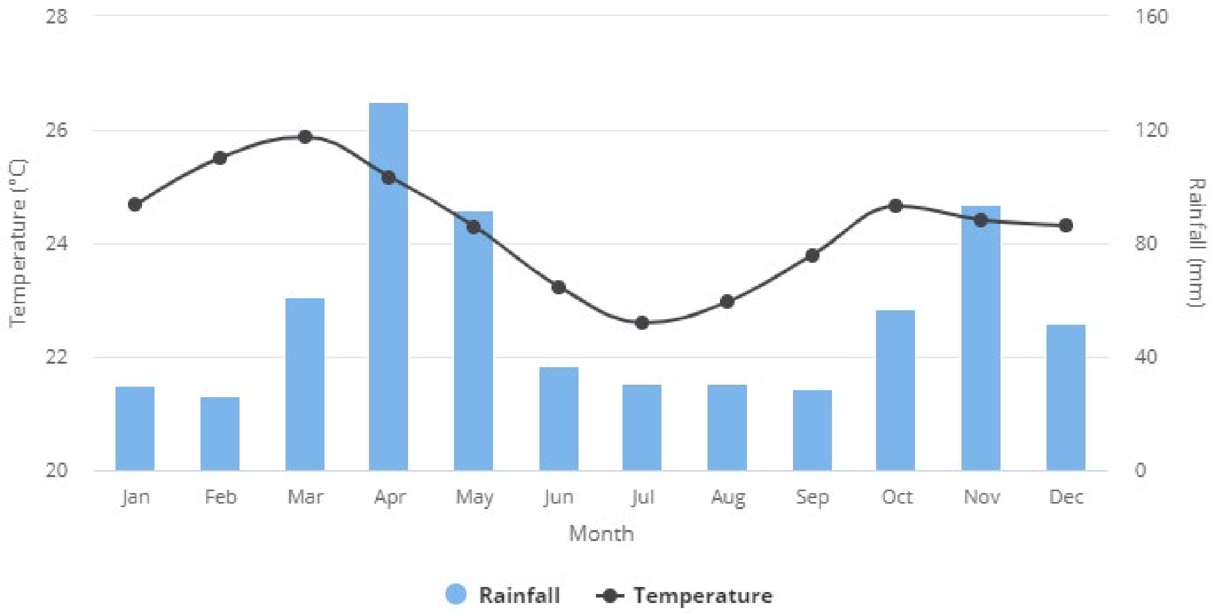
9.2.3 EXPOSURE ASSESSMENT

The Project's level of exposure was determined based on historical weather data (where available) and an analysis of scenarios for projected future climates and literature review of climate hazards, taking into consideration the associated uncertainty. Exposure is the presence of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places which could be adversely affected by a changing climate.

9.2.3.1 NATIONAL CLIMATE CONDITIONS

The Republic of Kenya is located across the equator in East Africa. Its relatively high topography moderates the tropical climate usually in place in these low-latitude regions, coastal plains to the eastern edge of the East African Plateau and the Great Rift Valley. The Project area lies in the west part of the country, which is considered warm temperate by the Köppen-Geiger distribution of climate zones (Kottek *et al*., 2006). This means that temperatures are relatively high throughout the year and that the region receives substantial amounts of precipitation in all seasons.

During the historical period, the mean annual temperature is about 24 °C. The rainy season usually begins in March and decreases in May to June. The second wet season begins around September/October and shows a decreasing trend in December. The mean annual amount of precipitation lies between 600 mm and 700 mm. The windiest time of the year occurs during the southeast monsoon, which extends from May to September (Figure 9-6).



Source: The World Bank Group (2021)

Figure 9-6 Average Monthly Temperature and Rainfall in Kenya from 1901 and 2016

Under the influence of climate change, Kenya's mean annual temperature has increased by 1.0 °C since 1960, at an average rate of 0.21°C per decade. The rate of increase has been most rapid in March to May (0.29 °C per decade) and slowest in June to September (0.19 °C per decade). However, observations of rainfall over Kenya since 1960 do not show statistically significant trends, as trends in the extreme indices based on daily rainfall data are mixed (The World Bank Group, 2021).

9.2.3.2 BASELINE STATISTICS AND FUTURE CLIMATE TRENDS

Table 9-6 to Table 9-8 present the different climate trends under the low- and high-carbon scenarios for the 2060-2079 horizon for each location considered, consistently with the 50-year life span of the Project components. Numbers in brackets represent the 10th and 90th percentile range of the inter-model spread (indeed, climate models do respond differently as a function of their climate sensitivity).

Table 9-6 Climate Baseline and Projections for Observation Location #1 (Near Nairobi)

Climate variable	Baseline (1986-2005)	Projections (changes from baseline to 2060-2079)	
		Low carbon (RCP4.5)	High carbon (RCP8.5)
Mean annual temperature (°C)	18.6 [18.3; 19.0]	+ 1.6 [+ 1.0; + 2.5]	+ 2.6 [+ 2.0; + 3.8]
Maximum temperature – March (°C)	26.8 [25.7; 27.8]	+ 1.6 [+ 1.0; + 2.2]	+ 2.5 [+ 1.5; + 3.8]
Minimum temperature – July (°C)	12.1 [11.4; 12.6]	+ 1.6 [+ 1.2; + 2.9]	+ 2.8 [+ 2.1; + 4.6]
Highest daily maximum temperature (°C)	30.1 [29.0; 31.1]	+ 1.8 [+ 0.2; + 3.8]	+ 2.9 [+ 1.4; + 5.1]
Number of summer days (T_{max} > 25 °C)	133.0 [104.3; 172.0]	+ 78 [+ 54; + 114]	+ 114 [+ 83; + 149]
Annual number of heat waves	1.5 [0.0; 3.0]	N/A	N/A
Probability of heat wave (%)	N/A	+ 20 [+ 10; + 40]	+ 40 [+ 20; + 70]
Mean annual precipitation (mm)	700 [527; 936]	+77 [- 181; + 369]	+ 85 [- 251; + 434]
Number of heavy precipitation days (>20 mm)	2.2 [0.0; 3.2]	+ 0.8 [- 1.4; + 5.9]	+ 1.5 [- 1.1; + 7.2]
Maximum daily rainfall (25-yr return level) (mm)	44.45	+ 4.41 [- 21.64; + 75.78]	+ 6.78 [- 19.29; + 89.62]
Maximum rainfall over 5 days (25-yr return level) (mm)	110.89	+ 15.30 [- 49.44; + 151.66]	+ 20.01 [- 28.80; + 148.16]
Mean drought index (Standardized Precipitation Evapotranspiration Index over 12 months)	0.8	+ 0.36 [- 0.91; + 1.18]	+ 0.33 [- 0.97; + 1.28]
Mean wind speed (km/h)	9.0 [8.4; 9.6]	N/A	- 10% in the boreal summer + 5% in the boreal winter
Maximum hourly wind speed (km/h)	24.4 [23.2; 25.7]	N/A	- 5% in the boreal summer + 5% in the boreal winter

Source: IPCC (2012); CSIC (2019); ECMWF (2020); The World Bank Group (2021).

Table 9-7 Climate Baseline and Projections for Observation Location #2 (Near Naivasha)

Climate variable	Baseline (1986-2005)	Projections (changes from baseline to 2060-2079)	
		Low carbon (RCP4.5)	**High carbon (RCP8.5)**
Mean annual temperature (°C)	15.8 [15.6; 16.2]	+ 1.6 [+ 1.1; + 2.5]	+ 2.7 [+ 2.1; + 3.8]
Maximum temperature – March (°C)	23.8 [22.5; 25.1]	+ 1.6 [+ 0.9; + 2.2]	+ 2.6 [+ 1.7; + 3.6]
Minimum temperature – July (°C)	10.1 [9.5; 10.7]	+ 1.6 [+ 1.3; + 3.1]	+ 3.1 [+ 2.1; + 4.5]
Highest daily maximum temperature (°C)	27.2 [26.3; 27.8]	+ 1.9 [+ 0.2; + 4.2]	+ 3.2 [+ 1.5; + 5.3]
Number of summer days (T_{max} > 25 °C)	24.8 [8.7; 46.8]	+ 86 [+ 56; + 117]	+ 130 [+ 86; + 155]
Annual number of heat waves	1.4 [0.0; 3.0]	N/A	N/A
Probability of heat wave (%)	N/A	+ 20 [+ 10; + 40]	+ 50 [+ 30; + 70]
Mean annual precipitation (mm)	1 059 [762; 1 372]	+ 101 [- 195; + 417]	+ 105 [- 334; + 466]
Number of heavy precipitation days (>20 mm)	4.7 [1.9; 8.1]	+ 1.2 [- 1.7; + 9.7]	+ 1.5 [- 1.4; + 12.8]
Maximum daily rainfall (25-yr return level) (mm)	93.48	+ 5.64 [- 17.31; + 63.83]	+ 8.24 [- 12.46; + 76.55]
Maximum rainfall over 5 days (25-yr return level) (mm)	139.96	+ 24.31 [- 35.57; + 130.08]	+ 17.39 [- 18.18; + 151.23]
Mean drought index (Standardized Precipitation Evapotranspiration Index over 12 months)	0.9	+ 0.31 [- 0.91; + 1.18]	+ 0.19 [- 1.19; + 1.31]
Mean wind speed (km/h)	5.9 [5.6; 6.2]	N/A	- 10% in the summer + 5% in the winter
Maximum hourly wind speed (km/h)	18.6 [17.5; 20.2]	N/A	- 5% in the summer + 5% in the winter

Source: IPCC (2012); CSIC (2019); ECMWF (2020); The World Bank Group (2021).

Table 9-8 Climate Baseline and Projections for Observation Location #3 (Near Mau Summit)

Climate variable	Baseline (1986-2005)	Projections (changes from baseline to 2060-2079)	
		Low carbon (RCP4.5)	**High carbon (RCP8.5)**
Mean annual temperature (°C)	16.0 [15.7; 16.4]	+ 1.6 [+ 1.1; + 2.6]	+ 2.7 [+ 2.1; + 3.8]
Maximum temperature – March (°C)	24.2 [23.1; 25.7]	+ 1.6 [+ 0.9; + 2.4]	+ 2.7 [+ 1.6; + 3.9]
Minimum temperature – July (°C)	10.3 [9.7; 10.8]	+ 1.7 [+ 1.4; + 3.1]	+ 3.0 [+ 2.3; + 4.5]
Highest daily maximum temperature (°C)	27.3 [26.4; 28.7]	+ 1.9 [0.0; + 4,0]	+ 3.0 [+ 1.5; + 4.7]
Number of summer days (T_{max} > 25 °C)	30.1 [14.7; 50.7]	+ 82 [+ 42; + 122]	+ 123 [+ 82; + 161]
Annual number of heat waves	1.3 [0.0; 3.0]	N/A	N/A
Probability of heat wave (%)	N/A	+ 20 [+ 10; + 40]	+ 40 [+30; + 70]
Mean annual precipitation (mm)	2 264 [1 826; 2 739]	+ 81 [- 185; +448]	+ 103 [- 260; + 521]
Number of heavy precipitation days (>20 mm)	20.3 [11.5; 29.3]	+ 0.8 [- 1,9; + 12.6]	+ 1.3 [- 1.3; + 11.3]
Maximum daily rainfall (25-yr return level) (mm)	94.38	+ 5.03 [- 18.9; + 59.91]	+ 11.79 [- 15.31; + 73.46]
Maximum rainfall over 5 days (25-yr return level) (mm)	233.16	+ 20.83 [- 47.63; + 113.27]	+12.63 [- 19.05; + 158.12]
Mean drought index (Standardized Precipitation Evapotranspiration Index over 12 months)	1.0	+ 0.47 [- 0.76; + 1.41]	+ 0.14 [- 1.03; + 1.52]
Mean wind speed (km/h)	5.0 [4.8; 5.3]	N/A	- 10% in the summer + 5% in the winter
Maximum hourly wind speed (km/h)	18.0 [16.3; 19.8]	N/A	- 5% in the summer + 5% in the winter

Source: IPCC (2012); CSIC (2019); ECMWF (2020); The World Bank Group (2021).

9.2.3.3 PROBABILITY SCORES FOR CLIMATE TRENDS

The likelihood and confidence of temperature and drought trends are generally high (Table 9-10). In terms of precipitation, the trends are less significant due to higher temporal and spatial variability. Probability score refers to the likelihood of observing a change in the climate variable over the next century. The higher is the probability score, the higher is the chance that climate variables will be modified over the 21st century (see Table 9-9 for the exact terminology). Climate hazards that are influenced by each climate variable are highlighted in the right column.

Table 9-9 Terminology of the likelihood of observing a change in a climate variable

Score	Probability
1	**Very low**
	Projected ranges in future climate are similar to historic ranges and no trend can be identified.
2	**Low**
	Projected ranges in future climate completely or significantly overlap historic baseline means and uncertainty ranges and/or do not exceed historic or design thresholds.
3	**Moderate**
	Projected ranges in future climate overlap historic baseline means and lower or upper uncertainty ranges (dependant on if the trends are increasing or decreasing) and/or meet or marginally exceed historic values.
4	**High**
	Projected ranges in future climate overlap historic lower or upper uncertainty ranges (dependant on if the trends are increasing or decreasing) and/or exceed historic values.
5	**Very High**
	Projected ranges in future climate are entirely out of the range of historic baseline means and uncertainty ranges and/or significantly exceed historic values.

Table 9-10 Likelihood and Confidence of Climate Trends for the 2060-2079 Period under RCP4.5 and RCP8.5

Climate variable	Trend	Likelihood of climate trends (- confidence penalty)			Corresponding climate hazards and probability score
		Observation Point 1	Observation Point 2	Observation Point 3	
Mean annual temperature (°C)	↑	5 (- 0)	5 (- 0)	5 (- 0)	Heat waves
Maximum temperature – March (°C)	↑	5 (- 0)	5 (- 0)	5 (- 0)	Heat waves Droughts
Minimum temperature – July (°C)	↑	5 (- 0)	5 (- 0)	5 (- 0)	N/A
Highest daily maximum temperature (°C)	↑	5 (- 0)	5 (- 0)	5 (- 0)	Heat waves
Number of summer days (T_{max} > 25 °C)	↑	5 (- 0)	5 (- 0)	5 (- 0)	Heat waves
Annual number of heat waves + Probability of heat wave (%)	↑	4 (- 0)	4 (- 0)	4 (- 0)	Heat waves
Mean annual precipitation (mm)	↑	3 (- 0.5)	3 (- 0.5)	3 (- 0.5)	Droughts Extreme precipitation and pluvial flooding
Number of heavy precipitation days (>20 mm)	↑	3 (- 0.5)	3 (- 0.5)	3 (- 0.5)	Extreme precipitation and pluvial flooding Landslides
Maximum daily rainfall (25-yr return level) (mm)	↑	4 (-1)	3 (-1)	3 (-1)	Extreme precipitation and pluvial flooding Landslides
Maximum rainfall over 5 days (25-yr return level) (mm)	↑	5 (-1)	5 (-1)	4 (-1)	Extreme precipitation and pluvial flooding Landslides
Mean drought index (Standardized Precipitation Evapotranspiration Index over 12 months)	↑	2 (- 1)	2 (- 1)	2 (- 1)	Droughts
Mean wind speed (km/h)	?	2 (- 1)	2 (- 1)	2 (- 1)	High winds and storm activity
Maximum hourly wind speed (km/h)	?	2 (- 1)	2 (- 1)	2 (- 1)	High winds and storm activity

9.2.3.4 HISTORICAL OCCURRENCE AND FUTURE TRENDS BY CLIMATE HAZARD

HEAT WAVES

Mean annual temperature is expected to rise by +1.6-2.7°C for the 2060-2079 period. This increase is also visible in maximum summer (March) temperature and minimum winter (July) temperature, which has a 10% chance to increase by +3.1°C in the worst-case scenario. This shift will lead to an increase in the frequency, intensity and duration of heat waves. On average over the year, location #1 (in the southern portion of the road infrastructure) presents higher daily maximum temperatures compared to the two other locations. The number of heat waves identified (period of at least three consecutive days above the 95th percentile of the distribution) has been slightly greater in location #1 in the recent past. The evolution of their frequency will evolve in a similar way for the three locations.

Data quality, likelihood and confidence levels are high on average. Statistical downscaling of climate models is considered a valid method to identify trends in temperatures at the seasonal or annual scale.

DROUGHTS

Drought conditions are usually triggered by a lack of precipitation and high temperatures facilitating evapotranspiration. Since location #1 experiences higher temperatures and receives less precipitation than the two other locations, drought conditions are more likely to happen in the southern part of the Project. Indeed, the drought index used in this study (the Standard Precipitation and Evapotranspiration Index – SPEI) exhibits slightly lower values than locations #2 and #3. Under the influence of climate change, the drought index is likely to increase in all locations, predicting a decrease in the likelihood of drought conditions. This means that the general increase in precipitation has a greater influence than the higher potential evapotranspiration due to higher temperatures. Results from the scientific literature, however, highlight mixed findings. Studies specific to Kenya have mostly focused on historical tendencies, and the few that include future projections of drought conditions highlight contradictory trends (Tan *et al.*, 2020). However, the hydrographic network flows inside of the region where the infrastructure project is located, directly leading to water accumulation, underground infiltration and evapotranspiration in the three surrounding lakes. Drought conditions near the infrastructure will likely be exacerbated in the future compared to the current period.

EXTREME PRECIPITATION AND PLUVIAL FLOODING

As already mentioned in the above section on drought, location #1 receives much less precipitation than location #2 and especially location #3. Location #3 is therefore more subject to extreme precipitation events than location #1. For instance, the maximum amount of precipitation received within five consecutive days is 111, 140 mm and 233 mm for locations #1, #2 and #3, respectively. Under the influence of climate change, precipitation regimes are likely to change overall, but a great variability remains among the different climate models. Overall, the mean annual change over the 21st century corresponds to an increase in annual precipitation of 11 to 12% for location #1, 10% for location #2, and 4 to 5% for location #3, respectively for low and high carbon emission scenarios. The number of days with more than 20 mm of precipitation will very slightly increase by the end of the century under the RCP8.5 scenario (between +1.3 and 1.5 days). Daily extreme precipitation events and maximum rainfall over 5 days are likely to increase in magnitude.

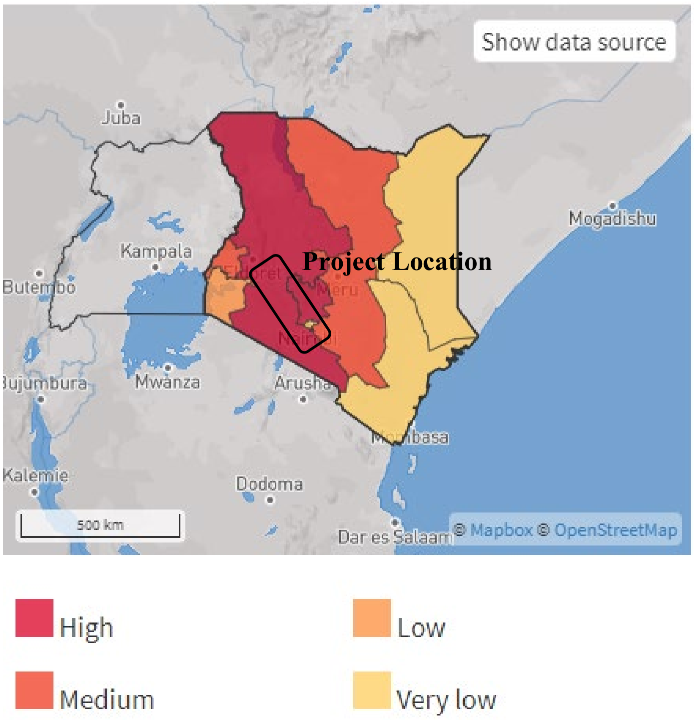
High variability between models for precipitation indicators leads to a moderate likelihood and a low confidence of trends. Nonetheless, a precaution principle would imply planning for an increase in overall precipitation and more frequent and intense extreme precipitation events. This applies especially in the northern part of the infrastructure, where major extreme precipitation events already occurred in the recent past.

HIGH WINDS AND STORM ACTIVITY

In the recent past, observation data shows that location #1 has been exposed to more intense winds than the two other locations. Wind is one of the hardest climate variables to projects, both in terms of direction and magnitude. Wind projection is the indirect result of assessing circulation patterns from daily temperature and precipitation outputs from global models. According to the most reliable climate projections, wind speed is likely to evolve differently depending on the location or the season of interest under the influence of climate change. Under RCP8.5, changes in the mean wind speeds and wind gusts for the 2081-2100 period (relative to 1981-2000) predict that Kenya will experience contradictory seasonal trends. That is, winds will decrease during the summer months (December through February) by approximately 10% (mean wind speed) and 5% (mean wind gusts), while winter months (June through August) will see an increase of approximately 5% in both mean wind speeds and wind gusts (IPCC, 2012).

LANDSLIDES

Landslides, although associated with geomorphological rather than climate risks, are still likely to be affected by climate change. Indeed, the triggering or aggravating factors of landslides include, among others, extreme precipitation as well as the increase in total annual precipitation (MTQ, 2018). In the Project area, landslide susceptibility is classified as high according to the information that is currently available at large scale (Figure 9-7).



Source: GFDRR (n.d.)

Figure 9-7 Current Landslide Susceptibility for Different Regions of Kenya

This means that this area has rainfall patterns, terrain slopes, geology, soil and land cover that make localized landslides a frequent hazard phenomenon. The Rift Valley is indeed highly exposed to landslides due to its topography and soil types. Major landslides occur every year following high precipitation events. Events of spring 2020 well represents the level of risk in the Project area (OCHA, 2020).

Climate change is likely to alter slope and bedrock stability through changes in precipitation regimes. It is difficult to determine future locations and timing of large rock avalanches, as these depend on local geological conditions and other non-climate factors. However, due to the type of infrastructure under study (linear and over more than 100 km), the likelihood of a landslide occurring near the asset is initially high and will significantly increase due to climate change. This may occur especially in the northern part of the Project, where precipitation amounts are larger than in the southern part. WSP recommends that geotechnical assessments be undertaken before commencement of construction works to confirm the level of risk associated with landslides and inform the final design of the road.

SOURCES OF UNCERTAINTY

There are several sources of significant uncertainties related to climate modeling. These sources are considered in this analysis to apply the best practices regarding the use of climate information:

- *Greenhouse gas emissions:* we considered greenhouse gas emissions under two different emission scenarios. The concentration of GHG in the atmosphere is indeed a major source of uncertainty in climate projections. Climate modelling takes this uncertainty into account through the inclusion of different emissions scenarios which produce a large range of outcomes, depending on socioeconomic conditions and the implementation of mitigation measures at global scale.
- *Climate models:* this analysis is based on an ensemble of global climate models. Climate models are complicated computer programs that include many variables and equations to simulate atmospheric and oceanic processes and changes in climate conditions over time. Despite this, the climate system is so complex that it is not possible to include all processes in the model and so they remain simplified versions of the real world. These trade-offs and approximations result in limitations and uncertainties. Given this uncertainty and the differences between individual climate models, it is not possible to select a single best climate model. To account for this, an ensemble of models is used, allowing the inter-model range of projections to be analysed.
- *Down-scaling techniques:* the best available data are produced by statistical downscaling of model simulations. This technique tends to underestimate extremes and to be imprecise to represent short-term climate events. In this respect, the analysis of regional climate model outputs, considering territorial features (e.g., topography and land use) would improve the quality of the data analysis.

9.2.3.5 EXPOSURE TO CLIMATE HAZARDS

Exposure is the presence of people, livelihoods, environmental services and resources, infrastructure, or economic, social, and cultural assets in places which could be adversely affected by a changing climate (IPCC, 2014). This section aims to summarize the current and future exposure of the Project to the climate-related hazards identified in Section 9.2.2. More precisely, the aim here is to link climate hazards selected as being relevant for the design, the service, and the construction of the infrastructure with climate baseline and trends. Table 9-11 present probability scores for each of these climate hazards. They begin with the most important hazards based on the average of scores of the related climate trends and confidence intervals of climate projections, as detailed in Table 9-10. The current probability scores of each climate hazard correspond to statistics of the recent past, whereas the future probability scores are obtained by combining current scores and likelihood of trends identified in Sections 9.2.3.2 and 9.2.3.3. Baseline scores are used for the analysis of impacts affecting the construction phase, where future scores are used for the analysis of impacts affecting the other phases of the project.

Table 9-11 Probability Scores for Baseline and Future Occurrence of the Selected Climate hazards

CLIMATE HAZARD	PROBABILITY SCORES					
	Location 1		Location 2		Location 3	
	Baseline	Future	Baseline	Future	Baseline	Future
Heat waves	High	Very high	Moderate	Very high	Moderate	High
Droughts	Moderate	High	Low	Moderate	Low	Moderate
Extreme precipitation and pluvial flooding	Low	Moderate	Moderate	High	High	Very high
High winds and storm activity	Moderate	Moderate	Low	Low	Low	Low
Landslides	Moderate	Moderate	High	Very high	High	Very high

9.3 VULNERABILITY ASSESSMENT

Vulnerability to climate change is the degree to which a system (here, the components of the Project) is capable or unable to cope with the negative effects of climate change. Vulnerability is then the combination of the sensitivity and the adaptive capacity of each component. Ratings have been assessed through the Vulnerability Matrix illustrated in Table 9-2.

9.3.1 POTENTIAL IMPACTS

Table 9-12 presents all interactions that can trigger a potential impact on the integrity of the infrastructure and its surroundings. Potential impacts are sorted out in a matrix depending on the infrastructure component/phase exposed and on the climate hazard triggering the impact. If a potential impact is linked to more than one climate hazard, the corresponding likelihood rating will correspond to the maximum value of the ratings in order to avoid underestimating the level of risk. Project components have been defined in Section 9.2.1 and are used here to categorize the different climate impacts identified:

- Construction phase and facilities;
- Pavement structures;
- Engineering structures;
- Additional road equipment;
- Nearby communities and the environment.

Potential impacts on the construction phase and facilities are assessed with current and near-future climate conditions (i.e., baseline ratings from the exposure assessment). Impacts on other categories are assessed with long-term projections (i.e., future ratings, see Table 9-11). The highest rating is considered among the three locations selected and the most impacted portion of the infrastructure is made in the risk register.

Table 9-12 List of Potential Impacts for each Climate Hazard Identified

	Potential impacts	Heat waves	Droughts	Extreme precipitation and pluvial flooding	High winds and storm activities	Landslides
Construction phase and facilities						
1	Loss of labour productivity during construction	■				
2	Increase in the number of health and safety incidents in the workplace	■		■	■	■
3	Decrease of potable water supply	■	■			
4	Delays in material deliveries and lack of access to construction site		■	■		■
Pavement structures						
5	Melting of pavement due to high temperatures	■				
6	Tree fall or rock crumbling causing damages on pavement			■	■	■
7	Higher maintenance needs on pavement due to cracks and destruction			■		■
8	Increase in vegetation spread on pavement	■				
Engineering structures						
9	Higher maintenance needs on bridge joints	■				
10	Excessive lateral wind loading on bridge and viaduct structures				■	
11	Thermal expansion of steel structures of bridges and viaducts	■				
12	Insufficient capacity of the drainage systems			■		
13	Blockage of crossing points due to water and debris accumulation			■	■	■
14	Corrosion of retaining walls			■		
Additional road equipment						
15	Power and communication system failure	■			■	■
16	Landscaping vulnerable to increased temperatures and reduced soil moisture	■	■			
17	Destruction or deterioration of shelters and street lighting			■	■	■
Nearby communities and the environment						
18	Dust dispersion in communities during construction		■		■	
19	Flooding of surrounding areas			■		
20	Reduced visibility due to smoke during wildfires	■	■			
21	Injuries or fatalities due to flash flooding of crossing points			■		■
22	Long-term loss of serviceability of the infrastructure		■	■		■
23	Large-scale disturbance of economic activities		■	■		■

9.3.2 SENSITIVITY AND ADAPTIVE CAPACITY

Sensitivity to climate change is the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise; UNEP, 2005). Adaptive capacity is the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences. Adaptive capacity can reduce a Project's vulnerability to potential impacts, and, depending on input provided by the client, the Project itself already has an intrinsic level of capacity to adapt to climate change. The measures already in place and those that would be easy to implement in the final design phase are listed.

Presented below in Table 9-13 is the summary of the sensitivity, adaptative capacity rationales for each impact, considering design standards to follow and local challenges[1]. Note, as a higher adaptive capacity decreases the impact from a climate hazard and a lower adaptive capacity increases the impact the colours have been assigned accordingly for that row. Reds contribute the most to increasing a climate risk, orange meaning moderate, and green and yellow signifying a higher capacity to adapt to climate impacts.

[1] Refer to documents supplied by Vinci Construction (Schedule 2: Design Construction Standards and Schedule 3: Performance Standards).

Table 9-13 Sensitivity and Adaptive Capacity Rationales for each Potential Impact

Potential impacts		Sensitivity	Adaptive capacity
1	Loss of labour productivity during construction	Construction of the infrastructure may be delayed and has no plan for weather contingencies. Even a small decrease in productivity will have a large impact. However, construction is likely to happen within the next years: climate trends displayed will then not have a significant influence on current climate conditions.	Working schedules can be arranged to better fit cooler hours of the day. Health guidelines for working in heat are applied and recurring events have been taken account in the program. Alternate personnel can be available, but only in limited quantity.
2	Increase in the number of health and safety incidents in the workplace	More incidents can jeopardize the construction schedule and on-time delivery of the infrastructure. However, construction is likely to happen within the next years: climate trends displayed will then not have a significant influence on current climate conditions.	Alternate staff to replace those unable to work remains scarce. The health and safety system for construction needs to be revised and significantly improved.
3	Decrease of potable water supply	Access to potable water for workers is essential during construction. Supply could be reduced as there is less precipitation during the dry season. Some municipal systems can provide for personal use. However, construction is likely to happen within the next years: climate trends displayed will then not have a significant influence on current climate conditions.	Potable water can be stored and brought to the construction site. But water availability in general can trigger some supply problems in case of very dry conditions.
4	Delays in material deliveries and lack of access to construction site	In case of extreme events blocking access paths, delivery of materials can be delayed or even cancelled and workers staying in neighboring communities will not be able to access the construction site. This would lead to potential major delays in construction. However, construction is likely to happen within the next years: climate trends displayed will then not have a significant influence on current climate conditions.	Deliveries can be scheduled in advance to assure availability of essential materials.

Potential impacts		Sensitivity	Adaptive capacity
5	Melting of pavement due to high temperatures	Concrete and bitumen are sensitive to very high temperatures and sun exposure. In the long term, the warmest day of the year will reach 33 C in the south. No issue on bitumen is identified for these temperature values. The infrastructure is built following codes and standards and to take account of climate change for the evaluation of the elasticity modulus. Melting of pavement remains very unlikely given the temperature ranges projected.	Following design standards is good but may be not sufficient. A security factor can be implemented but would require a change in design and material use.
6	Tree fall or rock crumbling causing damages on pavement	Although removal of tree hazards is part of the site work, trees on site will remain sensitive to this risk over time. Crumbling will remain a significant issue on secondary roads, directly constructed on rock. And damages can cause temporary loss of serviceability if substantially major.	Trees and unstable rock can be actively monitored and managed to prevent issues.
7	Higher maintenance needs on pavement due to cracks and destruction	If a major landslide or flood does occur due to high precipitation, serious damages could occur, and maintenance work may be urgent to ensure road safety.	When such a hazard occurs, damages are not avoidable, even if the infrastructure is strong. The only measure to be taken is to ensure a sufficient contingency fund to repair damaged road as soon as possible.
8	Increase in vegetation spread on pavement	Higher temperatures will lead to rapid growth of unwanted vegetation on the infrastructure.	Vegetation can be actively monitored and managed to prevent issues.
9	Higher maintenance needs on bridge joints	Increased thermal expansion can cause joint displacement and accelerated deterioration of materials. The design criteria give a minimum-maximum temperature range corresponding to historical average only and does not consider future climate conditions. However, thermal expansion remains very unlikely given the temperature ranges projected.	The design criteria comply with the recommendations of design standards but may not be sufficient in the relatively near future. A security factor can be implemented and would be considered in the design with a minimal cost.

Potential impacts		Sensitivity	Adaptive capacity
10	Excessive lateral wind loading on bridge and viaduct structures	Although high winds due to storm activity are projected to increase, it is anticipated that winds will still be within design thresholds.	Although it is expected that the infrastructure will be designed with these potential risks in mind already (design standards consistent with future climate conditions), retrofitting of the structure of bridges and viaducts remains very expensive.
11	Thermal expansion of steel structures of bridges and viaducts	Increased thermal expansion can cause joint displacement and accelerated deterioration of materials which may lead to premature failing that can lead to water and/or air leakage (ex. sealant joints). In the long term, the warmest day of the year will reach 33C in the south. Despite the fact that thermal expansion is certain before the end of the design life of the infrastructure, it has no consequence on isostatic structures (such as the viaducts) as long as the bridge joints and the bearings are correctly designed. Thermal expansion on hyperstatic bridges will result in internal stress, which are considered in the design. Thermal expansion of culvert is minimal as they are buried structures	Retrofitting of bridge and culvert components remains relatively feasible but would incur a significant additional cost that is not foreseen in any contingency plans.
12	Insufficient capacity of the drainage systems	The design criteria used for drainage and storm water management need to meet current and future extreme precipitation statistics. The high topography and the relatively insufficient storm water management system (in light of past experience and future statistics) may lead to major runoff and flooding of the asset. The hydrological model used (TRRL East African Flood Model) does not consider future climate projections. Insufficient capacity may be more critical in northern regions.	If flooding was to exceed the capacity of the system, it would overflow pathways and roads and even flood neighboring communities. Surface drainage flow could be retroactively improved which could be expensive and require site regrading. Retroactive grading changes, incorporating increase to storm pipes may be invasive and expensive.

Potential impacts		Sensitivity	Adaptive capacity
13	Blockage of crossing points due to water and debris accumulation	Crossing points are essential for wildlife and local communities. Flash floods can occur in these points when drainage capacity is insufficient.	Cleaning operations are easy to implement, but stormwater management capacity is hard and expensive to improve.
14	Corrosion of retaining walls	Corrosion of retaining walls is a slow process and will not affect the serviceability of the infrastructure as much as, for example, thermal expansion of bridge materials. The impact of air temperature and rainfall intensity on corrosion of structure is very minimal. The reduction of section due to corrosion is taken into consideration in the design of corroding structures (such as nailed walls).	Non-corrosive material can be used in the final design of the retaining walls for a reasonable cost.
15	Power and communication system failure	In case of extreme heat or high winds, major power failures can occur. The infrastructure does not have a back-up power source, and street lighting and signals may become out of service. This triggers the serviceability of the infrastructure itself.	An alternative source of power is difficult to implement in this situation and remains costly.
16	Landscaping vulnerable to increased temperatures and reduced soil moisture	Well-established species may not be adapted to new climate conditions. But the serviceability of the infrastructure is not compromised. In case of major plant extinction, soil may be more subject to landslides in some specific areas.	Watering frequency can be modified (although water supply must be sufficient to do so), and more heat resistant plants can be introduced if not already part of landscaping plan.
17	Destruction or deterioration of shelters and street lighting	In case of a major extreme event, shelters and street lighting may be destroyed, especially by strong winds if horizontal loading standards are not sufficient to future conditions. As a result, they can also be affected by landslides because some components of the infrastructure can be seriously damaged.	It is expected that the infrastructure will be designed with these potential risks in mind already (design standards consistent with future climate conditions), retrofitting of shelters and signals remains relatively affordable compared to the renewal of other larger components, such as bridges or culverts.

Potential impacts		Sensitivity	Adaptive capacity
18	Dust dispersion in communities during construction	Dispersion of dust is very likely during construction work and surrounding communities can be impacted by respiratory problems and reduced visibility. However, this impact is temporary and does not affect the construction of the infrastructure.	Monitoring of dust dispersion can not be done in an efficient way during construction. Warnings can be sent to surrounding communities to reduce the temporary impact on their activities. Water spreading is already a common practice in the environmental management plan.
19	Flooding of surrounding areas	In the recent years, an important number of communities and farms were flooded because of malfunctioning drainage systems directly linked to the infrastructure. Economic activities are strongly impacted for local communities. The high topography and the relatively insufficient storm water management system (in light of past experience and future statistics) may lead to major runoff and flooding of surrounding areas. The hydrological model used (TRRL East African Flood Model) does not consider future climate projections. Insufficient capacity may be more critical in northern regions.	If flooding was to exceed the capacity of the system, it would overflow neighboring communities. Surface drainage flow could be retroactively improved which could be expensive and require site regrading. Retroactive grading changes, incorporating increase to storm pipes may be invasive and expensive.
20	Reduced visibility due to smoke during wildfires	Good visibility is a priority for users of the infrastructure. In case of a major wildfire nearby, visibility can be significantly reduced, and traffic may have to be interrupted until the fire is under control.	Monitoring of wildfire occurrence is relatively easy to prevent low visibility problems for users. However, in a case of a wildfire, the infrastructure owner has no capacity to adapt to such extreme conditions.

Potential impacts		Sensitivity	Adaptive capacity
21	Injuries or fatalities due to flash flooding of crossing points	Crossing points are essential for wildlife and local communities. Flash floods can occur in these points when drainage capacity is insufficient and when accumulation of debris is significant.	Cleaning operations are easy to implement, but stormwater management capacity is hard and expensive to improve. Awareness campaign for local communities can be easily implemented to prevent any injuries in case of extreme weather conditions. However, controlling wildlife traffic at crossing points remains challenging.
22	Long-term loss of serviceability of the infrastructure	When a portion of the road is seriously damaged by a climate hazard (flash flood, landslide, wildfire), road closures are unavoidable. However, this may rarely happen, and if it does, only a small part of the infrastructure will be affected. The spatial distribution of linear infrastructure is an opportunity here to reduce its sensitivity to this specific impact.	The adaptive capacity of the owner remains low when a portion of the infrastructure becomes unusable. Actions to clean the infrastructure will be implemented as soon as possible, but a delay could occur. The adaptive capacity of local communities is low as well since there is no alternative road to travel to a neighboring county.
23	Large-scale disturbance of economic activities	In a case of a major climate hazard, local businesses, regional transit and international trade can be impacted, which leads to less traffic on the infrastructure. Alternatively, if the infrastructure is closed due to weather damages, economic activities which rely on transportation of merchandise or people may be strongly affected.	There is no alternative road to travel to a neighboring county and for transit of goods between Port of Mombasa and inland northeastern Africa (Uganda, Ethiopia, Congo Democratic Republic), and local businesses depend on road infrastructure to generate revenue (e.g. farmers).

9.3.3 VULNERABILITY SCORING

Presented below in Table 9-14 are the final vulnerability ratings of the Project to each impact. The matrices used to calculate the vulnerability can be found in Section 9.1.2. Here are presented the final vulnerability ratings (see Appendix 9-2 for the complete risk register).

Table 9-14 Vulnerability Ratings for each Potential Impact

	Potential impacts	Vulnerability scoring
1	Loss of labour productivity during construction	Low
2	Increase in the number of health and safety incidents in the workplace	Low
3	Decrease of potable water supply	Low
4	Delays in material deliveries and lack of access to construction site	Low
5	Melting of pavement due to high temperatures	Very low
6	Tree fall or rock crumbling causing damages on pavement	Low
7	Higher maintenance needs on pavement due to cracks and destruction	High
8	Increase in vegetation spread on pavement	Very Low
9	Higher maintenance needs on bridge joints	Very Low
10	Excessive lateral wind loading on bridge and viaduct structures	Low
11	Thermal expansion of steel structures of bridges and viaducts	Low
12	Insufficient capacity of the drainage systems	High
13	Blockage of crossing points due to water and debris accumulation	Moderate
14	Corrosion of retaining walls	Very Low
15	Power and communication system failure	Low
16	Landscaping vulnerable to increased temperatures and reduced soil moisture	Very Low
17	Destruction or deterioration of shelters and street lighting	Low
18	Dust dispersion in communities during construction	Low
19	Flooding of surrounding areas	High
20	Reduced visibility due to smoke during wildfires	Low
21	Injuries or fatalities due to flash flooding of crossing points	Moderate
22	Long-term loss of serviceability of the infrastructure	Moderate
23	Large-scale disturbance of economic activities	High

9.4 RISK EVALUATION

Risk is the potential loss of life, injury, or destruction/damage of assets which could occur to a system, society or a community in a specific period, determined probabilistically as a function of hazard, exposure, vulnerability and capacity. In other words, risk is the product of the likelihood and the severity of impacts. Applying this definition, climate-and weather-related risks have been identified by reviewing the available Project documentation and relevant literature, and by applying expert opinion and experience of previous similar projects. For the purpose of this assessment, the risk rating is defined as "the risk before the consideration of mitigation efforts". As such, this is the climate-and weather-related risk that exists before any type of resilience or mitigative measures are considered.

9.4.1 LIKELIHOOD AND SELECTION OF RELEVANT IMPACTS

Likelihood of impact is the probability of occurrence of an impact caused by a climate hazard that affects the society, the economy, an infrastructure and/or the environment. The likelihood of each impact is obtained by cross-referencing the associated vulnerability of the Project and the exposure to climate hazards causing this impact. Presented below in Table 9-15 is the likelihood of impact ratings for impacts which were rated 'moderate' or higher (20 out of 23). These are the impacts that will be carried through in the subsequent section of this chapter.

Table 9-15 Likelihood of Impact for Impacts with a Rating of 'Moderate' or Higher

Potential impacts		Likelihood scoring
1	Loss of labour productivity during construction	Moderate
2	Increase in the number of health and safety incidents in the workplace	Moderate
3	Decrease of potable water supply	Moderate
4	Delays in material deliveries and lack of access to construction site	Moderate
5	Melting of pavement due to high temperatures	Moderate
6	Tree fall or rock crumbling causing damages on pavement	Moderate
7	Higher maintenance needs on pavement due to cracks and destruction	Very High
9	Higher maintenance needs on bridge joints	Moderate
11	Thermal expansion of steel structures of bridges and viaducts	High
12	Insufficient capacity of the drainage systems	Very High
13	Blockage of crossing points due to water and debris accumulation	High
14	Corrosion of retaining walls	Moderate
15	Power and communication system failure	Moderate
17	Destruction or deterioration of shelters and street lighting	Moderate
18	Dust dispersion in communities during construction	Moderate
19	Flooding of surrounding areas	Very High
20	Reduced visibility due to smoke during wildfires	Moderate
21	Injuries or fatalities due to flash flooding of crossing points	High
22	Long-term loss of serviceability of the infrastructure	High
23	Large-scale disturbance of economic activities	Very High

9.4.2 SEVERITY OF IMPACTS AND INITIAL RISK RATING

Severity is a measure of impact a hazard has on an element of the Project. The severity of each impact is identified from a social, economic and environmental point of view. The final severity score corresponds to the maximum level of severity among the three sectors, to keep a conservative approach and not to underestimate an impact. Provided below in Table 9-16 are the severity ratings for impacts which had a likelihood of occurring 'moderate' or higher. Severity rationales have been provided in Appendix 9-1 (see Appendix 9-2 for the complete risk register).

Table 9-16 Severity Ratings for Impacts with Likelihoods of 'Moderate' or Higher

Potential impacts		Severity scoring
1	Loss of labour productivity during construction	Moderate
2	Increase in the number of health and safety incidents in the workplace	High
3	Decrease of potable water supply	Moderate
4	Delays in material deliveries and lack of access to construction site	Moderate
5	Melting of pavement due to high temperatures	Moderate
6	Tree fall or rock crumbling causing damages on pavement	Moderate
7	Higher maintenance needs on pavement due to cracks and destruction	Moderate
9	Higher maintenance needs on bridge joints	Moderate
11	Thermal expansion of steel structures of bridges and viaducts	Moderate
12	Insufficient capacity of the drainage systems	High
13	Blockage of crossing points due to water and debris accumulation	High
14	Corrosion of retaining walls	Moderate
15	Power and communication system failure	Moderate
17	Destruction or deterioration of shelters and street lighting	Low
18	Dust dispersion in communities during construction	Moderate
19	Flooding of surrounding areas	Very High
20	Reduced visibility due to smoke during wildfires	Moderate
21	Injuries or fatalities due to flash flooding of crossing points	High
22	Long-term loss of serviceability of the infrastructure	Moderate
23	Large-scale disturbance of economic activities	High

From these severity ratings, a level of risk linked to each impact is assessed. Nineteen out of the 20 selected impacts received a risk rating of "moderate" or higher. These risks can often be easily mitigated by iterative control measures and relatively easy-to-implement adaptation options (see Section 9.4.3).

9.4.3 CONTROL MEASURES AND RESIDUAL RISK RATING

Risk rating does not consider all the adaptation and mitigation measures that could or will be implemented during construction and, eventually, during operations. Indeed, some measures could potentially enable the risk rating to significantly decrease. Potential measures having an influence on moderate, high and very high risks are presented. If all measures are implemented in an efficient way, all potential impacts will represent a low to moderate risk until the end of the designed life of the infrastructure.

Risks with a rating below moderate may not require any specific measures in the short term. Examples of control measures can include hard measures, such as control systems and/or soft measures, such as risk assessment frameworks, strategies, and plans.

For this Project specifically, the measures presented in Table 9-17 can be implemented:

- to ensure security of workers and respect the work schedule during the construction and heavy maintenance of the infrastructure;
- to ensure climate resilience of all infrastructure components during the construction design;
- during the operation and maintenance processes;
- during a collaborative process where governments, research units, and small businesses can be included (i.e. large-scale measures);
- as measures to investigate (i.e., nice to have if possible).

Table 9-17 List of Control and Adaptation Measures for Higher Risks Identified

Proposed measures	Impacts with a reduced risk rating*		
During construction			
Implementation of a sustainable reserve of alternate personnel in case of emergency and high rates of absenteeism, i.e. capability of mobilizing extra staff in case of emergency	1		
Development of practices for working in extreme heat including break times and ensuring drinking water accessibility for workers and work interruption when conditions are too dangerous	1	2	
Ensuring workers understand the risks of working in extreme heat and have first aid on site for any heat-related illness	1	2	
Development of water management plans for dry conditions, and keep stored water on hand in the case of low supply	3		
Implementation of a contingency plan to ensure sufficient materials are already on site to continue construction	4		
Modification of the environmental management plan to increase the frequency of water spreading during very dry and windy conditions	18		
Construction design			
Inclusion of the foreseen temperature elevation in the criteria to design the pavement structure	5	9	
Inclusion of the foreseen temperature elevation in the design criteria for the choice of materials used	11		
Improvement of grading/surface drainage where water accumulates associated with flooding problems	12	19	
Ensure that the stormwater management capacity is sufficient given the values of future extreme precipitation statistics incorporating climate change effects	12	13	19
Consideration of the effect of corrosion of structure in the design	14		
Operation and maintenance			
Implementation of careful pavement monitoring to prevent significant damage, such as pavement melting and rock crumbling	5	6	9
High and frequent maintenance of drainage systems to avoid clogging	12	13	19
Regular monitoring to properly foresee potential maintenance costs on retaining walls	14		
Careful monitoring and maintenance work if needed at crossing points in case of a high likelihood of a major extreme event occurring	21		

Proposed measures	Impacts with a reduced risk rating*	
Collaborative process		
Investigation of opportunities for greywater reuse if municipal water infrastructure is in good shape	3	
Collaboration with scientific institutions to better monitor the occurrence of potentially destructive hazards	7	
Optimal integration of the Project with other major projects in the surrounding areas and planning of the drainage system at a larger scale to avoid that stormwater affects neighboring communities	12	19
Collaboration of national weather services and the Kenya Forest Service to better forecast disturbances due to wildfires and to better plan any necessary road closures	20	
Collaboration with local communities to implement awareness campaigns for the use of crossing points only when weather conditions allow it	21	
Promotion of climate resilient strategies in local business model to decrease interdependencies between transportation infrastructure and profitability	23	
Investigation		
Implementation of rainwater storage as a domestic water source on construction site	3	
Implementation of a contingency fund to ensure damages can be repaired on short notice (already considered)	7	
Verification that inspection and maintenance schedules are developed to identify and repair any issues (already considered)	11	
Identification of alternative sources of power in case of a major outage (already provided for the operation and maintenance center with a generator)	15	

Note * Colors correspond to initial risk ratings. Each number corresponds to a potential impact that is mitigated by the corresponding measure. Some of the measures have the potential to reduce the risk of more than one impact

9.5 CONCLUSION

The Climate Change Resilience Assessment, comprising the preliminary risk assessment and the detailed risk assessment, have been conducted in accordance with the methods and requirements of the ISO 31000 standards.

For this assessment, the best available climate projections and historical weather data were used to assess the vulnerability of this Highway Project to changes in climate and extreme weather for the construction, operation, and maintenance life of the assets. Risks were identified and evaluated based on the likelihood of the risk occurring, the consequence should the risk occur, and the planned control measures.

The vulnerability assessment showed that 20 potential impacts (out of 23) are likely to occur during the life span of the Project (with a moderate, high or very high likelihood). These impacts are mostly related to heat waves, extreme precipitation, pluvial flooding, landslides, high winds and drought conditions. Among these impacts, 19 of them are considered to represent a moderate, high or very high risk for the infrastructure project.

The WSP climate change resilience team considers that the Project would have a sufficient level of resilience if the suggested control measures are implemented. Nevertheless, risk assessment should be considered an ongoing process and it is recommended that the Project periodically revisit the vulnerability and risk assessments, and the control measures considered in this assessment as new information becomes available (e.g., climate projections, changes to operating parameters and/or local conditions).

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

This section of the ESIA presents the Environmental and Social Management Plan (ESMP) proposed for the construction and operation activities of the NNM Highway Project.

10.1 OBJECTIVES

The ESMP describes mitigation, monitoring and institutional measures to be taken during the project implementation to eliminate adverse impacts, offset them, or reduce them to acceptable levels." The objectives of the ESMP are in line with this definition, which are listed as follows:

- Present all standard and specific mitigation measures developed for the NNM Highway Project that should be part of the selected Contractor's contract and procedures;
- Define financing responsibility for the implementation and the supervision of these measures;
- Discuss governance aspects in relation to RVH requirements;
- Identify and describe monitoring activities that need to be realized during and after construction activities to ensure adequate implementation of mitigation measures and efficiency reducing associated impacts.

In addition to the information provided hereafter, an Environmental and Social Management System (ESMS) and a series of thematic environmental management plans will be developed and are succinctly presented in Section 10.4.

10.2 SUMMARY OF IMPACTS AND MITIGATION MEASURES

The following table presents a summary of the various impacts and mitigation measures presented in the previous sections of this chapter. Its purpose is to serve as a tool to facilitate the development of the contractors ESMP. It is structured in seven columns based on the selected VECs carried forward in the ESIA for the construction activities related to the Nairobi-Nakuru-Mau Summit Highway Project:

- Column 1 lists the assessed VECs (see Table 5-1 for VECs selection rationale);
- Column 2 identifies the sources of impact relating to the VECs (see Table 5-12);
- Colum 3 outlines the potential Project-related impacts to the VECs;
- Column 4 describes the proposed mitigation measures;
- Colum 5 and 6 identify responsibility for implementing the mitigation measures and monitoring and evaluating the associated work.

Finally, Column 7 provides an estimated cost which could become part of the normal construction costs or, for certain specific measures, imply additional costs.

Table 10-1 Environmental and Social Management Plan

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities: Implementation	Responsibilities: Monitoring and Evaluating	Costs
Atmospheric Environment – Ambient Air Quality Atmospheric Environment - GHG Emissions	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Structural Works, Base layer and pavement work, Presence and use of Highway, Operation and routine maintenance	Release of dust and atmospheric contaminants locally. Contribution to National GHG emissions.	**Standard Measures:** – Avoid leaving mechanical equipment, machinery, trucks, and vehicles idling unnecessarily at the work site. – Ensure all vehicles, equipment and machinery are in good working order with a particular attention to motor combustion efficiency and antipollution systems. – Limit vehicle and machinery speed within the work site to minimize dust generation. Authorized speeds on the work site should be specified and enforced by the contractor. – Use water bowsers as dust abatement to limit excessive dust emissions from granular material handling and piling, and vehicle movements. – Ensure trucks transporting fine granular (sand) material and asphalt are equipped with a tarpaulin to cover the material during travel between material site source and work site. – Drop granular material as close to the ground possible to reduce the generation of airborne particles. – Implement an Eco-driving attitude program that will help better manage heavy equipment and fuel consumption. – When practically possible, use alternative technologies, energy sources and materials. **Specific Measures:** – Ensure implementing the Traffic management plan as approved by KeNHA, for the transportation of granular material from existing quarries to the work site. – If ambient air quality-related grievances are received, develop and implement an ambient air quality monitoring program to verify construction-related emission levels, identify the main sources, and develop potential actions for improvement.	RVH[1]	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Ambient noise.	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Structural Works, Presence and use of Highway and routine maintenance.	Local increase of noise and/or vibration locally during construction and operation activities.	**Standard Measures:** – Maintain equipment and machinery including brakes, mufflers, catalyzers and silencers in good running condition, clean (power washed), free of leaks, excess oil and grease. – Prohibit idling of vehicles on the site or near sensitive receptors. Generators and machinery should be shut down when not in use. – Inform drivers to limit speed in sensitive areas and to limit noise from the rear panel of dumpster truck. – Drivers should be sensitized on noise reduction measures through an Eco-driving attitude program. – Equip the compressors and generators used on site with an acoustic enclosure, a noise barrier or placing them in a soundproof box. This is particularly important for such equipment that requires round-the-clock operation in areas with sensitive receptors. – If blasting is required at quarry sites, ensure noise and vibration mapping has been realized, limit load of explosives accordingly and advise local population in advance to prevent nuisances. **Specific Measures:** – Respect the noise levels set in the noise permit to be obtained from NEMA when working in the vicinity of sensitive areas including residential, institutional and/or educational components. – For all stations identified with a Low and Medium impact intensity and resulting in a moderate impact magnitude (see above), no specific noise reduction measure is recommended. This is because the current model could not take into consideration the potential noise reduction effect of having a smoother road surface which should induce some noise level improvements. However, it is recommended that a noise survey campaign be conducted in these areas at least twice a year for the first two years of operation to confirm that effective noise levels do not increase more than 3 dBA in comparison with initial noise level. After two years, the frequency could be revaluated based on the survey results. – For all stations identified with a high impact intensity resulting in a Major impact magnitude, it is recommended, when relocation cannot be considered or speed reduction is insufficient to bring noise levels down to acceptable levels, to implement noise barriers in the specific areas where concentration of sensitive receptors are found adjacent to the Highway's right-of-way. – Use porous concrete for the construction of the retaining walls on both sides of the various structures that will be constructed for the Nakuru crossing between CH 123+570 (ramp to access first viaduct) and CH 126+600 (ramp north of third roundabout) to minimise noise reflection and maintain noise at an acceptable level such as presented in Table 8.8 (stations S7 to S7f). For the first ramp starting at CH 123+570, the use of porous concrete is only required on its northeastern side because of the presence of the Lenana Primary School. – If ambient noise-related grievances are received for the section of the Highway where no noise reduction measures have been implemented, develop and conduct a specific noise monitoring program to verify existing problems and evaluate additional actions required.	RVH except for acquisition and relocation of sensitive receptor which is the responsibility of KeNHA	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs except for acquisition and relocation of sensitive receptor which is the responsibility of KeNHA.

[1] RVH will delegate the implementation and responsibility to Construction Joint Venture and/or Operation Company through contractual obligations, with adequate oversight and monitoring.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Water Resources – Hydrology	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance.	Temporary obstruction of surface water flow during construction and maintenance activities.	**Standard Measures:** – Define vehicle and machinery movement routes within the work site and ensure they are respected to limit the creation of ruts. – Where possible, run-off water from the work area and adjacent lands should be captured through ditches and redirected appropriately. – As much as possible, conduct work that may impact local hydrology during the dry seasons (from January to February and from June to September) to minimize the risks associated with watercourse obstruction or encroachment. – Ensure adequate water flow during work by diverting flood prone watercourses for the duration of the work if it needs to be done during rain seasons (from March to May and from October to December). – Except where specifically required (i.e. for bridge construction), avoid storage of granular or any other material within, on the shore of or near (less than 30 m) a water course to limit the risks of such material impeding water flow. – Conduct regular inspection and cleaning of culverts to remove encumbrances and maintain the efficiency of the drainage system. **Specific Measures:** – Verify efficiency of water management upgrades at the flood-prone areas identified during the public consultation rounds.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Water Resources – Surface Water Quality	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance.	Potential introduction of contaminants (suspended solids and others) in the local watercourses and wetlands during construction and operation activities.	**Standard Measures:** – Ensure vehicles, equipment and machinery are in good working order to minimize the leak of contaminants. – Remove existing vegetation as late as possible and revegetate as soon as possible to avoid leaving soils bare for longer than necessary to limit transport of fines in water run-off. This is particularly true on the shores of watercourses crossed by the Project. – Install terrestrial silt screens, where practically possible, between work areas and water's edge to limit transport of fines in water run-off. – Keep terrestrial and aquatic spill kits at the work site to accelerate intervention to confine and recuperate any occurring accidental spills or leaks. – Ensure the development of a strong Environmental Management Plan, including but not limited to, strong measures to improve efficiency in the use of water, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations: ▪ Hazardous waste and hazardous material (including cement powder bags) storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release. ▪ Store all waste in distinct closed containers to allow for some segregation (recyclables and waste) and adequate confinement. ▪ The fuel trucks that will ensure fueling of machinery at the work sites should carry a spill kit. Except for fixed water works equipment that cannot be moved, all machinery should be moved away from water side before fueling (at least 30 m). All fuel storage tanks should be equipped with adequate and required confinement capacity. ▪ Ensure some of the personnel trained are available to intervene in the event of accidental spills or leaks. ▪ Contacts of firms (names and phone numbers) specialized in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone. ▪ Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterization prior to use is recommended. – After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly stored on site in appropriate containers and regularly disposed off-site by certified companies. – Develop and implement an emergency preparedness and response plan in case of accidental pollution. **Specific Measures:** – Use adequate wastewater capture and/or treatment installations for wastewater from concrete production and surface waters from quarries in order to respect selected applicable criteria for release in the environment. – Ensure dedicating a specific area for the cleaning of concrete trucks. Capture the resulting wastewater and proceed to adequate treatment or disposal. – Ensure a particularly stringent application of the above standard measures when working at the level of the following surface water components: ▪ Manguo Swamp (CH 3+00 to 4+00), located on the east side of the right-of-way. ▪ Water courses flowing towards Naivasha lake including Malewa and Gilgil rivers (A8 Highway: approximate CH 42+800 to 43+000, 43+850 to 43+950, 59+650 to 59+750, 64+600 to 64+700 and 76+100 to 76+300; A8 South approximate CH: 47+050 to 47+250). ▪ Water courses flowing towards Elmentaita lake including Mereroni and Mbaruk rivers (A8 Highway approximate CH 90+000 to 91+000, 92+250 to 92+450, 95+600 to +850, 99+550 to 99+700, 104+400 to 104+600 and 106+200 to 106+350). ▪ Water courses forming the head of the Molo river basin flowing toward lake Baringo (A8 Highway approximate CH 148+800 to 148+900, 149+750 to 149+850, 153+750 to 153+850, 159+050 to 159+125, 169+500 to 169+600, 171+825 to 171+950 and 174+350 to 174+450). – Develop and conduct a regular surface water quality monitoring program covering all work sites located near high sensitivity sites or hydrologically connected to such sites, such as locations listed in the previous bullets, to verify existing problems and evaluate action requirements. – Develop and conduct a surface water quality monitoring program to verify existing problems and evaluate action requirements at any other location along the RoW, if surface water contamination-related grievances are received. – Monitor presence of run-off water reaching lakes Naivasha, Elementeita or Baringo, or effluents thereof. In the affirmative, implement additional water treatment facilities as required. Particular attention shall be give to the project section bordering Lake Elementeita and surrounding of CH 38+900; 40+100; 98+100; and 100+800. – Regularly verify and maintain as necessary the water treatment infrastructures listed in table 4-13 and any additional one added.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Water Resources – Groundwater quality	Implementation of temporary construction facilities, Site preparation, Use of borrow pits and quarries, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance.	Potential contamination of groundwater through accidental spills and leaks during construction activities.	**Standard Measures:** – Same measures as for surface water quality. **Specific Measures:** – Ensure a particularly stringent application of the above standard measures when working at the level of the following surface water components: ▪ Manguo Swamp (CH 3+00 to 4+00), located on the east side of the right-of-way. ▪ Water courses flowing towards Naivasha lake including Malewa and Gilgil rivers (A8 Highway: approximate CH 42+800 to 43+000, 43+850 to 43+950, 59+650 to 59+750, 64+600 to 64+700 and 76+100 to 76+300; A8 South approximate CH: 47+050 to 47+250). ▪ Water courses flowing towards Elmentaita lake including Mereroni and Mbaruk rivers (A8 Highway approximate CH 90+000 to 91+000, 92+250 to 92+450, 95+600 to +850, 99+550 to 99+700, 104+400 to 104+600 and 106+200 to 106+350). ▪ Water courses forming the head of the Molo river basin flowing toward lake Baringo (A8 Highway approximate CH 148+800 to 148+900, 149+750 to 149+850, 153+750 to 153+850, 159+050 to 159+125, 169+500 to 169+600, 171+825 to 171+950 and 174+350 to 174+450). – Develop and conduct a regular groundwater quality monitoring program covering all work sites located near high sensitivity sites, such as locations listed in the previous bullets, to verify existing problems and evaluate action requirements. – Develop and conduct a groundwater quality monitoring program to verify existing problems and evaluate action requirements at any other location along the RoW, if groundwater contamination-related grievances are received.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Water Resources – Groundwater quantity		Extraction of groundwater for construction and operation requirements.	**Standard Measures:** – Limit groundwater use to essential needs and aim at continually improve efficiency in the use of groundwater to minimise effect on local availability. – Regularly inspect all installations associated with groundwater extraction and distribution to eliminate leaks which are wasting the resource. – Regularly maintain the equipment used to spray water for dust abatement to eliminate leaks and minimise losses. **Specific Measures:** – Communicate with the Kenyan Water Resource Authority and any other land management authorities potentially concerned (such as protected area management authorities), before implementing a groundwater well (namely within the Lake Naivasha-Elmentaita basin) to validate best location, local capacity and obtain required permits. – Consider the installation of systems to collect and store rainwater to minimise dependency on groundwater within the work sites.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Soil and Sediment – Soil stability/erosion	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Structural work, Road furniture work.	Initiation of soil erosion through construction activities (groundworks).	**Standard Measures:** – Ensure the development of a strong Environmental Management Plan, including but not limited to, site assessment requirements prior to disturbances and availability of soil erosion protection systems. – Detailed slope stability assessments should be done where required for in areas of cut and or fill operations within the final route alignment. Final designs are to include suitable mitigation measures based on the findings of such studies. Soil stability and erosion should be monitored prior to the installation of such final mitigation measures. – Areas disturbed indirectly as part of construction activities (e.g., temporary access routes, temporary vegetation clearing) should be protected from erosion and returned to a protected state after disturbing activity is removed. – Temporary run-off and erosion control management plans should be created and implemented during construction phases. This should identify construction stages during which assessments and measures should be applied for each section of road as well as all temporary construction areas.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Soil and Sediment – Soil quality	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Base-layer and pavement work, Waste and hazardous material management, Presence and use of Highway, Operation and routine maintenance.	Contamination of surface soils through accidental leaks or spills of contaminants during construction and maintenance activities.	**Standard Measures:** – Ensure all vehicles, equipment and machinery are in good working order with a particular attention to fuel/oil pipes, tanks and sumps, hydraulic hoses, etc. – Keep spill kits at the work site to accelerate intervention in the event of a spill or leak. – Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations: ▪ Hazardous waste and hazardous material storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release. ▪ Store all waste in distinct closed containers to allow for segregation (recyclables and waste) and adequate confinement. ▪ The fuel trucks that will ensure fueling of machinery at the work sites should carry a spill kit. All fuel storage tanks should be equipped with adequate and required confinement capacity. ▪ Ensure personnel trained are available to intervene in the event of accidental spills or leaks are available. ▪ Contacts of firms (names and phone numbers) specialised in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone. ▪ Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterisation prior to use is recommended. – After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly disposed off-site by certified companies. **Specific Measures:** – If soil contamination-related grievances are received, or if impacts are suspected following any incidents, develop and conduct a soil quality monitoring program to verify existing problems and evaluate action requirements. – Develop an operation procedure to manage accidental soil contamination coming form accidental spills.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Soil and Sediment – Sediment quality	Implementation of temporary construction facilities, Site preparation, Drainage and stormwater management, Presence and use of Highway and routine maintenance.	Contamination of sediments through accidental leaks and spill of machinery used at the level of watercourses during construction and maintenance activities.	**Standard Measures:** – Ensure vehicles, equipment and machinery are in good working order to minimize leak of contaminants. – Keep terrestrial and aquatic spill kits at the work site to accelerate intervention to confine and recuperate any occurring accidental spills or leaks. – Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan that should consider the following recommendations: ▪ Hazardous waste and hazardous material (including cement powder bags) storage facilities should be built on an impermeable surface offering confinement capacity in the event of a spill or release. These storage facilities should offer protection against weather conditions, be access limited and secured, clearly identify content and present the names and coordinates of resources to contact in the event of spill or release. ▪ Store all waste in distinct closed containers to allow for some segregation (recyclables and waste) and adequate confinement. ▪ The fuel trucks that will ensure fueling of machinery at the work sites should carry a spill kit. Except for fixed water works equipment that cannot be moved, all machinery should be moved away from water side before fueling (at least 30 m). All fuel storage tanks should be equipped with adequate and required confinement capacity. ▪ Ensure some of the personnel trained are available to intervene in the event of accidental spills or leaks. ▪ Contacts of firms (names and phone numbers) specialized in spill intervention must be kept on-site in the event of a spill or leak that cannot be handled with on-site spill kits alone. ▪ Ensure material used for construction comes from known clean sources to avoid chemical contamination. If soils from a non-certified site are accepted, characterization prior to use is recommended. **Specific Measures:** – Regularly verify and maintain as necessary the water treatment infrastructures listed in table 4-13 and any additional one added.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Habitats and Flora	Implementation of temporary construction facilities, Site preparation, Waste and hazardous material management and Presence and use of Highway.	Loss of vegetation cover through site clearing and later through better access to territory favouring an increase in land development. Also, the Project may favour the spreading of invasive species and alteration of local conditions that will alter vegetation composition.	**Standard Measures:** – Avoid unnecessary clearance of vegetation. – Preserve existing vegetation where no construction activity is planned. – Protect small patches of natural and regenerated habitat located at the limit of the work site, such as clumps of trees, ponds or wetlands. These areas must be designated as sensitive, and staff and contractors must be formally made aware that these areas are not to be destroyed. – Maximise the use of vegetation resources from areas that are cleared for road construction activities as specified by KeNHA, NEMA or KFS's directives. – Remove and keep topsoil to be reused in the same area for revegetation needs. Revegetate temporally disturbed areas once the work is completed with indigenous flora species. – In order to limit the propagation of invasive species, all such invasive species within the corridor of impact and/or right of way shall be removed/cleared and replanted with local species. – Ensure all road verge replanting and landscaping is done using appropriate indigenous species. – Inspect construction vehicles and heavy machinery before first mobilization on site to ensure they are free of soil or viable segments of invasive alien species. – Do not use soils potentially contaminated with invasive alien species as a covering material on site or elsewhere. – Ensure the development of a strong Environmental Management Plan, including but not limited to, a Spill Prevention and Response Plan and a Waste Management Plan. – Rehabilitate burrow pits using indigenous vegetation when works are completed, or in accordance with landowner agreement. – Implement a construction closure plan in which rehabilitation measures are defined and budgeted. – All construction material and waste must be removed from the construction sites and the area rehabilitated once works are completed. – Implement an alien plant control and monitoring program aimed at removing new populations and preventing them from spreading to other natural areas. **Specific Measures:** – Implement a procedure for vegetation clearing based on detailed maps of presence of NH and CH, pre-construction ground-truthing walkover surveys, marking off specific areas prior to clearing, and monitoring for compliance. – Avoid placement of any supporting project activities (e.g. camps, laydown yards, topsoil storage etc) within remaining Natural Habitats, including an appropriate buffe. – The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities to identify the areas of natural habitat and priority plant species (as defined in the BAP). Mark and leave undisturbed to the extent feasible. – Undertake compensatory plantation either along the project corridor or at places identified by the Kenya Forest Services (KFS), in order to compensate for the tree felled. – Where possible, plant indigenous trees along the road that will not only act as shade or resource but help create suitable habitat and improve connectivity to other surrounding natural areas by creating an interconnected greenbelt. Trees planted will also act as atmospheric pollution barriers. – Only indigenous species approved by the KFS shall be used for plantation. – Where the road crosses the Forest Reserves (Koibatek and Kinale) and private conservancies (Marula Estate and Soysambu Conservancy) ensure that all temporary works remain within the road reserve and that no encroachment is made on these reserves and conservancies. If encroachment is inevitable, an adequate compensation for lost habitat shall be developed with KFS and the Private Conservancies. – Collaborate with KFS and Kenya Wildlife Services (KWS) to identify protection measures in case degradation of habitats or land-use changes are observed in relation to the road development in forest reserves or protected areas along the Highway.	RVH Some measures must be implemented in collaboration with KFS and KWS.	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Birds	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Presence of workers and influx of job seekers and routine maintenance.	Habitat loss, degradation or modification through construction work and presence of highway. Increase in mortality from vehicle collisions. Behaviour disturbances because of artificial lighting and noise generation.	**Standard Measures:** – Implement measures associated with Noise and Vibrations. – Implement measures identified to mitigate impacts on hydrology and water quality (see above), such as effective stormwater dissipating systems in order to maintain integrity of habitats important to congregatory species. – Implement measures identified to mitigate impact on habitat and flora (see above). – No hunting by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted. **Specific Measures:** – The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities shall identify any active nests of hollow-nesting and canopy-nesting birds. If a threatened bird species is nesting, consult a local avifauna specialist for guidance on actions to be taken. – Ensure that the directives of the noise permit to be obtained from NEMA will also be applied in areas of high-quality habitat for birds, in particular along Lake Elmentaita World Heritage Site, near Manguo Pond and in the Kinangop grassland IBA) – Avoid conducting construction work near Manguo Pond, through Marula Estate and other wetlands during the peak of the Grey-crowned cranes' (EN) breeding season, considered to be December. By late February cranes have finished breeding (Wamiti et al., 2020.). If not possible, initiate work prior to the breeding period to encourage Grey-crowned cranes to nest away from work areas. If nesting activities are detected, consult a local avifauna specialist to determine if and what actions should be taken. – Avoid conducting construction near the Kinangop grasslands IBA area (chainage 26+000 to 35+500) during the Sharpe's longclaw's (EN) breeding season, after the rains, from March to June, September to October and in December (Tyler, 2004). If not possible, initiate work prior to the breeding period to encourage Sharpe's longclaws to nest away from work areas. If nesting activities are detected, consult a local avifauna specialist to determine if and what actions should be taken. – Regularly remove litter and collision carcasses to avoid scavengers to be attracted to the road. – Implement proposed Wildlife Crossing Structures, including land bridges and bridge underpasses as provided in the Wildlife Mitigation Report in Appendix 8-2. These types of Wildlife Crossing Structures are likely to be used by birds with strong terrestrial behaviourImplement a roadkill monitoring program and identify adaptive management measures if roadkill hotspots are documented.	RVH Some measures must be implemented in collaboration with KFS and KWS.	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Reptiles and Amphibians	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Presence of workers and influx of job seekers and Presence and use of Highway.	Habitat loss, degradation or modification through construction work and presence of highway. Increase in mortality from vehicle collisions. Barrier effect caused by the presence of the Highway.	**Standard Measures:** – Implement measures associated with Noise and Vibrations. – Implement measures identified to mitigate impacts on hydrology and water quality (see above). – Implement measures identified to mitigate impact on habitat and flora (see above). – No hunting by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted. **Specific Measures:** – The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities shall identify small patches of habitat important to herpetofauna, including roadside rocky ridges, hedges, bush clumps and flooded terrain that forms seasonal wetlands without affecting local stakeholders. These areas to be avoided as much as possible, especially when located at the limit of the road work site. Areas to be preserved must be marked-off and staff and contractors must be formally made aware that these areas are not to be destroyed. – Implement proposed Wildlife Crossing Structure, including land bridges, bridge underpasses, dedicated culverts, multi-use culverts and canopy bridges (for arboreal reptiles) as provided in the Wildlife Mitigation Report in Appendix 8-2. All these types of Wildlife Crossing Structures are likely to be used by reptiles and amphibians. – Implement a roadkill monitoring program and identify adaptive management measures if roadkill hotspots are documented.	RVH Some measures must be implemented in collaboration with KFS and KWS.	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Mammals – Small Mammals	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Presence of workers and influx of job seekers and Presence and use of Highway.	Habitat loss, degradation or modification through construction work and presence of highway. Increase in mortality from vehicle collisions. Barrier effect caused by the presence of the Highway. Increase hunting because of an easier access to territory.	**Standard Measures:** – Implement measures associated with Noise and Vibrations. – Implement measures identified to mitigate impacts on hydrology and water quality (see above). – Implement measures identified to mitigate impact on habitat and flora (see above). – No hunting by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted. **Specific Measures:** – The pre-construction walkover survey within the road reserve, quarry sites and other temporary construction facilities shall identify small patches of habitat important to small mammals, including clumps of trees, hedges and bush clumps. These areas to be avoided as much as possible, especially when located at the limit of the road work site. Areas to be preserved must be marked-off and staff and contractors must be formally made aware that these areas are not to be destroyed. – Where the road crosses the Forest Reserves (Koibatek and Kinale) ensure that all temporary works remain within the road reserve and that no encroachment is made in the Forest Reserves. If encroachment is inevitable, an adequate compensation for lost habitat shall be developed with KFS. – Implement proposed Wildlife Crossing Structure, including land bridges, bridge underpasses, dedicated culverts, multi-use culverts and canopy bridges as provided in the Wildlife Mitigation Report in Appendix 8-2. All these types of Wildlife Crossing Structures are likely to be used by small mammals.	RVH Some measures must be implemented in collaboration with KFS and KWS.	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Mammals – Large Mammals	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Presence of workers and influx of job seekers and Presence and use of Highway.	Habitat degradation or modification through construction work and presence of highway. Increase in mortality from vehicle collisions. Barrier effect caused by the presence of the Highway. Increase hunting because of an easier access to territory.	**Standard Measures:** – Implement measures associated with Noise and Vibrations. – Implement measures identified to mitigate impacts on hydrology and water quality (see above). – Implement measures identified to mitigate impact on habitat and flora (see above). – No hunting by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted. **Specific Measures:** – Ensure fencing is maintained around the road during construction in the Marula Estate and Soysambu Conservancy, to avoid animals being injured by construction activities. – Ensure that the directives of the noise permit to be obtained from NEMA will also be applied in areas of high-quality habitat for wildlife. – Establish a wildlife crossing technical committee for a period of five to ten years, to develop and implement a monitoring and evaluation program of the rate of use of crossing structures and their effectiveness at achieving population outcomes for wildlife. The composition as well as the objectives of this committee as well as the monitoring and evaluation program to be developed and implemented should align with orientations provided in chapter 6 of Appendix 8-2. – Implement proposed Wildlife Crossing Structure, including land bridges, bridge underpasses, dedicated culverts, multi-use culverts and canopy bridges as provided in the Wildlife Mitigation Report in Appendix 8-2. All these types of Wildlife Crossing Structures are likely to be used by large mammals. Implement wildlife fencing in Marula Estate, with fence jump out options, and in short lengths at all dedicated wildlife crossing structures (see Wildlife Mitigation Report in Appendix 8-3). – Construct noise and light screens at wildlife crossings and the approaches to the wildlife crossings. This is particularly important at the high priority crossings to enable more sensitive wildlife species to approach and use the crossing structures. – Apply wildlife-friendly lighting design principles (see Wildlife Mitigation Report in Appendix 8-3). – Install signage warning drivers of the risk of WVC along the highway in high quality habitat for wildlife (A8 South: Kikuyu Escarpment forest, and area between Maai Maihu and Longonot; A8: Kikuyu Escarpment forest, KWS Training institute, Marula Estate, Soysambu Conservancy, Koibatek Forest). – Regularly remove litter and collision carcasses to avoid scavengers to be attracted to the road. – Implement a roadkill monitoring program and identify adaptive management measures if roadkill hotspots are documented.	RVH Some measures must be implemented in collaboration with KFS and KWS.	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Freshwater Ecology – Aquatic Habitat, Macroinvertebrates and Fish	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Drainage and stormwater management, Structural work, Waste and hazardous material management, Presence and use of Highway and routine maintenance.	Habitat degradation or modification through construction work and presence of highway. Limitation to fish movements. Mortality of fish and macroinvertebrates. Increase fishing because of workers' presence and better access to territory.	**Standard Measures:** – Implement measures identified to mitigate impacts on hydrology and water quality (see above). – No fishing by the contractor's crew shall be allowed. Possession, transport, collection, fishing, hunting or purchase of IUCN Red-listed species, CITES listed species, and any species protected by national law by the contractor's crew will not be permitted. **Specific Measures:** – As much as possible, ensure the maintenance of upstream and downstream connectivity for fish during construction works in streams and rivers. – Restore shores and riverbeds to their pre-existing condition once works are completed. – Ensure culvert and drainage structures dimensioning allows for connectivity of aquatic habitat.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

<table>
<tr><th rowspan="2">Valued Component</th><th rowspan="2">Source of Impacts</th><th rowspan="2">Potential Impacts</th><th rowspan="2">Mitigation Measure</th><th colspan="2">Responsibilities</th><th rowspan="2">Costs</th></tr>
<tr><th>Implementation</th><th>Monitoring and Evaluating</th></tr>
<tr><td>Ecosystem Services – Traditional medicine</td><td>Implementation of temporary construction facilities, Site preparation, Waste and hazardous material management and Presence and use of Highway.</td><td>Loss of vegetation cover and forested areas.
Increase pressure due to better access of territory</td><td><u>Standard Measures:</u>
– Implement measures identified to mitigate impact on habitat and flora (see above).
<u>Specific Measures:</u>
– Where the road crosses the Forest Reserves (Koibatek and Kinale) ensure that all temporary works remain within the road reserve and that no encroachment is made in the Forest Reserves. If encroachment is inevitable, an adequate compensation for lost habitat shall be developed with KFS.
– Conduct a pre-construction walkover tree survey within the road reserve, quarry sites and other temporary construction facilities to determine if trees used in traditional medicine are present. The species most frequently mentioned for their medicinal use is Prunus africana. Warburgia ugandensis, Azadirachta indica and Aloe species were also very frequently recorded. Mark and leave undisturbed to the extent feasible.
– If loss of traditional medicine trees is not avoidable, undertake compensatory plantation either along the project corridor or at places identified by the KFS, in order to compensate for the loss of medicinal plants.
– Collaborate with KFS and KWS to identify protection measures in case degradation of habitats or land-use changes are observed in relation to the road development in forest reserves or protected areas along the Highway.</td><td>RVH</td><td>Lenders, NEMA and KeNHA E&S Specialists</td><td>To be included in construction/ operation costs.</td></tr>
<tr><td>Population and Land Tenure</td><td>Land acquisition, Resettlement and compensation and Use of borrow pits and quarries.</td><td>Temporary or permanent loss of land due to space needed for construction activities and the presence of some of the infrastructures of the Highway.
Potential loss of economic activities for the same reasons.</td><td><u>Standard Measures:</u>
– Ensure that rented land is rehabilitated, after work is completed, as per agreement with owner and, if any, Kenyan regulatory requirements.</td><td>KeNHA</td><td>Lenders and NEMA E&S Specialists</td><td>Costs are under the responsibility of KeNHA</td></tr>
</table>

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Community Well-being – Health and Safety	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance.	Increased risk of injury and health problems for construction workers. Health problems caused by dust and contamination. Safety risk for pedestrians, risk of wildlife-vehicle collisions, and more frequent and severe traffic accidents. Increased prevalence of malaria and dengue and of communicable diseases including STIs and HIV/AIDS. Increased crime in surrounding communities.	**Standard Measures:** – Implement soil management measures (dust reduction and contamination) as outlined above. – Implement atmospheric environment mitigation measures (dust reduction and contamination) as outlined above. – Implement mitigation measures for large mammals outlined in Section 8.2.2.4 to limit their crossing of the highway. – Ensure all drivers working for the project have a valid driver's license, are certified for driving the vehicle they are responsible for, and have successfully followed a recognized driving course covering road safety measures and the importance of sharing the road with pedestrians and other types of vehicles. – Control driver activities to avoid exceeding normal work shifts and to ensure they have enough rest periods. – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum safety and traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Develop and implement specific access routes to and within the work site that are optimized to reduce travel distances by vehicles and machinery and ensure all drivers working for the project are aware of the established routes. ▪ Ensure implementing the Traffic management plan as approved by KeNHA, for the transportation of granular material from existing quarries to the work site. ▪ Verify with the Ministry of Transport the existing authorized load limits on the various sections of the road network to be used, if any, and enforce compliance. ▪ Provide safe and convenient pedestrian paths and crossing points along the road alignment and construction areas, including under and over passes. ▪ Ensure installation and maintenance of speed control and traffic control systems at pedestrian crossing areas. ▪ Ensure installation and maintenance of appropriate road signs, signals, markings, and other traffic regulation devices related to pedestrian facilities and to regular local and regional vehicular traffic. ▪ Around work areas where significant interactions with pedestrians are likely, install barriers and buffer zones to deter pedestrian access to the roadway, and reorient them towards designated crossing points and protect them from potential hazards. – Develop and implement a strong Code of Conduct detailing the guidelines on expected engagement with local communities and penalties for failure to adhere to regulations, and closely monitor its application and effectiveness. The Code of Conduct should include among others: ▪ A strict prohibition of GBV (including harassment, exploitation and abuse) and sexual intercourse with partners younger than 18 years of age (underage sex). ▪ The requirement to immediately report any suspected case of GBV or underage sex to construction supervising engineer. ▪ A strict prohibition for engaging in illicit or criminal activities. – Avoid as much possible the use of chemicals for clearing vegetation. Favour manual or mechanical clearing methods. **Specific Measures:** – If diversion of traffic is necessary, take into account key location livelihoods, health and safety services and sociocultural activities in planning alternate routes. – Establish partnerships with social and health services at project level. – The migrant workers will undergo a pre-hiring and annual medical check up and will be offered treatment if sick. They will also be trained on disease prevention and recognition to avoid spreading. Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities to facilitate interactions between workers and communities. – Avoid the formation of open holes, or ensure these are covered as much as possible, especially during the rainy season. – During construction, signs announcing known animal crossing areas will be installed to alert drivers. – If possible, design traffic diversion in a way to prevent or limit overtaking in the most hazardous sections of the highways. – Propose, when appropriate, specific local measures to increase safety for road sections where vehicles interact with sensitive areas (dense urban areas, roadside markets, etc.). For example, implement temporary signalisation, pedestrian crossing lights, by-passes, etc. – Design safety awareness campaign in collaboration with local administrations and governmental agencies aimed at local populations. – Monitor the use of pedestrian crossings and conduct specific awareness campaign to encourage their use. – Insert road use topics amongst the subjects to be covered within the stakeholder engagement plan to increase safety awareness. – Consider, as much as possible, the likelihood of vandalism and theft when designing road furniture, especially in the most hazardous sections of the highways.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Community Well-being – Other	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance.	Impacts on livelihoods, gender aspects, Indigenous Peoples, and labour conditions include: Nuisances (noise, smell, dust, vibrations, and lights). Limitation of pedestrian and livestock movement. Effect on mobility because of traffic diversion and slowing down. Degradation of community relations and cohesion due to land use and compensation disputes, tensions and conflicts over the awarding of jobs and contracts, increased inequities that risk further marginalizing vulnerable groups, and inadequate communication with communities and stakeholders. Increased pressure on local natural resources and services.	**<u>Standard Measures:</u>** – Implement mitigation measures on livelihoods, gender aspects, Indigenous Peoples, and labour conditions as outlined below. – Regarding nuisance: ▪ Implement noise measures as outlined above. ▪ Implement soil management measures (dust reduction and contamination) as outlined above. ▪ Implement atmospheric environment mitigation measures (dust reduction and contamination) as outlined above. ▪ Limit work activities to normal work hours (8 h to 18 h) as much as possible. ▪ Respect the noise levels set in the noise permit to be obtained from NEMA when working at night. ▪ Ensure the development and implementation of a Waste Management Plan that should allow for safe and quick disposal of waste. ▪ After confirming with the National Environment Management Authority (NEMA) of existing options, all waste should be properly stored on site in appropriate containers and regularly disposed off-site by certified companies. – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum safety and traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Develop and implement specific access routes to and within the work site that are optimized to reduce travel distances by vehicles and machinery and ensure all drivers working for the project are aware of the established routes. ▪ Ensure implementing the Traffic management plan as approved by KeNHA, for the transportation of granular material from existing quarries to the work site. This Plan should include a map highlighting sensitive receptors in relation with access routes to be used. The map should be updated regularly with access route changes. ▪ Provide Project drivers with awareness sessions on the Traffic Management Plan and keep records of the trainings. ▪ Conduct a regular mandatory drug and alcohol testing for drivers working on the construction sites. ▪ Verify with the Ministry of Transport the existing authorized load limits on the various sections of the road network to be used, if any, and enforce compliance. ▪ Provide safe and convenient pedestrian paths and crossing points along the road alignment and construction areas, including under and over passes. ▪ Ensure installation and maintenance of speed control and traffic control systems at pedestrian crossing areas. ▪ Ensure installation and maintenance of appropriate road signs, signals, markings, and other traffic regulation devices related to pedestrian facilities and to regular local and regional vehicular traffic. ▪ Around work areas where significant interactions with pedestrians are likely, install barriers and buffer zones to deter pedestrian access to the roadway, and reorient them towards designated crossing points and protect them from potential hazards. – As required by IFC Performance 1, develop and implement a Stakeholder Engagement Plan (SEP) to keep communities informed of work site evolution, planned activities and any potential risk that may arise from the work site. The SEP should include, among others, the following components: ▪ A list of Project stakeholders derived from the present ESIA, the RAP, information from RAP implementation as well as any other relevant information. ▪ Analysis of stakeholder engagement to date. ▪ Identification of methods of communication and information disclosure for specific groups; and ▪ Action plan for stakeholder information and engagement during project construction. – Plan and conduct at least one yearly stakeholder engagement session to inform, in one session, all interested and influential stakeholders on the road/highway activities. Subjects to be covered include a summary of activities held during the last year, upcoming projects, ESMP implementation results, HSE aspects, and a discussion pertaining to the main grievances received and how to resolve them. Some time should be allowed for questions and exchanges. – Develop and implement a strong Code of Conduct detailing the guidelines on expected engagement with local communities and penalties for failure to adhere to regulations, and closely monitor its application and effectiveness. The Code of Conduct should include among others: ▪ A strict prohibition of GBV (including harassment, exploitation and abuse) and sexual intercourse with partners younger than 18 years of age (underage sex). ▪ The requirement to immediately report any suspected case of GBV or underage sex to construction supervising engineer. ▪ A strict prohibition for engaging in illicit or criminal activities. – Continue favoring local recruitment for job openings. – Ensure adequate monitoring of noise levels in sensitive areas. – Follow-up on nuisance related grievance to promptly identify problem sources and design adapted mitigation measures. – Extend the stakeholder engagement plan into the Operation phase to cover the entire Project lifecycle as required by IFC PS1. Through its application, communicate job opportunities and application process and initiate discussions on the interaction of local communities with the highway. – Minimise traffic flow interruptions or disturbances during routine maintenance activities through adequate planning and efficient communication and signalisation.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
			Specific Measures: – Maximize the hiring of local labour through the following measures: ▪ Apply human resource policies favouring local labour. ▪ Implement training programs to build local capacity; and ▪ Disclose information on newly created business opportunities. – Establish partnerships with social and health services at project level. – If diversion of traffic is necessary, take into account key location of livelihoods and sociocultural activities in planning alternate routes. – Through the implementation of the Stakeholder engagement plan, engage stakeholders on topics such as cohabitation of communities and the highway which could generate potential improvements.			
House, Social Amenities and Community Assets – Housing Conditions	Land acquisition, Resettlement and compensation, Drainage and stormwater management, Presence and use of Highway, Operation and routine maintenance.	Potential influence on local house value because of the presence of the highway	**Standard Measure:** – Implement measures for noise reduction outlined above. – Ensure that access is provided to connect local roads and properties with current direct access to the A104.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
House, Social Amenities and Community Assets – Social Amenities and Community Assets		Reduced access to informal roads due to construction activities and during routine maintenance of highway.	**Standard Measure:** – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. – Minimise traffic flow interruptions or disturbances during routine maintenance activities through adequate planning and efficient communication and signalisation. **Specific Measures:** – Avoid locating borrow pits and quarries in the path of informal roads. If necessary in those areas, ensure as much as possible a detour for non-motorised vehicles. – If diversion of traffic is necessary, take into account key location of important social amenities and paying special attention to those used by vulnerable groups (e.g., schools and health centers) in planning alternate routes.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Livelihood Strategies and Economic Activities – Land-Based Livelihood Activities	Land acquisition, Resettlement and compensation, Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance.	Reduction of agricultural production by the generation of dust, particles and pollution and by the loss of land. Effect on supply and produced goods circulation because of traffic diversion and slowing down.	**Standard Measures:** – Implement soil management measures (dust reduction and contamination) outlined above. – Implement atmospheric environment mitigation measures (dust reduction and contamination) outlined above. – Implement surface and groundwater quality mitigation measures outlined above. – Ensure the development of a strong Environmental Management Plan, including but not limited to, site assessment requirements prior to disturbances, a spill prevention and response plan and a waste management plan. – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. **Specific Measures:** – Avoid locating borrow pits and quarries on agricultural and livestock lands and in forested areas and respect the official agreement with the landowner with regards to site rehabilitation once work is completed. – If diversion of traffic is necessary, take into account key location of land-based activities and their access to markets and local businesses in planning alternate routes.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Livelihood Strategies and Economic Activities – Self-Employed and Business Based Livelihood		Effect on supply and produced goods circulation because of traffic diversion and slowing down. Temporary displacement of street vendors.	**Standard Measures:** – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. – To maximize the project's positive impacts on the creation of jobs, the following enhancement measures are recommended: ▪ Apply human resource policies favoring local labor. ▪ Implement training programs to build local capacity. ▪ Disclose information on newly created business opportunities. – Ensure to include self-employed and business-based livelihood as part of the stakeholder engagement plan, namely those having a direct interaction with the highway. **Specific Measures:** – If diversion of traffic is necessary, take into account key location of local businesses and their access to suppliers and economic outlets such as markets in planning alternate routes.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Livelihood Strategies and Economic Activities – Fisheries (water-based livelihood)		See impacts on freshwater ecology above. Effect on supply and produced goods circulation because of traffic diversion and slowing down. Increased pressure on the resource because of population influx.	**Standard Measures:** – Implement the mitigation measure identified for freshwater ecology (i.e., ensure that culverts and drainage structures allow for connectivity of aquatic habitat) (Section 8.2.3). – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. **Specific Measures:** – If diversion of traffic is necessary, take into account key location of fishing and aquaculture sites and processors, and their access to suppliers and economic outlets such as fish markets in planning alternate routes.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Livelihood Strategies and Economic Activities – Industry (Large-Scale Economic Activities)	Land acquisition, Resettlement and compensation, Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance.	Effect on supply and produced goods circulation because of traffic diversion and slowing down.	**Standard Measures:** – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. **Specific Measures:** – Ensure continued access to industries located along the highways (e.g., the diatomite quarry at Kariandusi). – If diversion of traffic is necessary, take into account key location of industries and their access to suppliers and economic outlets. in planning alternate routes.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Livelihood Strategies and Economic Activities – Transport Sector		Effect on transport of goods along the Trans-African Highway because of traffic diversion and slowing down.	**Standard Measures:** – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. **Specific Measures:** – If diversion of traffic is necessary, take into account key location of industries and their access to suppliers and economic outlets. in planning alternate routes.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Livelihood Strategies and Economic Activities – Tourism and Recreational Activities		Potential loss of ecological components that form part of the attraction for tourists. Effect on transport efficiency of tourists because of traffic diversion and slower pace.	**Standard Measures:** – Implement the following aforementioned mitigation measures to reduce pollution and environmental degradation of touristic natural areas: ▪ Flora, fauna, and freshwater ecology (Sections 8.2.1, 8.2.2, and 8.2.3). ▪ Soil management (dust reduction and contamination) (Section 8.1.4.). ▪ Atmospheric environment (dust reduction and contamination) (Section 8.1.1.). ▪ Surface and groundwater quality mitigation measures (Sections 8.1.3.2 and 8.1.3.3). – Ensure the development of a strong Environmental Management Plan, including but not limited to, site assessment requirements prior to disturbances, a spill prevention and response plan and a waste management plan. – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to provide maximum traffic flow and that includes, among others, the following measures: ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. **Specific Measures:** – If diversion of traffic is necessary, take into account key location of major tourists' sites in planning alternate routes.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Labour Conditions	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Road furniture work, Waste and hazardous materials management, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Operation and routine maintenance.	Increased risk of injuries and physical and mental illnesses, risk of abuse by contractors hiring underage workers (child labour, violation of workers' rights, worker insecurity, fatigue and stress generating conflict at the household and community levels and potentially act as a trigger for social problems such as drug and alcohol abuse and GBV influx of workers and job seekers may negatively affect the social acceptability of the Project.	**Standard Measures:** – Develop and implement hiring guidelines that meet or exceed relevant national regulations and international standards, including: ▪ Occupational Safety and Health Act (Section 2.3.2). ▪ Public Health Act (Section 2.3.3). ▪ Employment Act (Section 2.3.9). ▪ Work Injury Benefits Act (Section 2.3.10); and ▪ International Finance Corporation (IFC) Performance Standard 2: Labour and Working Conditions (Section 2.5). – Contractually require all contractors, subcontractors, and suppliers to adopt and comply with policies and procedures that comply with national regulations and international standard and address all aspects of labour standards relevant to the project – Develop and implement a Health and Safety Management plan that meets or exceeds national regulations and international standards to protect every worker involved in construction activities, including temporary workers. Specific provisions must be included for: ▪ Supply of drinking water of adequate quantity and quality. ▪ Provision of gender-separated sanitation at construction sites. ▪ Declaration of accidents through an accident reporting mechanism. ▪ Handling of domestic and specialized waste, as well as dangerous goods. ▪ Procedures in case of injuries and accidents. ▪ Provision and use of personal protective equipment (e.g., helmets, fall protection equipment, etc.) ▪ Securing of equipment and demarcation of any excavation work areas; and ▪ Deployment of signs and fences in construction areas, where necessary. – Develop and implement an Emergency Measures Plan. – Develop and implement a monitoring system for the application of the above plans, regulations, and standards by all levels involved in the Project, including contractors, subcontractors, and suppliers of goods and services. – Develop and implement a grievance redress mechanism for workers and residents and establish a safe and ethical reporting environment that allows for anonymous reporting. – Implement a long-term training program throughout the construction phase to ensure adequate training and qualification of all staff employed for the project. – Provide medical facilities throughout the construction phase for the use of workers where required. – Ensure reasonable working hours, wages and other benefits. – Provide suitable and safe amenities and sanitation facilities, including available drinking water and latrines. – Implement measures for supporting the recruitment and retainment of female workers outlined in Section 8.3.7. **Specific Measures:** – Maximize the hiring of local labour through the following measures: ▪ Apply human resource policies favouring local labour including, but not limited to, local hiring targets. ▪ Implement training programs to build local capacity; and ▪ Disclose information on newly created business opportunities. – Establish partnerships with social and health services at project level. – Prepare a list of relevant medical and social resources and services for workers and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document. – Provide assistance to workers struggling with physical and mental health issues and substance abuse in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.).	RVH	Lenders and KeNHA human resources specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Vulnerable and Marginalized Groups (VMGs)	Implementation of temporary construction facilities, Transportation and circulation, Site preparation, Use of borrow pits and quarries, Drainage and stormwater management, Structural work, Base layer and pavement work, Purchase of materials, goods and services, Presence of workers and influx of job seekers, Presence and use of Highway, Operation and routine maintenance.	Limitation of movement for community member and of access to roadside for selling goods.	**Standard Measures:** – As detailed in the VMGPF (KeNHA, 2019), develop and implement a strong Code of Conduct (CoC) detailing the guidelines on expected engagement and penalties on issues around the local community, child protection and gender-based violence protection, including sexual exploitation and abuse (SEA). The Code of Conduct should include among others: ▪ A strict prohibition of GBV and sexual intercourse with partners younger than 18 years of age (underage sex). ▪ The requirement to immediately report any suspected case of GBV or underage sex to the construction supervising engineer. – Develop a Gender and Social Inclusion (GSI) Policy for the Project's activities. – Develop and conduct GSI information/ awareness sessions with all staff. – Develop and implement a Free, Prior, and Informed Consent process in line with the IFC Performance Standard 7. – Develop and implement an Indigenous Peoples Plan that includes, but is not limited to, the following components: ▪ A culturally appropriate Grievance Redress Mechanism developed in partnership with affected Indigenous communities. ▪ A participatory monitoring process to evaluate the effectiveness of the FPIC agreement and ongoing consent; and ▪ The conditions under which the consent process can be reinitiated and the FPIC agreement renegotiated. – To maximize the project's positive impacts on the creation of jobs, the following enhancement measures are recommended: ▫ Apply human resource policies favouring local labour. ▫ Implement training programs to build local capacity. ▫ Disclose information on newly created business opportunities. – Ensure the continued implementation of the Grievance Redress Mechanism developed in partnership with affected Indigenous communities. – Implement the participatory monitoring process to evaluate the effectiveness of the FPIC agreement and ensure ongoing consent. **Specific Measures:** – Consider, when and if possible, preferred Maasai crossing locations when planning pre-construction and construction activities to minimize detours required by herders. – Limit, when and if possible, the duration for which stalls and curio shops would not have access to the right of way. – Support GBV victims through the following measures: ▪ Prepare a list of relevant resources and services for GBV victims and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document. ▪ Provide assistance to GBV victims in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.). – Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities (targeting men, women, boys and girls) to facilitate workers and community interactions. – Include, as much as possible, footbridges and underpasses in preferred locations identified by the Maasai. – Consider, when and if possible, Indigenous Peoples' use of the RoW (e.g., grazing, stalls and curio shops) when planning routine maintenance activities. – Increase as much as possible the safety of areas used by Maasai women such as pedestrian crossings and sections adjacent to the right-of-way with curio shops.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities		Costs
				Implementation	Monitoring and Evaluating	
Genders Aspects	Land acquisition, Resettlement and compensation, Purchase of materials, goods and services, Presence of workers and influx of job seekers and Operation and routine maintenance.	Inadequate distribution of dues following land or goods acquisition. Risk of Gender based violence, increase abandonment of wives and of prevalence of sexually transmitted infections because of population influx.	**Standard Measures:** – In the case of compensation to be given in response to expressed grievances, ensure strong representation of women in the process in order to attribute and distribute compensation equitably. – Ensure proper consideration of gender issues in decision-making processes. – Fully implement, monitor and enforce legal and regulatory requirements pertaining to non-discrimination interventions/strategies and gender under employment laws of Kenya. – Encourage the recruitment of female workers, with equal payment for male and female workers, for equivalent jobs. This can be achieved through the following potential measures: ▪ Set targets for women employment. ▪ Recruit and train women to be integrated in existing work teams. ▪ Offer equal salaries for the same work to all employees with the same level of experience and skills, whether they are men, women or people with a disability. ▪ Implement family-friendly measures such as health coverage and time-off for the birth of a new child. Ensure these measures are in line with Kenya's governmental regulation. ▪ Provide civic and employee education on sexual harassment in the workplace. ▪ Ensure adequate amenities in field-based work such as segregated toilets, adequate waste disposal facilities, water for personal hygiene, etc. ▪ Develop and implement gender and issue sensitive staff grievance redress mechanisms and establish a safe and ethical reporting environment that allows for anonymous reporting. – Develop a Gender and Social Inclusion (GSI) Policy for the Project's activities. – Develop and conduct GSI information/ awareness sessions with all staff. – Develop and implement a strong Code of Conduct that protects women, girls, boys and men from gender-based violence (physical, sexual, and psychological) and closely monitor its application and effectiveness. The Code of Conduct should include among others: ▪ A strict prohibition of GBV and sexual intercourse with partners younger than 18 years of age (underage sex). ▪ The requirement to immediately report any suspected case of GBV or underage sex to construction supervising engineer. – Develop and implement internal grievance and support that is accessible to all employees, pays special attention to the different realities of female and male victims of GBV, and includes the possibility of denouncing any form of harassment or intimidation. Ensure proper actions are taken according to the Kenyan legislation in cases of harassment. – Develop and implement an external gender-sensitive grievance redress mechanism that is accessible to all segments of the general population, pays special attention to the different realities of female and male victims of GBV, and includes the possibility of denouncing any form of harassment or intimidation. Ensure proper actions are taken according to the Kenyan legislation in cases of harassment. – Implement and follow-up on gender-sensitive grievance redress mechanisms, paying special attention to the different realities of female and male victims of GBV. – Collect gender-segregated data during monitoring and evaluation, and ensure proper consideration of gender issues in decision-making processes. – Fully implement, monitor and enforce legal and regulatory requirements pertaining to non-discrimination interventions/strategies and gender under employment laws of Kenya. **Specific Measures:** – Establish partnerships with social protection services at project level. – Support GBV victims through the following measures: ▪ Prepare a list of relevant resources and services for GBV victims and ensure all relevant staff (e.g., human resources, supervisory staff, grievance redress mechanism staff, etc.) have access to and are familiar with this document. ▪ Provide assistance to GBV victims in accessing needed resources and services (e.g., helpline, physical and psychological health services, etc.). – Organize education campaigns, including a STI and HIV/AIDS prevention program, for the workers and surrounding communities to facilitate workers and communities' interactions. – Ensure that the Project offers some procurement opportunities for women, youth and persons with disabilities as required by Kenyan policies. This can be facilitated by: ▪ Establishing a system for tracking bidders and awardees from women-headed or majority women-owned firms. ▪ Setting up a mechanism to promote bid-readiness support for women-owned or majority women-owned small firms and businesses. ▪ Maintaining vigilance for opportunities which could be offered to women groups. – Provide, if possible, additional income generating opportunities to women during construction (e.g., provision of catering services, selling local products). – Increase as much as possible the safety of areas used by women such as pedestrian crossings and sections adjacent to the right-of-way with stalls.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

Valued Component	Source of Impacts	Potential Impacts	Mitigation Measure	Responsibilities: Implementation	Responsibilities: Monitoring and Evaluating	Costs
Public Infrastructure and Services - Roads	Land acquisition, Resettlement and compensation, Implementation of temporary construction facilities, Site preparation, Drainage and stormwater management, Presence and use of Highway, Operation and routine maintenance.	Potential degradation of public roads due to increase in heavy truck movement and diversion of traffic to secondary roads.	**Standard Measures:** – Identify transport methods best suited to the existing transport infrastructure. – Frequently perform inspections on local roads used by construction activities and accesses used for material transport and perform maintenance work and repair where and if necessary. – Establish adequate signage on roads used by construction activities to ensure road user and pedestrian security. – Ensure the development of a Traffic Management Plan that considers the distinctive features of the Project area in order to minimize road damage flow and that includes, among others, the following measures: ▪ Identify roads that can sustain heavy machinery and those that are particularly vulnerable to wear and tear. ▪ Control access to work areas to ensure that only necessary personnel and machinery is present. ▪ Optimize transport routes to reduce travel distances by vehicles and machinery. **Specific Measures:** – Consult the relevant transportation agency (KeNHA, KURA, KeRRA) and County Governments to identify which roads should be taken by trucks transporting heavy material, equipment and structures. – Impose a speed limit for various vehicles, put a stricter limit on roads in poor conditions. – In the case unpaved roads need to be used during periods of heavy rainfall, conduct maintenance and repairs as quickly as possible to limit impact on local circulation.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Public Infrastructure and Services - Railway		Potential temporary interruption of train circulation to allow some specific construction activities associated with the crossing structures.	**Standard Measures:** – Contact and maintain communication with the Kenya Railways Corporation to avoid service interruptions by planning construction work around the train schedule. – In the unlikely case of accidental service interruptions: ▪ Coordinate with the Kenya Railways Corporation to minimize the duration of interruption and quickly inform users.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Public Infrastructure and Services – Electricity and Telecommunication		Displacement or reconnection of some local distribution line for construction work purposes may cause some temporary interruption.	**Standard Measures:** – Contact and maintain communication with KETRACO and Kenya Power to minimize impacts from service interruptions by determining: ▪ The best time for power interruptions; and ▪ Strategies to minimize the duration of power interruptions. – Inform users of planned service interruptions sufficiently ahead of time for them to put in place strategies to mitigate the consequences of power interruptions. – Re-establish power as quickly as possible when interruptions are unavoidable.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Public Infrastructure and Services – Underground Utilities		Potential damages and service interruption to underground pipelines crossing the A8 Highway.	**Standard Measures:** – Install signage clearly indicating the location of pipelines. – Implement spill prevention and response measures for groundwater quality, soil quality and sediment quality outlined above. – Contact and maintain communication with the KPC to minimize the risk of accidental breakage. Ensure the presence of KPC specialists during at key stages of work such as during any excavation work. – In the case of accidental breakage: ▪ Rapidly implement the Spill Response Plan. ▪ Conduct repairs as quickly as possible in coordination with the KPC; and ▪ Inform users of service interruption.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Archaeology and Cultural Heritage	Site preparation and Use of borrow pits and quarries.	Possibility of destroying undiscovered artefact during the soil movement works associated with construction and operation activities.	**General Measures:** – In the event of a suspected chance finding of an unknown or undocumented cultural artefact, the following actions must be taken: ▪ Stop the quarrying and excavation work. ▪ Contact the (National Museum of Kenya) NMK and request that an NMK representative be sent to evaluate the finding. ▪ Work may resume if the suspected artefact does not have cultural interest. Further investigation work must be initiated if the item is of cultural interest. ▪ Once the site has been fully investigated and NMK has provided clearance, quarrying or excavation work may resume. **Specific Measures:** – Avoid or limit all construction activities, unless necessary, along the projects right-of-way limit at the level of the Molo fire victim memorial. – Ensure that access to the Molo fire victim memorial and to the Mai Mahiu Catholic Church is permitted and facilitated at all time.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.
Visual Environment	Transport and circulation, Use of borrow pits and quarries, Structural work, Presence and use of Highway and Operation and routine maintenance.	Reduction of visual fields quality with the presence of the construction activities and the presence of new elevated infrastructures (viaducts, overpasses, elevated structure in Nakuru City).	**Standard Measures:** – Implement mitigation measures on habitat, especially those targeting vegetation outlined above. **Specific Measures:** – Planting of vegetation as proposed in Section 8.2.1 would improve the visual environment along the highway. – Avoid, when and if possible, locating borrow sites and new quarries in scenic areas. – Consider as much as possible the impact on the visual environment in designing the portion of the A8 cutting through Nakuru City.	RVH	Lenders, NEMA and KeNHA E&S Specialists	To be included in construction/ operation costs.

10.3 GOVERNANCE

The Project global governance scheme is presented in Figure 10-1 and shows that Rift Valley Highway Ltd (RVH) is the relational core managed equally by Meridiam and VINCI Highways/Concessions.

RVH is the private partner of the Kenyan Highway Authority (KeNHA) under a public private partnership agreement. The company is responsible for implementing the Project and its management coordinates and oversees all activities for this implementation under the following subcontracts:

- A Design and Construction Contract (EPC Contract) with Vinci Construction Grands Projets (lead member), Vinci Construction Terrassement GP SAS (a division of Vinci Construction Terrassement SAS) and Sogea Satom (minority partner, bringing its capacity to mobilize local resources) (the EPC Contractor);
- An Operation and Maintenance Contract (O&M Contract) with Vinci Highways, a fully owned subsidiary of Vinci Concessions (the O&M Contractor).

An Interface Contract between RVH, the EPC Contractor and the O&M Contractor manages all interactions between the EPC Contractor and the O&M Contractor as the construction process progresses to ensure the smooth transfer of activities from construction to operation and the completion of some follow-up activities.

All contracts mentioned above contain provisions relating to the governance of the Project and in particular on the following aspects:

- discussion/approval requirements related to the Project's design and activities;
- notifications and reporting to the different contractual parties and Project's stakeholders;
- claims management and defects remediation plans;
- resolution of deadlock situations by recourse to a joint committee or an independent expert and dispute resolution mechanisms.

It is the intention of the GoK to eventually create a National Toll Fund (NTF) to ensure management of tolling revenues from the Highway including the funding of all payment obligations. The NTF will act as the interface on tolling aspect between the Toll Operator, responsible for the toll collection, the GoK and RVH.

A Tolling Interface Agreement is expected to be signed between KeNHA, RVH and the future Toll Operator to set out the terms and conditions regarding the cooperation, working arrangements and liaison procedures between the parties during the installation and operation of the tolling systems relating to the Project.

The Project will receive core financing from a large group of Lenders (including both commercial lenders and development finance institutions). Coordination between those lenders will be managed by a number of agents (Facility Agents, Security Agents and Intercreditor Agents) and detailed decision-making rules under an Intercreditor Agreement.

Finally, the Project and its funders will be supported by the Government of Kenya through a Letter of Support (LOS).

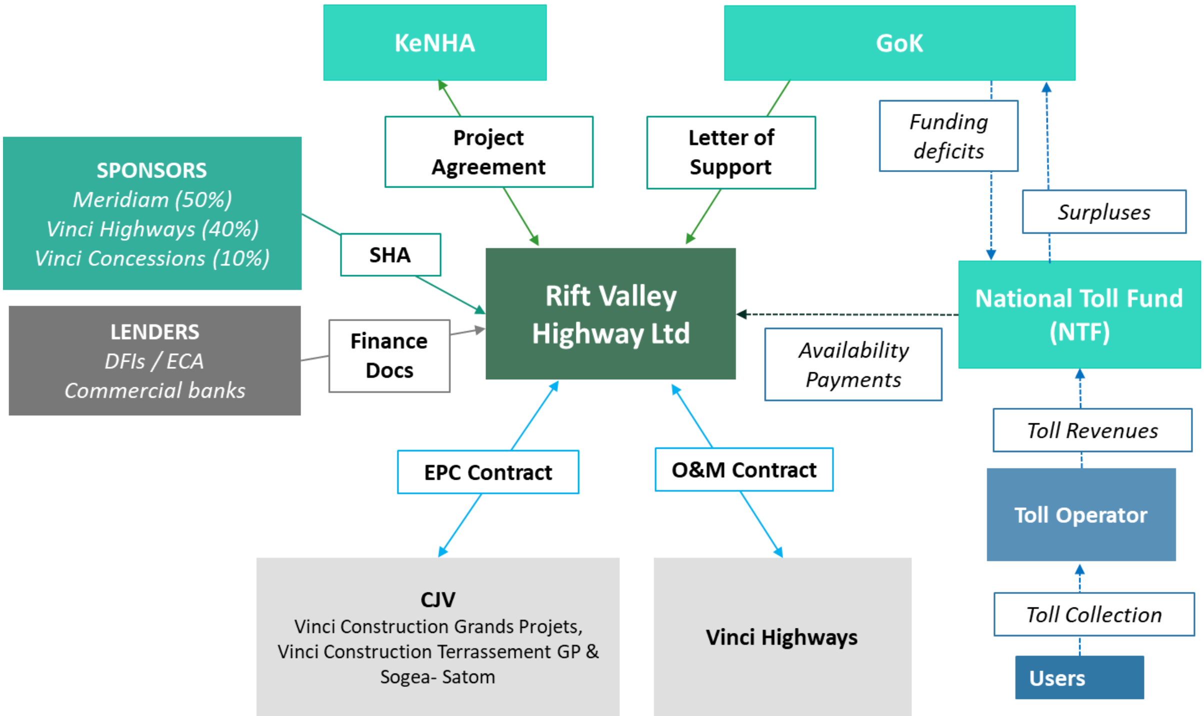


Figure 10-1 Proposed Organisational Structure of RVH for the Project

The organisational structure proposed within RVH to ensure the management of Health, Safety, Environment and Community (HSEC) aspects is based on two distinct levels that is:

- for RVH, E&S management aspects that will be overseen by an E&S Manager responding directly to RVH's CEO. This Manager will be supported E&S officers and a Community Liaison Officer as presented in Figure 10-2;
- For the EPC Contractor (or CJV) and O&M Contractor (or Vinci Highways) Quality, Health & Safety and Environment (QHSE) management aspects that will be overseen by a QHSE Manager responding respectively to the Project Engineer and to the Company Director. This Manager will be supported by HSE Officers and a Community Liaison Officer as presented in Figure 10-2.

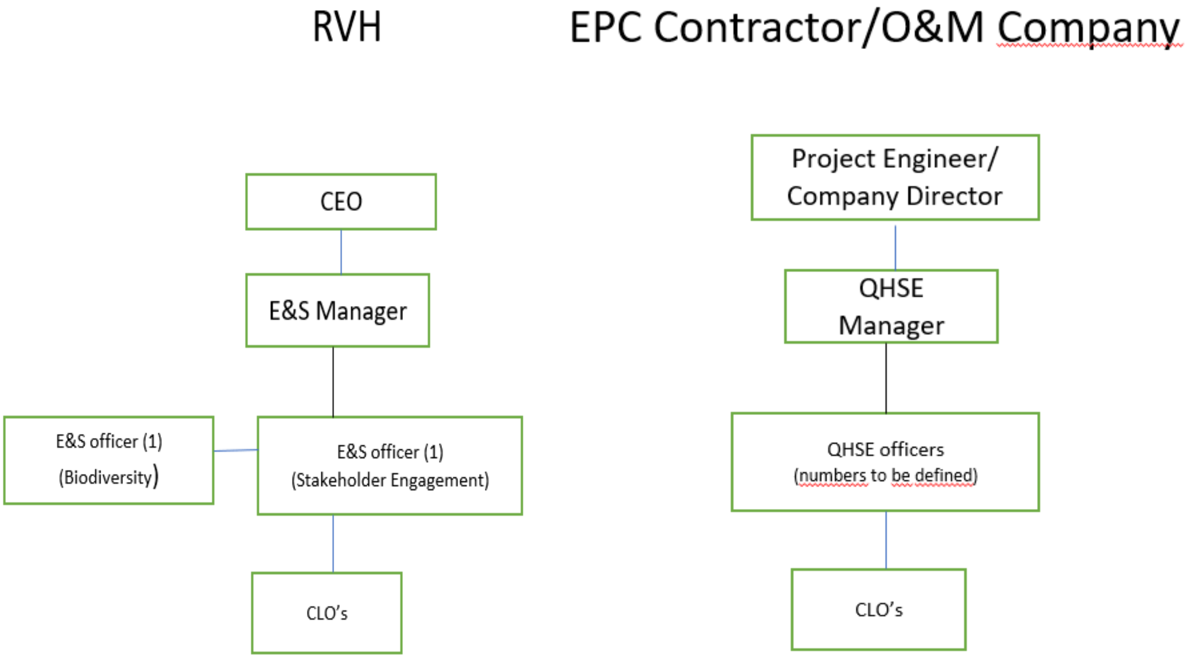


Figure 10-2 E&S and QHSE Management Structure for the Project

Additional information (such as job descriptions) is supplied in the ESMS prepared as a distinct document for the Project. It should also be noted that both the EPC Contractor and O&M Contractor will be linked to RVH through their respective EPC contract and O&M contract which contains the ESMP and the obligation to prepare construction and operation management plans. More specifically for the O&M Contractor, this contract clearly defines the obligations of the O&M Contractor with regards to preparing the operation management plans and to comply with all E&S Required Standards (incl. all applicable laws relating to E&S, the IFC Performance Standards, the IFC Environmental, Health and Safety Guidelines, the World Bank General EHS Guidelines and all commitments included in the ESIA). However, requirements surrounding heavy maintenance will remain under RVH's direct responsibility.

To ensure efficient communication between the various Project proponents, including the GoK, KeNHA, the EPC Contractor, the O&M Contractor and the toll operator, a contractual structure including the following components was developed:

- A 30-year Project Agreement with KeNHA (covering ongoing payments and termination payments);
- An EPC Contract with a consortium of VINCI Construction Terrassement, Vinci Construction Grands Projets and Sogea Satom;
- An O&M Contract with VINCI Highways;
- A binding Letter of Support issued by the National Treasury of the GoK to cover political risks, termination payments under the Project Agreement and any funding deficit in the NTF.

There will also be Direct Agreements for the Lenders with KeNHA and the EPC and O&M Contractors, and an Interface Contract with the Toll Operator. It is important to underline the fact that all of these contracts include various mechanisms to facilitate and ensure the efficient sharing of information/notifications between the various parties. Finally, it must be highlighted that more clarity will be given on the communication interfaces between project proponents in the ESMS.

10.4 ESMS AND ASSOCIATED MANAGEMENT/ACTION PLANS

RVH is preparing, in parallel to this ESIA, an Environmental and Social Management System (ESMS) and a series of associated Management/Action Plans to ensure the adequate management of all environmental and social aspects related to construction as well as operation and maintenance (O&M) activities. These documents will be implemented by the EPC Contractor for the construction phase and by the O&M Contractor for the operation phase (See proposed organisational structures in Figure 10-1 and 10-2). The proposed documents are briefly presented in the following sections. The ESMS is being developed in compliance with IFC Performance Standard 1 requirements, and its effective use will promote improved environmental and social performance.

10.4.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT SYSTEM

The ESMS is a collection of tools designed to ensure compliance with policies relating to the Project's sustainable development, i.e., environment, community development, and occupational health and safety. Its main objectives are:

- To ensure compliance with all applicable policies, procedures, laws and regulations;
- In case of non-compliance, ensure that corrective actions and appropriate follow-up are undertaken;
- Identify persons who have responsibilities for compliance matters;
- To fully communicate the environmental and social commitments undertaken by RVH;
- To provide managers and staff with a clear framework for ESMS implementation.

The ESMS brings together all the measures to avoid, mitigate and compensate potential impact resulting from the project's pre-construction, construction and operation phases on the natural and social environments. It identifies sectors for intervention, defines roles and responsibilities and establishes intervention standards to ensure any adverse effect on workers, communities and the environment within and around the project area is identified and mitigated.

The ESMS applies to all activities of the pre-construction, construction and operation phases of the project within the project area. These include: Site acquisition, installation of temporary facilities, site clearing and preparation, effective construction of highways, storage of material and equipment, maintenance, cement and asphalt production, laboratories, offices, quarries and borrow pits, bulk fuel storage, routine maintenance and operation and heavy maintenance activities.

More specifically, the proposed ESMS will cover the following aspects in compliance with IFC PS1 requirements:

- policies and legal framework. The policies will be based on those existing with the Proponent that is:
  - For Meridiam:
    - Sustainable Development Charter, May 2020. 6 p.
    - Sustainability Risk Policy: Approach for a Responsible ESG and Sustainability Management, May 2021. 18 p.
    - Meridiam Anti-bribery and Corruption Policy, January 2015. 9 p.
  - For Vinci:
    - Sustainability Policy, July 2021. 1 p.
    - Environmental Guidelines, November 2020. 8 p.

- Occupational Health and Safety: Essential and Fundamental Actions, June 2017. 8 p.
- Vinci's Guide on Human Rights, April 2017. 20 p.
- Code of Ethics and Conduct, December 2017. 20 p.
- Anti-Corruption Code of Conduct, December 2017. 24 p.

- organisation structure and chart;
- a summary of the project related impacts;
- a description of the management programs;
- communication aspects and grievance mechanisms;
- training activities;
- document control and record management, and;
- the process of internal monitoring and review (auditing).

10.4.2 PROCEDURES AND MANAGEMENT PLANS

As part of their Environmental and Social Management Plan, the EPC Contractor and the O&M will develop a number of Procedures and Management Plans to ensure proper implementation of environmental and social aspects. Table 10-2 present a brief overview of the various documents to be prepared and implemented by the various Project actors before the beginning of construction activities. The table includes a brief description of the document (its main purpose) and identifies who will be responsible for its application.

It must be highlighted that although there is no specific Gender Management Plan, associated aspects are covered as specific sections within various of the documents presented in Table 10-2 including: Code of Conduct, Local and Labor Recruitment plans, VMG Plan, Migrant Labor Management Plan and Grievance Mechanisms.

Table 10-2 Proposed Procedures and Management/Action Plans

Document	Description	Responsible Entity		
		RVH	EPC Contractor	O&M Contractor
Contractors Management Plan	Establishes a set of expectations between the contractor and its employer in terms of services to be supplied, expected qualifications, control of work's quality, etc. It also defines the communication processes and specific responsibilities.	X		
Communication Procedures and Stakeholder Engagement Plan	Includes directions to conduct internal and external communication. Identifies key Stakeholders, defines their relation/sensitivity to the Projects and the communication modalities to favor when engaging with them, establishes a meeting calendar and keeps track of engagements completed. Required by IFC PS1.	X		
Grievance Mechanisms, Overseeing Procedures	Defines the process by which grievances are received and managed up to their resolution. Required by IFC PS1.	X		
Community Health, Safety and Security Risk Assessment and Management Plan	Identifies the various risks associated with the project's activities for the community's health, safety and security and proposes specific actions to mitigate them.	X	X	X

Document	Description	Responsible Entity		
		RVH	EPC Contractor	O&M Contractor
Local Recruitment Plan	Defines the actions that will be implemented to favor local recruitment	X		
VMG/Indigenous People Plan	Identifies the VMGs potentially affected by the project and how specific grievances will be managed, monitored, evaluated and reported. It also defines the agreed arrangements established during the FPIC process and the process to implement them.	X		
Community Development Strategy	Describes the strategy to be implemented to identify and develop specific actions, in collaboration with the Communities, to assist in their development as part of RVH's corporate social responsibility activities.	X		
Biodiversity Management and Monitoring Plan	Defines the specific actions that will be implemented to ensure the protection and enhancement of biodiversity, as well as those to monitor the success of the actions completed to protect and enhance biodiversity (revegetation, wildlife crossings, etc.) and to minimise the interaction between the work site or the highway and the surrounding fauna.	X	X	X
RoW Management/ Monitoring Plan	Defines how the RoW will be kept free of any encroachment and maintained during construction and operation.	X	X	X
Climate Change-Related Risk Management Plan	Presents the main climate change-related risks and the proposed actions to minimise short to long-term effects to the highways. A special attention will be given to water management aspects in terms of infrastructure design and capacity.	X		
Stakeholder Engagement Plan	Defines the various stakeholders with whom the project will interact during construction and operation, the specific engagement activities to be held and how they will be held. Completed activities will be recorded in the plan and updated on a yearly basis. Required by IFC PS1.		X	X
Noise Management Plan	Defines the management of the noise related infrastructure and of the assessment of their efficiency over time. It will cover design reviews, mechanisms to assess efficiency, plan corrective actions and implement them during operation.	X		
Contractor Monitoring Plan	Defines the procedures to be implemented to ensure that the Contractor respects the environmental and social requirements identified in the ESIA and associated ESMP.	X		
Labor Recruitment and Migrant Labor Management	Defines the recruitment process to be implemented during the construction and operation phases. Defines the ways in which the migrant labor will be managed to facilitate their local integration during the construction phase.		X	X
HR Policy/Manual	Defines all the rights (salary, social benefits, etc.) of the hired employees.		X	X
Code of Conduct	Defines the obligations (respect of work hours, avoid consumption of prohibited substances, respect of other workers, etc.) of the hired employees.		X	X

Document	Description	Responsible Entity		
		RVH	EPC Contractor	O&M Contractor
Harassment/Sexual Exploitation and Hazard and Risk Assessment and Management	Explains the procedure to be follower for the identification of hazards and risks in the various works fields and defines the actions to be implemented to minimise/eliminate them.		X	X
Occupational Health and Safety Management	Provide clear direction on health, safety and security management to ensure compliance with Project Standards, limit accidents and increase employees awareness.		X	X
Community Health & Safety Management	Establishes the potential health and safety risks associated with and for the Project and proposes mitigation measures to minimise risks and effective impacts.		X	X
Security Management	Assesses the security challenges with the work site and defines the actions to maintain a high level of security (access control, security guards, etc.). Also ensures that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner that avoids or minimizes risks to the Affected Communities, as required by IFC PS4.		X	X
Traffic Management Plan	Defines the actions to be implemented to ensure safe and efficient traffic management around and within work sites.		X	
Hazardous Material Management	Identifies the hazardous material present and defines the manutention, storage, use and elimination of this material as well as the employees awareness to them.		X	X
Waste Management	Identifies the main types of waste generated, how they will be managed on work sites and through which channel will they be managed (recycling, elimination).		X	X
Water Management	Defines how surface water will be managed to avoid contamination of surrounding watercourses, to avoid flooding, to keep the work area free from water accumulation and to improve efficiency in the use of water resources.		X	
Air Quality, Water Quality and Noise Management/ Monitoring	Defines the modalities through which these environmental aspects will be monitored and against which standards. Presents the processes to identify and implement the best course of action to correct any problematic situation identified.		X	X
Emergency Preparedness and Response	Identifies the main emergency situation that can occur as well as the material required and the best response procedure to rapidly resolve a specific situation.		X	X
Clearing and Revegetation Procedures	Identifies the areas to be cleared and those to be revegetated and based on detailed maps of presence of NH and CH, pre-construction ground-truthing walkover surveys, marking off specific areas prior to clearing, and monitoring for compliance. Procedures will also indicate the timing for such clearance, to be defined based on the type of receptors present in any specific patch.	X	X	
Erosion Control and Sedimentation	Defines the procedure and infrastructures to be implemented to protect and stabilise sensitive slopes and to intercept free flowing particles to avoid sedimentation.		X	

Document	Description	Responsible Entity		
		RVH	EPC Contractor	O&M Contractor
Invasive Species Management and Control	Supplies a list of typical invasive species known to be present in the Project area and proposes specific actions to minimise the risk of introduction/dissemination or to remove/eliminate those present.		X	X
Chance Finding Procedure	Describes the process to be followed in the case of a chance finding of archaeological value during excavation work.		X	
Road Safety Management and Monitoring	Defines the means to be implemented to increase road user's awareness about road safety and the equipment that will be installed to help reduce/managed efficiently accidents (signage, traffic cameras, etc.).			X

10.5 ENVIRONMENTAL AND SOCIAL MONITORING AND FOLLOW-UP

This section of the ESIA presents the environmental and social (E&S) monitoring and follow-up programs that should be implemented to ensure general and specific mitigation measures during construction activities and their long-term success at the operation phase are adequately applied.

10.5.1 ENVIRONMENTAL AND SOCIAL MONITORING

Monitoring is aimed at ensuring all recommended mitigation measures and the Contractor' Environmental and Social Management Plan (CESMP) are implemented during construction, all activities are documented, and any glitches in the system are rapidly identified and adjusted.

E&S monitoring allows for the effectiveness of mitigation measures during the construction phase to be verified. These management measures are validated to ensure proper mitigation of anticipated impacts throughout the construction phase. Consequently, the monitoring plan is meant to evolve and be adapted over time to address any unexpected changes or impacts. E&S monitoring is based on:

- site inspections;
- verification of the effectiveness of mitigation measures;
- reviews and updates, as required, based on observations and potential changes in construction or operation activities.

Table 10-3 lists the main E&S monitoring measures to be applied during the construction phase. It is important to note that the monitoring obligations below are meant to correlate with the Project-related impacts and mitigation measures detailed in Table 10-2 above.

As mentioned, responsibility for the collection of baseline condition data, prior to the initiation of work, lies with the Contractor. This is meant to ensure baseline conditions to which monitoring results will be compared to are site-specific, recent, and reflect the true situation on the field prior to construction work. Baseline data collection should be conducted at various representative sites within the PDA.

Table 10-3 Environmental and Social Monitoring Activities

<table>
<tr><th>Components</th><th>Action</th><th>Standards / Targets</th><th>Location</th><th>Frequency</th><th>Responsibilities</th><th>Supervision</th><th>Monitoring & Evaluation</th></tr>
<tr><td rowspan="2">Ambient Air Quality</td><td>Conduct regular visual inspection of construction sites and access roads.</td><td rowspan="2">Avoid significant degradation of baseline conditions associated with dust production, equipment and machinery idling, or generating abnormal amounts of exhaust fumes (refer to the air quality monitoring and management plan to be prepared by the Contractor).</td><td rowspan="2">At work site.</td><td>Continuous during construction activities.</td><td rowspan="2">Contractor</td><td rowspan="2">Work Site Engineer and HSE representative</td><td rowspan="2">Lenders, KeNHA and NEMA E&S specialists</td></tr>
<tr><td>During periods of intense construction work with significant amount of dust generated, other monitoring approach should be considered such as:
– Air sampling pumps: air sampling requires a suitable pump, cassette or filter with media, tubing and calibrator. One a sample is collected; it's sent for analysis according to the sampling method used.
– Optical particle counter: a laser counts particle with light-scattering technology.</td><td>As required depending on construction activities, apparent dust emissions and reception of grievances.</td></tr>
</table>

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
Ambient Noise	Inspect construction site and measure dB levels, at locations where noisy activities are realized close to sensitive receptors (houses, schools, etc.) and following reception of specific noise related grievances.	Respect the noise levels set in the noise permit to be obtained by NEMA (refer to the noise monitoring and management plan to be prepared by the Contractor).	At work site and at its periphery.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists
	Inspect construction site.	Adequate use of noise reduction PPE by employees during noisy activities. (Refer to the occupational health and safety management plan to be prepared by the Contractor).	At work site.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists
Surface Water Flow	Inspect construction site and clean crossing and drainage structure when material or waste accumulations are observed.	Ensure adequate evacuation of stormwater from work site and that no water ponds or local flooding appear (refer to the water management and monitoring Plan to be prepared by Contractor).	At work site and at its periphery.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
Surface Water Quality and Freshwater Ecosystem Integrity	Conduct visual inspection of water quality around the activities realized near watercourses or wetlands.	Avoid significant degradation of baseline conditions. Installed silt screens must be kept in place and well anchored (refer to the water management and monitoring Plan to be prepared by Contractor).	At work site in the area of watercourse crossings and along existing wetland (ex. Manguo Swamp area).	Continuous during construction activities	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists
	Conduct a regular surface water quality monitoring program	Avoid significant degradation of baseline conditions.	At work areas hydrologically connected to high sensitivity site (e.g. list at section 8.1.3.2 above), and any other area where surface water contamination-related grievances are received	Weekly during construction activities	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists
Groundwater Quantity	Inspect groundwater wells and distribution network at work sites.	Ensure that the groundwater pumping and distribution system has no leaks causing water losses.	At work site.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists
Groundwater Quality	Conduct a regular groundwater quality monitoring program	Avoid significant degradation of baseline conditions.	When within 100m of high sensitivity sites (e.g. list at section 8.1.3.3 above), and any other area where groundwater contamination-related grievances are received	Monthly during construction activities	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
Habitats and Flora	Implement a procedure for vegetation clearing based on detailed maps of presence of NH and CH, pre-construction ground-truthing walkover surveys, marking off specific areas prior to clearing, and monitoring for compliance.	Avoid or minimize encroachment in natural or critical habitat. Identify the locations of areas of natural habitat and priority plant species (as defined in the BMP). Mark and leave undisturbed to the extent feasible. If not possible, refer to a flora specialist or to KWS to orient actions. (Refer to the Biodiversity Management Plan to be prepared by RVH).	Within the road reserve, quarry sites and other temporary construction facilities	Once, before construction starts in a new section	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists
Terrestrial Fauna	Conduct pre-construction walkover of fauna habitat.	Identify active birds' nests and small patches of habitat important to fauna to be protected to the extent possible. (Refer to the Biodiversity Management Plan to be prepared by RVH).	Within the road reserve, quarry sites and other temporary construction facilities	Once, before construction starts in a new section	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists
	Inspect construction sites.	Ensure that agreement to be reached with Soysambu and Marula Estate on fencing to be maintained during construction is followed. Detect the presence of wildlife entering the construction sites and ensure their safe capture and release outside the work site limits. (Refer to the Biodiversity Management Plan to be prepared by RVH).	At work site.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
Human Environment - General	Develop, implement and operate a gender-sensitive grievance mechanism in compliance with IFC PS1 for general population potentially affected by construction activities, including reports of GBV.	Respond to and close all grievances received.	Mainly from local areas surrounding work site but all grievances must be considered.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA and NEMA E&S specialists
Community Health and Safety	Implement an accident register to identify the various incidents implicating Project activity-related vehicles and road accidents between members of the general population (Refer to the Community Health, Safety and Security Risk Assessment and Management Plan to be prepared by RVH and Contractor).	All accidents properly documented. Minimise number of accidents implicating Project activity-related vehicles.	Entire Project area.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
	Visually inspect work areas during routine site visits to evaluate the state of measures implemented to ensure local population and road users' safety (Refer to the Community Health, Safety and Security Risk Assessment and Management Plan to be prepared by RVH and Contractor).	Right-of-way and work areas clearly indicated; machinery and truck traffic limited to access road right-of-way and work areas; safe and convenient pedestrian paths and crossing points along the road alignment and construction areas are provided (including under and over passes); speed control and traffic control systems at pedestrian crossing areas are installed and maintained; appropriate road signs, signals, markings, and other traffic regulation devices related to pedestrian facilities and to regular local and regional vehicular traffic are installed and maintained; barriers and buffer zones are installed around critical work areas where interactions with pedestrians are possible; and minimise open holes with stagnant water.	Entire Project area.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists
Public Infrastructures and Services	Inspect local roads and accesses used for material transport.	Local roads are maintained at baseline condition.	All roads used by heavy vehicles and machinery working on the Project.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
Mobility and Livelihoods	Evaluate the effectiveness of the Traffic Management Plan.	Working areas are clearly indicated; transport routes are optimized; diversion roads do not block access to health services; key economic activity locations (e.g., access to suppliers, business and major tourism locations, and economic outlets) and sociocultural activity locations.	Entire workspace.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists
Livelihood	Assess the proportion of local people among contractor's employees.	Parity or better.	Entire construction workforce.	Continuous during pre-construction and construction activities.	Contractor	Contractor's Human Resource Agent	Lenders and KeNHA Human Resources Agents
Labour conditions	Ensure contractor, subcontractor and suppliers offer adequate labour conditions to their employees, including temporary workers (Refer to the Labor Recruitment Management Plan to be prepared by the Contractor).	Employment Act, Occupational Safety and Health Act, Public Health Act and Work Injury Benefits Act (Section 2.3.10) of Kenya and IFC Performance Standard 2 (Labor) should be considered as basic requirements.	Project work sites and area.	At time of hiring employees and all third parties and at least once a year during construction activities.	Contractor	Contractor's Human Resource Agent	Lenders and KeNHA Human Resources Agents
VMGs	Maintain regular communication with the Maasai to ensure ongoing Free, Prior and Informed Consent (Refer to the VMG action Plan to be prepared by RVH).	All questions and concerns are addressed in a transparent manner. FPIC is regularly confirmed. In the case predetermined conditions to reinitiate the FPIC process are met, renegotiations will occur.	Maasai communities of Namuncha and Ereri villages.	Continuous during construction activities	Contractor	Contractor's Social Specialist	Lenders and KeNHA's VMG specialists
	Favour the employment of Indigenous People (Refer to the Indigenous People Plan to be prepared by RVH).	Content of Memorandum of Agreement signed with the VMGs.	At least for the areas of the A8 South bordering or within Maasai territory.	Continuous during pre-construction and construction activities.	Contractor	Contractor's Human Resource Agent	Lenders and KeNHA Human Resources Agents

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
Gender Relations	Favour the employment of women.	Aim employing women in as many of the construction work fields as possible.	Entire construction workforce.	Continuous during pre-construction and construction activities.	Contractor	Contractor's Human Resource Agent	Lenders and KeNHA Human Resources Agents
	Ensure equal payment for male and female workers for equivalent jobs and qualifications.	100% of female employees	Entire workforce.	Continuous during entire Project.	Contractor	Contractor's Human Resource Agent	Lenders and KeNHA Human Resources Agents
	Provide some procurement opportunities for women, youth and persons with disabilities	Implementation of: – a system to track bidders and awardees from women-headed or majority women-owned firms; – a mechanism to promote bid-readiness support for women-owned or majority women-owned small firms and businesses; – a survey activity aimed at opportunities which could be offered to women groups.	Entire supply chain.	Continuous during entire Project.	Contractor	Contractor's Human Resource Agent	Lenders and KeNHA Human Resources Agents
Gender Relations	Prepare a list of relevant resources and services for GBV victims and ensure all staff have access to and are familiar with this document.	100% of relevant staff.	Relevant staff: Indigenous grievance redress mechanism staff, supervisory staff, human resources, and others as required.	Continuous during entire Project.	Contractor	Contractor's Human Resource Agent	Lenders and KeNHA Human Resources Agents

Components	Action	Standards / Targets	Location	Frequency	Responsibilities	Supervision	Monitoring & Evaluation
Archaeology and Cultural Heritage	During quarrying or other excavation work, have a qualified or trained person act as an observer to detect any signs of unknown and undocumented cultural artefacts.	All potential findings investigated by a specialist of the National Museum of Kenya (NMK).	All areas requiring excavation.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders, KeNHA Heritage specialists, and NMK specialists.
Worker Health and Safety	Provide all workers with Health and Safety sensitisation (Refer to the Occupational Health and Safety Management Plan to be prepared by the Contractor).	100% of workers to receive training.	Entire construction workforce.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists
	Assess proportion of work accidents duly reported.	100%	Entire construction workforce.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists
	Assess number of accidents involving lost time.	If any, demonstrate that actions are taken to reduce/eliminate accident risks.	Entire workspace.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists
	Assess number of notices of violation received for failure to comply with H&S regulations.	If any, demonstrate that actions are taken to reduce/eliminate violation notices.	Entire workspace.	Continuous during construction activities.	Contractor	Work Site Engineer and HSE representative	Lenders and KeNHA Health and Safety Specialists

10.5.2 ENVIRONMENTAL AND SOCIAL FOLLOW-UP

Environmental monitoring will be carried out by the Highway operator, since it takes place after the completion of the work. However, the construction Contractor will remained tied with some of the mitigation they will have implemented such as revegetation and erosion control. Liability is normally set for at least a 12-month period following the end of construction work.

Environmental monitoring is an approach to monitor the progress of certain components affected by the project, and to verify the accuracy of the predictions and environmental issues identified. It also verifies the effectiveness of short, medium and long-term mitigation measures in the environmental assessment that would remain uncertain.

Given the impacts of the Highway project, follow-up programs are recommended in relation to the following:

- Noise;
- Surface water and freshwater habitat quality;
- Soil stability;
- Natural and critical natural habitat loss;
- Success of revegetation and compensatory plantation;
- Invasive alien flora species;
- Use of wildlife crossing by terrestrial fauna;
- Population outcomes for wildlife;
- Roadkill monitoring;
- Use and efficiency of pedestrian and cattle crossings;
- VMG's satisfaction and FPIC agreement results, and
- Climate change resilience.

10.5.2.1 NOISE

Noise monitoring is required for two types of areas along highway A8:

- Areas where modelled noise level increase is expected to be low enough not to require specific intervention (see section 8.1.2, Operation phase). The purpose is to confirm that noise level increases are effective as modelled and thus these areas do not need intervention;
- Areas where specific interventions were realized to minimise anticipated impacts on sensitive receptors and at wildlife crossings and to verify if the intervention is efficient.

A survey should be conducted twice within the first year of operation at these locations and each time a significant traffic increase is confirmed. Also, such surveys should be realized in areas where frequent grievances are recorded to verify the existence of a problem and allow for the development of solutions.

For both cases, noise monitoring should be composed of standard 24-hour noise surveys and minimally follow the protocol presented in Appendix 5-1.

10.5.2.2 SURFACE WATER AND FRESHWATER HABITAT QUALITY

In order to reduce the risk of surface water contamination originating from stormwater flowing from the Highway, various water treatment installations already integrated into the initial design are present near sensitive watercourses and wetlands. A follow-up of the effluents of these installations should be conducted on a monthly basis during the rainy seasons for the first year of operation and adapted for the following years according to obtained results. If the results are negative and show a stable trend, only one survey per year could then be required.

Additional surveys could be realized following specific events (accidents with spills) or repetitive grievances in relation to water quality for a watercourse.

Additionally, occurrences of run-off water reaching lakes Naivasha, Elementeita or Baringo, or effluents thereof will be monitored. In the affirmative, additional water treatment facilities will be implemented. Particular attention shall be given to the project section bordering Lake Elementeita and surrounding of CH 38+900; 40+100; 98+100; and 100+800.

10.5.2.3 SOIL STABILITY

All areas where work occurred in steep slopes and where potential soil instability was created through excavation activities should be inspected on a monthly basis for the first six months following the end of work. Subsequently, they should then be inspected every 6 months for the next two years to detect any signs of erosion which could become problematic for the highway operation. Areas where erosion was detected should be the focus of stabilisation work favoring, as much as possible, the use of vegetation.

10.5.2.4 NATURAL AND CRITICAL NATURAL HABITAT LOSS

Once construction is over, the total area of natural and critical natural habitat loss will need to be assessed on the field. Although most of the work will have taken place in the existing road reserve (considered modified habitat), areas cleared for larger infrastructure, work sites, temporary construction facilities and new borrow pits and quarries must be recorded. This will require validating pre-construction estimated losses (to be estimated in a future version of the BAP) against post-construction actual losses. Compensation plans for loss of natural and critical natural habitats will be adjusted according to the results of this monitoring.

10.5.2.5 SUCCESS OF REVEGETATION AND COMPENSATORY PLANTATION

All areas that were revegetated following construction work, should be inspected on a monthly basis for the first year of operation and then every 6 months for two years to ensure success of revegetation. All vegetation that did not survive should be replaced immediately.

The success of compensatory plantations within the project corridor or at designated sites, will also be monitored. Survival rates of trees planted during reforestation will be assessed. Particular attention will be given to species of conservation concern or of use-value that may have been planted. This monitoring can be done in coordination with the KFS. Further details on the monitoring of compensation areas for the loss of natural and critical natural habitats shall be included in the Compensation Plan and developed in collaboration with a flora specialist and the Forestry Department. Rehabilitated roads and work areas will also be monitored to ensure revegetation success. This monitoring shall be carried out every year for the first five years, then once every two years.

10.5.2.6 INVASIVE ALIEN FLORA SPECIES

Following Project construction and site revegetation, an invasive alien plant control and monitoring program will be implemented. This monitoring should be carried out as monitoring of revegetation and plantation success (section 10.5.2.5), i.e. on a monthly basis for the first year of operation and then every 6 months for two years to ensure success of revegetation, at the same time as road reserve maintenance. Areas that were the object of plantations in order to compensate for habitat loss should also be monitored for IAS.

Along with noting the presence and abundance of known IAS within the ROW, colonisation of IAS in habitats adjacent to the road reserve should also be verified. If problematic introduction or proliferation of IAS is observed, appropriate suppression and control measures should be identified.

10.5.2.7 USE OF WILDLIFE CROSSINGS BY TERRESTRIAL FAUNA

A detailed evaluation of the rate in which crossing structures are used will be undertaken. The rate of use will be measured using camera traps deployed at both entrances of each WCS and facing the approaches to crossing structures to determine the relative abundance of species using them. This will enable an evaluation of the suitability for the use of crossing structures by measuring the abundance of animals that are nearby and may use the structures, as well as those that approach and turn around. This monitoring should take place for at least five years and consideration will be given for longer durations if key species are yet to use the structures. Studies from Europe and North America have shown that a period of five to 10 years is required for some species to use WCS.

10.5.2.8 POPULATION OUTCOMES FOR WILDLIFE

The population-level effect from the crossing structures is an important measure to demonstrate how successful the package of mitigation was from the results of its conservation benefits for the species. A budget should be set aside on an annual basis for the first ten years to contribute to research projects that investigate the population-level effects of the road and mitigation. This commitment should be used to leverage additional funds from a range of partners and donors to undertake this work. This approach uses funds for research as an additional compensatory tool to improve outcomes on this project and improve the planning, design and implementation of future road and rail projects in Kenya and Africa overall.

Parameters that can be monitored to assess population-level success, include:

- Rates of movement and purposes of movement across the highway for a select group of species that are of conservation concern or are expected to be representative of other species. The same target species were used for the wildlife movement study (giraffe, zebra buffalo and hyena);
- Rate of gene flow across the highway for certain species, such as giraffes. This should be implemented for species for which gene flow is a concern or where measurements of gene flow are expected to yield important data. These studies should be done in collaboration with relevant research centres or NGOs (e.g., Giraffe Conservation Foundation if giraffes are studied);
- Changes in the size of the population on one or both sides of the highway. This can be cost effectively implemented at Soysambu and Marula as these areas undertake regular aerial censuses of their wildlife populations and also at the level of the KWS property south of Naivasha where wildlife crossing infrastructure should create a new fauna movement corridor between Lake Naivasha and the eastern side of the A8 Highway;
- Changes in the rate of survival or longevity of key species, which require the marking and identification of individual animals and following them over time.

The proponent will establish a reference and implementation committee with representatives from KWS, KeNHA, the adjacent conservation land managers, relevant wildlife conservation NGOs (e.g., Giraffe Conservation Foundation, Ewaso Lions and Grey's Zebra Trust, Endangered Wildlife Trust) and ecologists with expertise in road ecology and linear infrastructure studies to develop and implement the monitoring and evaluation program. In addition, this highway project is an excellent opportunity to support postgraduate research programs at a Masters and PhD level to do research on the impacts of highway upgrades and simultaneously meet any reporting requirements.

10.5.2.9 ROADKILL MONITORING

Roadkill monitoring will be undertaken to quantify the rates of Wildlife-Vehicle Collisions (WVC) and wildlife injury and mortality in order to assess the effectiveness of the proposed fence design for all species of wildlife. Roadkill monitoring will be undertaken at two scales – for the first five years monitoring will be through standardised surveys by RVH road maintenance crews following specified protocols (e.g., Collinson *et al.* 2014).

After that, the RVH road maintenance crews will record all roadkill that they clean up, plus any they incidentally observe during routine maintenance tasks. Data collected will be a combination of the results of the drive-by surveys as well as records of any collisions they attend. All data will be collected using an appropriate mobile phone application and regular training for the staff to identify species will be provided.

In the event that roadkill hotspots are documented, adaptive management measures will need to be identified.

10.5.2.10 USE AND EFFICIENCY OF PEDESTRIAN AND CATTLE CROSSING

After 6 months of operation, pedestrian and cattle movement surveys should be conducted to evaluate current use of crossing infrastructures (FOB, overpasses and PUP/CUPs). The survey should include observation sessions and interaction with local residents and livestock owners to obtain comments.

Also, during the routine inspection of the highways, special attention should be given to signs of intrusion on the highways by pedestrian and grazing livestock.

Adjustment to existing infrastructures may have to be considered if significant problems are detected.

10.5.2.11 VMG'S SATISFACTION OF FPIC AGREEMENT RESULTS

A regular satisfaction review of VMGs of the results from the actions taken from the signed agreement during the FPIC process should be organised through regular meetings at minimum frequency of once a month. This should be completed for the first two years of the project's operation and then once every 6 months for another three years. These reviews should be organised through the Community's committees and official minutes should be prepared and distributed to participants. Actions should be proposed and taken on observations made by community members.

10.5.2.12 CLIMATE CHANGE RESILIENCE

Climate change has been shown to be a potential source of impact on infrastructure such as the new highways (see Chapter 9). Nevertheless, the science associated with climate change is constantly evolving. It is important to reassess the risk profile and associated recommendations when new data becomes available. Changes in climate projections, changes in maintenance practices, and changes in the condition of the highways may affect the risk profile of the various components of the A8 and A8 South Highways, hence the need to monitor this information periodically.

The impact of changing climatic conditions over the life of the new Highways should be closely monitored. Depending on the condition of the assets, RVH will adjust the nature and frequency of the inspections and ensure that the damage is covered by carrying out required work.

11 REFERENCES

- ADEKA, J.E., R.O. Strobl and R. Becht. 2008. *An Environmental System Analysis of Lake Elementaita, Kenya with Reference to Water Quality*. Proceedings of Taal2007: The 12th World Lake Conference: 1365-1371. 8 p.
- AERMET, *ERA5-Kenya: Meteorological Data*," On line . https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview
- AFRICAN DEVELOPMENT BANK GROUP. 2016. *Development and Indigenous Peoples in Africa*. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/Development_and_Indigenous_Peoples_in_Africa__En__-__v3_.pdf
- AGNEW, A.D.Q. 2013. *Upland Kenya Wild Flowers and Ferns, Third Edition*. Nature Kenya Publications, Nairobi, Kenya. Consulted in June 2021.
- AUC. 2015. *Agenda 2063*: *The Africa We Want*, https://au.int/sites/default/files/pages/3657-file-agenda2063_popular_version_en.pdf.
- BALLOT, Andreas, Lothar Krienitz, Kiplagat Kotut, Claudia Wiegand, James S. Mercalf, Geoffrey A. Codd and Stephan Pflugmacher. 2003. *Cyanobacteria and cyanobacterial toxins in three alkaline Rift Valley lakes of Kenya - Lakes Bogoria, Nakuru and Elmenteita*. Journal of Plankton Research. Vol. 26, Number 8 Pages 925-935.
- BECHT, Robert and David Malcom Harper. 2002. Towards an understanding of human impact upon the hydrology of Lake Naivasha, Kenya. Hydrobiologia, Vol. 488 (1), pages 1 to 111.
- BECHT et al., *Holocene palaeohydrology, groundwater and climate change – Central Kenya Rift*.Copyright © 2009 IAHS Press 769 (2005b).
- BECHT, Robert and J. Nyaoro. 2006. The influence of groundwatger on lake-water management: the Naivasha case. Environmental Science.
- BEDELIAN, C. 2014. *Conservation, tourism and pastoral livelihoods: Wildlife conservancies in the Maasai Mara, Kenya* [Ph.D.]. University College London
- BENNUN, L., Serckx, A., Tatum-Hume, E. & Katariya, V. 2018. *Proposed Expansion of Rironi-Mau Summit Highway, Kenya: Critical and Natural Habitat Screening and Recommendations for Biodiversity Management.* Report prepared on behalf of the World Bank. The Biodiversity Consultancy Ltd, Cambridge
- BENNUN, L. & Njoroge, P. 1999. *Kenya*. In Fishpool L D C, and Evans M I (Eds.) Important Bird Areas in Africa and associated islands: priority sites for conservation. Pisces Publications and BirdLife International, Newbury and Cambridge. Consulted in July 2021.
- BERNTSEN, J. L. 1976. *The Maasai and Their Neighbors: Variables of Interaction*. African Economic History, 2, 1–11. https://doi.org/10.2307/3601509
- BIRDLIFE INTERNATIONAL. 2016a. *Euplectes jacksoni*. The IUCN Red List of Threatened Species 2016: e.T22719249A94619458. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22719249A94619458.en. Consulted July 2021
- BIRDLIFE INTERNATIONAL. 2016b. *Prionops poliolophus*. The IUCN Red List of Threatened Species2016: e.T22707760A94136849. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22707760A94136849.en. Consulted July in 2021
- BIRDLIFE INTERNATIONAL. 2017. *Gyps rueppelli*. The IUCN Red List of Threatened Species 2017: e.T22695207A118595083. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22695207A118595083.en. Consulted in July 2021
- BIRDLIFE INTERNATIONAL. 2018a. *Gyps africanus*. The IUCN Red List of Threatened Species 2018: T22695189A126667006. http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22695189A126667006.en. Consulted in July 2021

- BIRDLIFE INTERNATIONAL. 2018b. *Aquila rapax*. The IUCN Red List of Threatened Species 2018: e.T22696033A131671001. http://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T22696033A131671001.en. Consulted in July 2021

- BIRDLIFE INTERNATIONAL. 2020. *Terathopius ecaudatus*. The IUCN Red List of Threatened Species 2020: e.T22695289A174413323.https://dx.doi.org/10.2305/IUCN.UK.2020-.RLTS.T22695289A174413323.en. Consulted in 2021

- BIRDLIFE INTERNATIONAL. 2021. Data Zone - *Important bird Areas of Kenya*. Consulted in April 2021.

- BLACKBURN, R. H. 1971. *Honey in Okiek Personality*, Culture and Society [Ph.D.]. Michigan State University.

- BLACKBURN, R. H. 1982. *In the Land of Milk and Honey: Okiek Adaptations to Their Forests and Neighbors*. In E. Leacock & R. Lee (Eds.), Politics and History in Band Societies (pp. 283–305). Cambridge University Press; Editions de la Maison des Sciences de l'Homme.

- BODYARSSON, G. & Pruess, K. & Stefansson, V. & Björnsson, Sveinbjörn & Ojiambo, S. 2021. *Summary of modeling studies of the East Olkaria geothermal field*, Kenya. GRC. 9. Online: https://www.researchgate.net/publication/255005114_Summary_of_modeling_studies_of_the_East_Olkaria_geothermal_field_Kenya/citation/download. Consulted in May 2021.

- BOURGERON, P.S., Humphries, H.C. & Jensen, M.E. 2001. *Representativeness assessments*. Pp 292 – 306. In: A guidebook for integrated ecological assessment. Eds: Jensen, M.E. & Bourgeron, P.S. Springer Verlag.

- BOURGERON, P.S., Humphries, H.C. & M.E. Jensen 2001. *General data collection and sampling design consideration for integrated regional ecological assessments*. Pp 92-107 In: A guidebook for Integrated Ecological Assessment. Eds. Jensen, M.E. & Bourgeron, P.S. Springer Verlag. ISBN: 0-98582-4.

- BRITANNICA, The Editors of Encyclopaedia, 2017. "*East African Rift System*". *Encyclopedia Britannica*, 21 Feb. 2017. Online: https://www.britannica.com/place/East-African-Rift-System. Accessed 24 March 2021. Consulted in February 2021.

- BRITANNICA, The Editors of Encyclopaedia. Köppen climate classification. Online: https://www.britannica.com/science/Koppen-climate-classification. Consulted on April 2021.

- BRITISH GEOLOGICAL SURVEY, 2021. *Climate of Kenya*. Online: http://earthwise.bgs.ac.uk/index.php/Climate_of_Kenya. Earthwise. Consulted in June 2021.

- BROWN, D.S. 1994. *Freshwater Snails of Africa and their Medical Importance*. Second Edition. Taylor & Francis, London.

- CADWALLADR, D.A., 1965. *The decline in the Labeo victorianus Blgr.(Pisces: Cyprinidae) fishery of Lake Victoria and an associated deterioration in some indigenous fishing methods in the Nzoia River, Kenya*. East African Agricultural and Forestry Journal, 30(3), pp.249-256.

- CBD, Convention on Biological Diversity, 2021. Country Profile – Kenya- Main Details. Online: https://www.cbd.int/countries/profile/?country=ke. Consulted in August 2021.

- CEMAGREF. (1982). *Etude des méthodes biologiques quantitatives d'appréciation de la qualité des eaux. Rapport Division Qualité des Eaux Lyon*. Agence financière de Bassin Rhone- Méditerranée. Corse, Pierre-Bénite.

- CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES. 2009. *Post-election Violence in Kenya and its Aftermath. Blog post on smart global health*. Retrieved from: https://www.csis.org/blogs/smart-global-health/post-election-violence-kenya-and-its-aftermath

- CHILG FUND. 2021. *Poverty and Education*. Retrieved from: https://www.childfund.org/poverty-and-education/.

- CITIES ALLIANCE. 2020. *Venture Strategy and Structure Magumu Wholesale Market and Logistics Centre*, Nyandarua County, Kenya. Retrieved from: https://www.citiesalliance.org/sites/default/files/2020-11/Nyandarua%20County%20Magumu%20Market%20Venture%20Strategy%20and%20Structure%20-.pdf

- CLIMATE-DATA.ORG. "*Kenya Climate Data*," n.d. Online: https://en.climate-data.org/africa/kenya/kiambu-1727/. Consulted in April 2021.

- CLIMATES TO TRAVEL. "*World Climate Guide*," n.d. World climate guide. Online: https://www.climatestotravel.com/climate/kenya. Consulted in April 2021.

- CLIMATE WATCH. 2019. Washington, D.C.: World Resources Institute. Available online at: www.Climatewatchdata.org. Consulted in April 202.

- COAST, E. 2002. *Maasai Socioeconomic Conditions: A Cross-Border Comparison*. Human Ecology, 27.

- CONTI, P.; Pistis, M; Bernardinetti, S.; Barbagli, A.; Zirulia, A.; Serri, L.; Colonna, T.; Guastaldi, E.; Ghiglieri, G., 2021. *Tectonic Setting of the Kenya Rift in the Nakuru Area, Based on Geophysical Prospecting*. Geosciences 2021, 11, 80. https://doi.org/10.3390/geosciences11020080

- COPERNICUS. 2021. *ERA5 Hourly Data on Single Levels from 1979 to Present.* On line: https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-single-levels?tab=overview. Consulted in May 2021.

- CORBET, P.S., 1961, January. *The food of non‐cichlid fishes in the Lake Victoria basin, with remarks on their evolution and adaptation to lacustrine conditions*. In Proceedings of the Zoological Society of London (Vol. 136, No. 1, pp. 1-101). Oxford, UK: Blackwell Publishing Ltd.

- COUNTY GOVERNMENT OF KIAMBU. 2017. *County Fiscal Strategy Paper (CFSP*). 86 pages.

- COUNTY GOVERNMENT OF KIAMBU. (2018). *Kiambu County Integrated Development Plan 2018-2022.* County Government of Nakuru.

- COUNTY GOVERNMENT OF NAKURU. 2018. *Second County Integrated Development Plan 2018 - 2022*. 358 p.

- COUNTY GOVERNMENT OF NYANDARUA. (2018). *The Socio-economic Transformative Agenda for Nyandarua County: Nyandarua County Integrated Development Plan (CIDP2) 2018-2022*. Government of Nyandarua.

- COUNTY GOVERNMENT OF NYANDARUA. 2021. *Ongoing County Rural Roads Construction Programme*. Retrieved from the County Government of Nyandarua's Website: https://www.nyandarua.go.ke/portfolio-item/ongoing-county-rural-roads-construction-programme/

- CROOK, V. 2013. *Ansellia africana*. The IUCN Red List of Threatened Species 2013: e.T44392142A44437667. https://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T44392142A44437667.en . Consulted in June 2021.

- CSIC – Consejo Superior de Investigaciones Científicas, Spain. 2019. *Global SPEI database*. Online: https://spei.csic.es/database.html. Consulted in March 2021.

- DEJONG, Thomas. 2011. *Water abstraction Survey in Lake Naivasha Basin, Kenya, International Land and water management*, Wageningen University and Research, Netherlands. 40 p. On Line: https://filetransfer.itc.nl/pub/naivasha/DeJong2011.pdf. Consulted in June 2021.

- DESOUZA, Priyanka, Victor Nthusi, Jacqueline M. Klopp, Bruce E. Shaw, Wah On Ho, John Saffell, Roderic Jones and Crlo Ratti. 2017. *A Nairobi Experiment in Using Low Cost Air Quality Monitors*. Clean Air Journal. Vol. 27, No. 2, 32 p.

- DESOUZA, Priyanka. 2020. *Air Pollution in Kenya: A Review*. 10 p.

- DICKENS, C.W.S. & GRAHAM, P.M. 2002. *The South African Scoring System (SASS) Version 5 Rapid Bioassessment Method for Rivers*. African Journal of Aquatic Science, 27: 1-10.
- DÜHNFORTH, Miriam, Andreas G.N. Bergner and Martin H. Trauth. 2006. *Early Holocene Water Budget of the Nakuru-Elementeita Basin, Central Kenya Rift*. Journal of Paleoliminology. 36:281-294. 14 p.
- EARTHWISE. *Climate of Kenya; Koppen-Geiger Classification*. Online. Consulted April 2021.
- ECMWF – European Centre for Medium-Range Weather Forecasts. 2020: *The ERA5 dataset*. On line: https://www.ecmwf.int/en/forecasts/datasets/reanalysis-datasets/era5. Consulted in March 2021.
- ECCLES, D.H. 1992. *Field guide to the freshwater fishes of Tanzania*. FAO Species Identification Sheets for Fishery Purposes. FAO: Roma. V, 145 pp.
- ELLIOTT, S.D., Blakesley, D. & Hardwick, K. 2013. *Restoring tropical forests: A practical guide*. Kew Publishing. Royal Botanic Gardens, Kew, UK.
- ELORANTA, P. & SOININEN, J. 2002. *Ecological status of Finnish rivers evaluated using benthic diatom communities*. Journal of Applied Phycology, 14: 1-7.
- FAHRIG, L. and Rytwinski, T. 2009. *Effects of roads on animal abundance: an empirical review and synthesis*. Ecology And Society **14**, 21 (online).
- FEDERAL RESERVE BANK OF KANSAS CITY, 2016. "*How Much Economic Damage do Large Earthquakes Cause?*" https://www.kansascityfed.org/oklahomacity/oklahoma-economist/2016q1-economic-damage-large-earthquakes/. Accessed 24 March 2021.
- FFMES. 2021a. *Land use and land use change analysis. Nairobi-Nakuru-Mau Summit Highway Project Biodiversity synthesis studies for the ESIA.* Republic of Kenya.35 p
- FFMES, 2021b. Biodiversity baseline investigation -Vegetation, plants and habitats. Nairobi-Nakuru-Mau Summit Highway Project. Expansion & Upgrade. Biodiversity baseline studies for the ESIA. 51 p.
- FFMES. 2021c. *Biodiversity baseline investigation -Vegetation: Woody biomass, carbon and woody populations condition. Nairobi-Nakuru-Mau Summit Highway Project Expansion & Upgrade.* Biodiversity baseline studies for the ESIA.39 p.
- FFMES. 2021d. *Biodiversity baseline investigation -Avifauna. Nairobi-Nakuru-Mau Summit Highway Project. Expansion & Upgrade*. Biodiversity baseline studies for the ESIA. 146 p.
- FFMES. 2021e. *Biodiversity baseline investigation -Herpetology. Nairobi-Nakuru-Mau Summit Highway Project. Expansion & Upgrade*. Biodiversity baseline studies for the ESIA. 90 p.
- FFMES. 2021f. *Biodiversity baseline investigation -Mammals. Nairobi-Nakuru-Mau Summit Highway Project. Expansion & Upgrade*. Biodiversity baseline studies for the ESIA. 34 p.
- FFMES. 2021g. *Biodiversity baseline investigation -Freshwater Ecology Baseline Study. Nairobi-Nakuru-Mau Summit Highway Project. Expansion & Upgrade*. Biodiversity baseline studies for the ESIA. 72 p.
- FFMES. 2021h. *Biodiversity baseline investigation -Standardised Biodiversity Sensitivity Analysis. Nairobi-Nakuru-Mau Summit Highway Project. Expansion & Upgrade*. Biodiversity baseline studies for the ESIA. 26 p.
- FFMES. 2021i. *Biodiversity baseline investigation -IFC PS6 Habitat Analysis. Nairobi-Nakuru-Mau Summit Highway Project. Expansion & Upgrade*. Biodiversity baseline studies for the ESIA. 64 p.
- FEOW (Freshwater Ecoregions of the World). 2021. *Freshwater Ecoregions of the World*. http://www.feow.org/globalmap. Consulted in January 2021.

- FLONE INITIATIVE. 2018. *Violence against Women and Girls in Public Road Transport and Connected Spaces in Nairobi County, Kenya*. Preliminary Research and Baseline Study report. Retrieved from: https://issuu.com/floneinitiative/docs/violence_against_women_and_girls_in.
- FUSS, S. et al. 2014. *Betting on negative emissions*. Nature Climate Change, 4, 850-853.
- GEOTHERMAL DEVELOPMENT COMPANY. 2021. *Menengai Geothermal Project*. https://www.gdc.co.ke/menengai.html
- GERBER, A. & GABRIEL, M.J.M. 2002. *Aquatic Invertebrates of South African Rivers*. Institute of Water Quality Study, 149 p.
- GFDRR – Global Facility for Disaster Reduction and Recovery (n.d.): *ThinkHazard!*, Online: https://thinkhazard.org/en/. Consulted in January 2021.
- GLOBAL CITIZEN. 2020. *Understanding How Poverty is the Main Barrier to Education*. Retrieved from: https://www.globalcitizen.org/en/content/poverty-education-satistics-facts/.
- GLOBAL FOREST WATCH. 2020. "*Forest Change – Kenya*". www.globalforestwatch.org
- GOVERNMENT OF THE REPUBLIC OF KENYA. 2017. Wildlife Migratory Corridors and Dispersal Areas. Kenya Rangelands and Coastal Terrestrial Ecosystems – Kenya Vision 2030 Flagship Project. 237 p.
- GOVERNMENT OF KENYA. 2013. *National Climate Change Action Plan* 2013-2017. 258 p.
- GUTH, A. 2014. *Maps of the Southern Kenya Rift*. Dept. of Geology, Michigan Technological University. doi: 10.1130/2014.DMCH016.
- HARDING, W.R. and TAYLOR, J.C. 2011. *The South African Diatom Index (SADI) - A Preliminary Index for Indicating Water Quality in Rivers and Streams in Southern Africa*. WRC Report No. 1707/1/11. Water Research Commission, Pretoria. ISBN: 978-1-4312-0172-3.
- HOLMES, K.L.m P.C. Goebel, L.R. Willians and M. Schecengost. *Environmental influences on macroinvertebrate assemblages in headwater streams of northeastern Ohio*. Journal of Freshwater Ecoogy. Vol. 26, No. 3, September 2011, 409-422
- HUGHES, L. 2006. *Moving the Maasai: A Colonial Misadventure*. Palgrave Macmillan
- ICPAC and WFP. "*Atlas of Climate Risk and Food Security in the Greater Horn of Africa Region*." ICPAC and the World Food [Programme (WFP) Atlas 2018, n.d. Online: www.icpak.net. Consulted in April 2021.
- IES. 2021. *The Cultural Atlas. Kenya*. Retrieved from: https://culturalatlas.sbs.com.au/ kenyan-culture/kenyan-culture-religion.
- IFC. 2007. *General EHS Guidelines: Environmental. Air Emissions and Ambien Air Quality*. 15 p. Online: https://www.ifc.org/wps/wcm/connect/4e01e089-ad1a-4986-b955-e19e1f305ff0/1-1%2BAir%2BEmissions%2Band%2BAmbient%2BAir%2BQuality.pdf?MOD=AJPERES&CVID=ls0KF2J. Consulted in May 2021.
- IFC. 2012. *Performance Standards*. On line: https://www.ifc.org/wps/wcm/connect/Topics_Ext_Content/IFC_External_Corporate_Site/Sustainability-At-IFC/Policies-Standards/Performance-Standards. Consulted in February 2021.
- IFC. 2019. *International Finance Corporation's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources*. International Finance Corporation. World Bank Group. Online: www.ifc.org/ps6
- IPCC - Intergovernmental Panel on Climate Change. 2006. *Non-Energy Products from Fuels and Solvent Use*. 18 p. On line: https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_5_Ch5_Non_Energy_Products.pdf. Consulted in May 2021.

- IPCC - Intergovernmental Panel on Climate Change. 2007. *CO_2 Emissions from Cement Production*. Written by GIBBS, M.J., Peter Soyka and David Conneely. 8 p. On line: https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/3_1_Cement_Production.pdf. Consulted in May 2021.
- IPCC – Intergovernmental Panel on Climate Change. 2012. *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change* [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 p.
- IPCC – Intergovernmental Panel on Climate Change. 2014. *Summary for policymakers.* In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.
- IPCC - Intergovernmental Panel on Climate Change. 2016. *Guidelines for National Greenhouse Gas Inventories. Chapter 3: Mobile Combustion.* 78p.
- IUCN. 2011. *Kenya Lakes System in the Great Rift Valley*, Kenya. 10 p.
- IUCN. 2021. *IUCN Red-List of Threatened species*. Online: https://www.iucnredlist.org/
- IUCN SSC Amphibian Specialist Group. 2016. *Mertensophryne lonnbergi. The IUCN Red List of Threatened Species* 2016: e.T54694A16949350. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T54694A16949350.en. Consulted July 2021.
- JOHN P.O. OBIERO et al. 2018. Kenya Climate. Research publication (Department of Environmental and Biosystems Engineering, University of Nairobi, P.O, Box 30197, Nairobi, Kenya (Department of Agricultural Engineering, Egerton University, P.O. Box 536, Njoro, Kenya, n.d.).
- KABUYE, C., Mwangoka, M., Ndangalasi, H., Kindeketa, W., Kalema, J., Minani, V., Kelbessa, E., Gereau, R.E., Luke, W.R.Q. & Malombe, I. 2020. *Euphorbia bussei. The IUCN Red List of Threatened Species* 2020: e.T179379A1576751. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T179379A1576751.en. Downloaded on 30 June 2021.
- KECI, E., PAPARISTO, A.; PEPA, B., 2012. *Data on biological assessment of water quality in Erzeni River using as bio-indicators different groups of benthic invertebrates*. International Journal of Ecosystems and Ecology Science (IJEES) 2012 Vol.2 No.3 pp.273-278
- KELLIHER, K.D. 2018. *We are the Big Six:' Maasai Perceptions and Organization of Cultural Tourism in Kenya* [M.A.]
- KELLY, M.G. & WHITTON, B.A. (1995). *The trophic diatom index: a new index for monitoring eutrophication in rivers.* Journal of Applied Phycology, 7: 433-444.
- KEMEI, R. K., J. W. Kaluli and C. K. Kabubo. 2015. *Assessment of Occupational Safety and Health in Construction Sites in Nairobi County, Kenya*. Paper presented to the Institution of Engineers of Kenya (IEK) Conference in 2015. 13 pages. Retrieved from: https://iekenya.org/forms/papers/IEK_CONF_2015_6.1_PAPER_KEMEI.pdf.
- KEMPER, N. (1999). R4: *Intermediate Habitat Integrity Assessment for Use in the Rapid and Intermediate Assessments*. Resource Directed Measures for Protection of Water Resources: River Ecosystems. Version 1.0. Department of Water Affairs and Forestry.
- KeNHA. 2018. Proposed Development, Operation and Maintenance of the Nairobi-Nakuru-Mau Summit (A8) Highway (PPP) Project – Resettlement Action Plan. 160 p.

- KeNHA. 2019a. *Consultancy Services for Development of Guidelines on Gender Mainstreaming: Report on Identification of Potential Gender Barriers, Gender Inequalities, Gaps and Entry Points for Gender Mainstreaming in Road Infrastructure*. Retrieved from: https://www.kenha.co.ke/Downloads/ESIA/REPORT_GENDER_BARRIERS.pdf.

- KeNHA. 2019b. *Tender Documents for the Mau Mau Road, Lots 1A, 1B, 2 and 3.* Retrieved from: https://www.kenha.co.ke/index.php?option=com_content&view=article&id=274&Itemid=

- KeNHA. 2020. *Geological Study, Feasibility Study, ESIA, Preliminary and Detailed Engineering of Suswa – Mai Mahiu (B7) Road Section* http://www.nema.go.ke/images/Docs/EIA_1730-1739/EIA_1739%20KeNHA%20ESIA%20SUSWA-MAI%20MAHIU_SR%201799-min.pdf

- KENYA INSTITUTE OF CURRICULUM DEVELOPMENT. 2021. *Curriculum Reform*. Retrieved from: https://kicd.ac.ke/curriculum-reform/

- KENYA METEOROLOGICAL DEPARTMENT (KMD). 2021. *State of the Climate – Kenya 2020.* 46 p.

- KENYA NATIONAL BUREAU OF STATISTIC (KNBS). *County Statistical Abstract: Nakuru County." Kenya National Bureau of Statistics, 2015 and County Statistical Abstract: Nyandarua County." Kenya National Bureau of Statistics, 2015.*

- KENYA NATIONAL BUREAU OF STATISTIC (KNBS). 2016. *Micro, small and medium establishment (MSME) survey: Basic report.* Kenya National Bureau of Statistics.

- KENYA NATIONAL BUREAU OF STATISTIC (KNBS). 2018. *Basic Report on Well-Being in Kenya. Based on the 2015-2016 Kenya Integrated Household Budget Survey (KIHBS).* Retrieved from: https://www.knbs.or.ke/?wpdmpro=basic-report-well-kenya-based-201516-kenya-integrated-household-budget-survey-kihbs

- KENYA NATIONAL BUREAU OF STATISTIC (KNBS). 2019. *Kenya Population and Housing Census. Volume IV: Distribution of Population by Socio-Economic Characteristics*. Kenya National Bureau of Statistics.

- KENYA ROAD BOARD (KRB). 2021. KRB Map Portal. Retrieved from: https://maps.krb.go.ke/kenya-roads-board12769/maps/.

- KENYA VISION 2030. 2021. *Economic and Macro Pillar*. Retrieved from: http://vision2030.go.ke/economic-pillar/#.

- KENYA WILDLIFE SERVICE (2021). Priority Ecosystems and Species. Accessed 29th June 2021. Online: http://www.kws.go.ke/content/priority-ecosystems-and-species

- KERERI, James O. 2019. *Construction Sector versus Labor Costs in Kenya: A Two Way Love Affair*. International Journal of Architecture, Engineering and Construction, vol.8, No. 2, June 2019, 54-61.

- KETRACO. 2021. *What is the difference between KETRACO,KPLC and KenGen?* Retrieved from: https://www.ketraco.co.ke/information-center/faqs/general#faq-What-is-the-difference-between-KETRACO,KPLC-and-KenGen

- KIMAIYO, T. J. 2004. *Ogiek Land Cases and Historical Injustices, 1902-2004*. Ogiek Welfare Council.

- KIMANI, K. & Pickard, J. (1998). *Recent Trends and Implications of Group Ranch Sub-Division and Fragmentation in Kajiado District, Kenya*. The Geographical Journal, 164(2), 202–213. https://doi.org/10.2307/3060370

- KINDT, R., van Breugel, P., Lillesø, J.-P.B., Bingham, M., Sebsebe Demissew, Dudley, C., Friis, I., Gachathi, F., Kalema, J., Mbago, F., Minani, V., Moshi, H.N., Mulumba, J., Namaganda, M., Ndangalasi, H.J., Ruffo, C.K., Jamnadass, R. and Graudal, L. 2011 *Potential natural vegetation of eastern Africa. Volume 2: Description and tree species composition for forest potential natural vegetation types*. Forest & Landscape Working Papers no. 62-2011.

- KINDT, R., van Breugel, P., Orwa, C., Lillesø, J.P.B., Jamnadass, R. and Graudal, L. 2015. *Useful tree species for Eastern Africa: a species selection tool based on the VECEA map*. Version 2.0. World Agroforestry Centre (ICRAF) and Forest & Landscape Denmark. //vegetationmap4africa.org.
- KIPURI, N. 2020. *Oral Literature of the Maasai*. East African Educational Publishers.
- KLEYNHANS, C.J. 1996. *A qualitative procedure for the assessment of the habitat integrity status of the Luvuvhu River (Limpopo system, South Africa).* Journal of Aquatic Ecosystem Health, 5: 41-54.
- KLEYNHANS, C.J. 2007. *Module D: Fish Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2*). Joint Water Research Commission and Department of Water Affairs and Forestry report, Pretoria, South Africa.
- KOBEI, D., Shatika Chivusia, S., Claridge, L., Ghai, J., Nkonge, C., Alden Wily, L., & Domínguez, L. (2020). *Defending Our Future: A Report on Implementing the Ogiek Judgment in Kenya* (p. 20). Katiba Institute & Ogiek Peoples' Development Program (OPDP). https://www.ogiekpeoples.org/images/downloads/Defending-our-future-Ogiek-Report.pdf
- KOEKEMOER & TAYLOR (in press): *Appendix J: Diatom assemblage and epilithon anaysis. In: Joint Maputo River Basin Water Resources Study – Moçambique, Swaziland and South Africa. Environmental Flow Requirements: Module A: Ecoclassification of 4 Environmental Flow Requirement Sites*. Specialist Appendices.
- KOISSABA, B. R. 201). *Effects of globalization in the Maasai Family*.
- KOISSABA, B. R. 2016. *A Critical Analysis of Factors that Contribute to Maasai Land Appropriation: The Case of Maasai Land Appropriation in Kajiado and Narok Counties in Kenya* [Ph.D.]. Clemson University.
- KOTTEK, M., J. GRIESER, C. BECK, B. RUDOLF, AND F. RUBEL 2006. *World Map of the Köppen-Geiger climate classification updated*. Meteorol. Z., 15, 259-263. DOI: 10.1127/0941-2948/2006/0130.
- KUMAR, P. (Ed.). (2010). TEEB-The Economics of Ecosystems and Biodiversity (TEEB): Ecological and Economic Foundations, Earthscan, London.
- KURIA, *et al*., *Chapter 8 - Groundwater Distribution and Aquifer Characteristics in Kenya): Developments in Earth Surface Processes, Elsevier*, Volume 16,2013,Pages 83-107,ISSN 0928-2025,ISBN 9780444595591,https://doi.org/10.1016/B978-0-444-595591.000086 https://www.sciencedirect.com/science/article/pii/B9780444595591000086
- LANGAT, D.K., Maranga, E. K., Aboud, A. A., & Cheboiwo, J. K. 2016. *Role of Forest Resources to Local Livelihoods: The Case of East Mau Forest Ecosystem, Kenya*. International Journal of Forestry Research, 2016, 1–10. https://doi.org/10.1155/2016/4537354
- LAVELL, A. ET AL. 201.: *Climate change: new dimensions in disaster risk, exposure, vulnerability, and resilience*. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)].
- LENS, L.; Muchai, M.; Bennun, L.; Duchateau, L. 2000. *How grassland fragmentation and change in land use affect Sharpe's Longclaw, Macronyx sharpei*, a Kenya highland endemic. *Ostrich* 71: 300-303.
- LEPAGE, D. 2021. *Checklist of the birds of Kenya*. Avibase, the world database.
- MAASAI ASSOCIATION. (n.d.). *Maasai People, Kenya. Maasai Association: Preserving and Celebrating Maasai Cultural Heritage.* Retrieved July 5, 2021, from http://maasai-association.org/maasai.html
- MACS (mid-atlantic coastal streams workgroup). 1996. *Standard operating procedures and technical basis: Macroinvertebrate collection and habitat assessment for low-gradient nontidal streams*. Delaware Department of Natural Resources and Environmental Conservation, Dover, DE.

- MAMO, D. (Ed.). 202). *The Indigenous World 2021*. The International Work Group for Indigenous Affairs (IWGIA). https://iwgia.org/doclink/iwgia-book-the-indigenous-world-2021-eng/eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.eyJzdWIiOiJpd2dpYS1ib29rLXRoZS1pbmRpZ2VubGVzLXdvcmxkLTIwMjEtZW5nIiwiaWF0IjoxNjE4OTE0NDcyLCJleHAiOjE2MTkwMDA4NzJ9.16jl03Uv-9UUBvvf4xV5yXkXCPlT46vbfKaGwvYvbv

- MANN, M., J. 1971. *Some taxonomical notes on the fish fauna of the Baringo area*. African Journal of Tropical Fish. 1(1); 25-34.

- MASESE, .O, M Muchiri, M. & Raburu, P.O. 2009. *Macroinvertebrate assemblages as biological indicators of water quality in the Moiben River, Kenya*. African Journal of Aquatic Science 2009, 34(1): 15–26.

- MCCALL GJH. 1967. *Geology of the Nakuru-Thomson's Falls Area (1:125,000). Report 78, Geological Survey of Kenya*, Nairobi, 143 p.

- MCCALL, G.J.H., 2007. *Geology and Ground Water Conditions in the Nakuru Area*. Ministry of Environment and Natural Resources, Mines and Geological Department, Technical Report No. 3.

- MCMILLAN, P.H. 1998. *An integrated habitat assessment system (IHAS v2) for the rapid biological assessment of rivers and streams.* A CSIR research project. Number ENV-P-I 98132 for the water resources management programme. CSIR.

- MCSWEENEY, C. M. New and G. Lizcano. 2010. *UNDP Climate Change Country Profile: Kenya*. Online: https://www.geog.ox.ac.uk/research/climate/projects/undp-cp/UNDP_reports/Kenya/Kenya.lowres.report.pdf. Consulted in April 2021

- MENDES, D.M, DE FREITAS LEÃOB, R. & TOLEDOA, L.F. 2015. *Drift fences in traps: theoretical evidence of effectiveness of the two most common arrays applied to terrestrial tetrapods*. Natureza & Conservação 13(2015): 60–66.

- MERETA, S.T., BOETS, P., MEESTER, L.D., GOETHALS, P.L.M., 2013. *Development of a multimetric index based on benthic macroinvertebrates for the assessment of natural wetlands in Southwest Ethiopia*. Ecol. Indicat. 29, 510e521.

- METEOBLUE. 2021. *Historical data of Kenya (Various cities*). Online: www.meteoblue.com. Consulted in April 2021.

- MICHELI, I. 2014a. *The Ogiek of Mariashoni, Nakuru District, Mau Forest Complex, Kenya*. A Sociolinguistic Report

- MICHELI, I. 2014b. *The Ogiek of the Mau Forest: Reasoning Between Identity and Survival*.

- MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY. 2015. *National Curriculum Policy*. Republic of Kenya, 33 pages. Retrieved from: https://kicd.ac.ke/wp-content/plugins/pdfjs-viewer-shortcode/pdfjs/web/viewer.php?file=https%3A%2F%2Fkicd.ac.ke%2Fwp-content%2Fuploads%2F2017%2F10%2Fnational-curriculum-policy.pdf&download=false&print=false&openfile=false

- MINISTRY OF WATER AND SANITATION. 2019; *Ground water occurrence in Kenya*. Online: http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Nairobi/kenya.pdf. Consulted on May 2021.

- MILLENNIUM ECOSYSTEM ASSESSMENT SERIES (MEA). 2005. Ecosystems and Human Well-being: Current State and Trends. Volume 1. Islandpress, London.

- MOLLEL, E.Y. 2011. *The Impact of Globalization on Maasai Culture with Special Focus on the Ilmuran Age-group* [Master]. University of Stavanger.

- MONDA, J.M. 2014. *Pyrethrum Sector in Kenya –Current Status*. http://projects.nri.org/options/images/Current_status_of_pyrethrum_sector_in_Kenya.pdf

- MTQ – Ministère des Transports, de la mobilité durable et de l'électrification des transports du Québec, Direction de la sécurité civile. 2018. *Synthèse des impacts appréhendés des changements climatiques sur les infrastructures de transports et les services du Ministère*. 38 p.
- MUELLER-DOMBOIS, D. & Ellenberg, H. 1974. *Aims and Methods of Vegetation Ecology*. Wiley, New York.
- MWANGI, E. 2007. *Subdividing the Commons: Distributional Conflict in the Transition from Collective to Individual Property Rights in Kenya's Maasailand*. World Development, 35(5), 815–834. https://doi.org/10.1016/j.worlddev.2006.09.012
- MWANGI, Matu Johnson. 2016. *Factors Influencing Performance of Contractors in the Road Construction Sector: Case of Selected Contractors in Kenya*. Master Thesis, University of Nairobi. 91 pages.
- MWENDWA, Edward, F.K. Lelo, S.T. Kariuki, A.A. Shitandi and Nemwel N. Aming'a. 2015. *Effect of Human Activities on the Ecosystem of Areas Surrounding Lake Elementaita, Naivasha Sub County, Kenya*. Journal of Scientific Research & Reports, 6(7): 523-531. 9 p.
- NAIROBI CITY WATER AND SEWERAGE COMPANY. 2021. Kikuyu Springs. On line: https://www.nairobiwater.co.ke/kikuyu-springs/. Consulted on August 2021.
- NATIONAL CONSTRUCTION AUTHORITY. 2014. *Construction Industry Survey – Capacity Status Report on Skills, Equipment, Materials and Financing*. 14 pages. Retrieved from: https://www.nca.go.ke/research/research-publications
- NDUNGU, Jane Njeri. 2014. *Assessing Water Quality in Lake Naivasha*. 174 p.
- NEMA, National Environment Management Authority. 2014. *The Environmental Management and Co-ordination (Air Quality) Regulations*, 2014. 99 p. Online: https://www.nema.go.ke/images/Docs/Regulations/air%20quality%20regulations2014-1.pdf. Consulted in May 2021.
- NEMA, National Environment Management Authority. 2011. Kenya State of the Environment and Outlook 2010. Supporting the Delivery of Vision. Online: http://www.enviropulse.org/documents/Kenya_SOE.pdf
- NEMA, National Environment Management Authority. (2009). Kenya National Environment Action Plan 2009 – 2013. National Environment Management Authority (NEMA), Nairob
- NICHOLSON, S.E. 1996. *A Review of Climate Dynamics and Climate Variability in Eastern Africa*. The limnology, climatology and paleoclimatology of the East African lakes, pp.25-56.
- NICOLLE, H., & Guillaume, M. (2017). *Youth Employment in Kenya: Literature Review*. British Council, Samuel Hall, UKAid.
- NORTHERN CORRIDOR TRANSIT AND TRANSPORT COORDINATION AUTHORITY. 2021. *Rail Network and The Northern Corridor Transport Network*. Retrieved from: http://www.ttcanc.org/index.php.
- NTHUSI, Victor, April 2017, *Nairobi Air Quality Monitoring Sensor Network Report*. Online: https://www.researchgate.net/publication/317256296_Nairobi_Air_Quality_Monitoring_Sensor_Network_Report_-_April_2017. Consulted in February 20201.
- OBIERO Et Al, John P.O. 2013. *The Climate of Kenya*. Research publication. Department of Environmental and Biosystems Engineering, University of Nairobi, P.O. Box 30197, Nairobi, Kenya Department of Agricultural Engineering, Egerton University, P.O. Box 536, Njoro, Kenya, n.d.
- OCHA – United Nations Office for the Coordination of Humanitarian Affairs. 2020. *Kenya: Floods and Landslides - Apr 2020*. Online: https://reliefweb.int/disaster/fl-2020-000128-ken Consulted in March 2021.

- OCDE. 2018. *Enhancing Connectivity through Transport Infrastructure: The Role of Official Development Finance and Private Investment*, The Development Dimension, Éditions OCDE, Paris, https://doi.org/10.1787/9789264304505-en.
- ODHIAMBO, G.O, A.M. Kinyua, C.K. Gatebe and J. Awange. 2010. *Motor Vehicles Air Pollution in Nairobi, Kenya*. Research Journal of Environmental and Earth Sciences. 2 (4): 178-187. 11 p.
- Ogada, D., and Keesing, F. 2010. Decline of raptors over a three-year period in Laikipia, central Kenya. *Journal of Raptor Research* 44: 129-135.
- OKECH, Emily. 2012. *Anthropogenic Influence on Surface and Ground Water Quality in Lake Nakuru Basin, Central Kenya Rift Valley*. 57 p.
- OLE SAITOTI, T. 1990. *Maasai*. Abradale Pres.
- OLOL-DAPASH, M. 2001. *Maasai Autonomy and Sovereignty in Kenya and Tanzania. Cultural Survival.* http://www.culturalsurvival.org/publications/cultural-survival-quarterly/maasai-autonomy-and-sovereignty-kenya-and-tanzania
- ONYWERE, S. M. 1997. *Structural analysis of the drainage basin of Kenyan rift valley lakes within the aberdare detachment, using satellite data, GIS and field observations, Kenyatta University;* 1997-03.http://ir-library.ku.ac.ke/handle/123456789/18254
- PARSITAU, D. 2017. *Engaging the Custodians of Tradition and Culture: : Leveraging the Role of Multiple Actors in Maasai Girls' Education.* Center for Universal Education at Brookings. https://www.brookings.edu/wp-content/uploads/2017/11/damaris-parsitau_final_20171101_web.pdf
- PARSITAU, D. 2019. *God in the Village: The Dynamics of Rural Pentecostalism and Development in Maasailand in Kenya.* In D. A. Forster, E. Gerle, & G. Gunner (Eds.), Freedom of Religion at Stake: Competing Claims among Faith Traditions, States, and Persons (pp. 88-). Wipf and Stock Publishers.
- PEDA.NET. “*Climate Change in Kenya*,” n.d.On line: Consulted in May 2021.https://peda.net/kenya/ass/subjects2/geography/ccik. Consulted on April 2021.
- PIANOSI, F., Beven, K., Freer, J., Hall, J.W., Rougier, J., Stephenson, D.B. & Wagener, T. 2016. Sensitivity analysis of environmental models: A systematic review with practical workflow. *Environmental Modelling & Software* 79: 214 – 232.
- POPE’ Francis D., Michael Gatari, David Ng’ang’a, Alexander Poynter and Rhiannon Blake. 2018. Airborne Particulate Matter Monitoring in Kenya Using Calibrated Low Cost Sensors. 30 p.
- RAINI, Jackson. 2006. *Assessment of Water Quality and Quantity of Lake Nakuru, Kenya*. 7 p.
- REGIONAL CENTRE FOR MAPPING OF RESOURCES FOR DEVELOPMENT (RCMRD). 2021. *The Rising Water Level and Expansion of the Rift Valley Lakes from Space*. Online: https://rcmrd.org/the-rising-water-level-and-expansion-of-the-rift-valley-lakes-from-space. Consulted in May 2021.
- RETA, G.L. (2011). *Groundwater and Lake water balance of Lake Naivasha USING 3-D Transiet ground water model*, University of Twente, Enschede. 65 p. On line: http://essay.utwente.nl/85007/1/reta.pdf. Consulted in June 2021.
- RICO, A., P. Kindlmann, F. Sedlacek, 2007. *Barrier effects of roads on movements of small mammals*. Folia Zool. – 56(1): 1–12
- ROSENBURG, D.N. & RESH, V.H. 1993. *Freshwater biomonitoring and benthic macroinvertebrates*. Chapman and Hall. New York, NY. In: Keçi, E., Paparisto, A. & Pepa, B. (2012). Preliminary Data of Biological Assessment of Water Quality in Erzeni River in Albania using Benthic Macroinvertebrates as Bio-indicators of Water Quality. Balwois General Administration, Ohrid, Republic of Macedonia.
- RIFT LAKES CONSERVANCIES ASSOCIATION (RLCA). 2016. *Rift Lakes Region Conservancies.* Online: https://kwcakenya.com/regional-associations/rift-lakes-conservancies-association/ Online: Consulted June 2021

- RYAN, K., Fitts, W., Muia, M., Johnson, N., & Lau, H. 2009. *Tracking East African Cattle Herders from Prehistory to the Present*. Expedition, 51(3), 27–36.
- SAGGERSON, E., 1991, *Geology of the Nairobi Area: Degree Sheet 51, N.E. Quarter: Nairobi, Kenya* Geological Survey, v. 98.
- SANG, J.K. 2001. *The Ogiek in Mau Forest. In From Principles to Practice: Indigenous Peoples and Protected Areas in Africa—Case Study 3: Forest Peoples Programme, Kenya* (pp. 111–138). Forest Peoples Programme. https://www.forestpeoples.org/sites/fpp/files/publication/2010/10/kenyaeng.pdf
- SENO, S.K., & Shaw, W. W. 2002. *Land Tenure Policies, Maasai Traditions, and Wildlife Conservation in Kenya.* Society & Natural Resources, 15(1), 79–88. https://doi.org/10.1080/089419202317174039
- SPEAR, T., & Waller, R. (Eds.). 1993. *Being Maasai: Ethnicity and Identity In East Africa*. Ohio University Press.
- STAFFEL. 2011, *The Energy and Fuel Datasheet*, University of Birmingham, UK.
- SETEC International. 2018. *PPP Competition Nairobi-Nakuru-Mau Summit Highway in Kenya – Traffic Study*. 173 p.
- SCHUMACHER, J.V., REDMOND, R.L., HART, M.M. & JENSEN, M.E. (2001). Mapping patterns of human use and potential resources conflicts on public lands. Pp 436 – 443. In: A guidebook for integrated ecological assessment. Eds: Jensen, M.E. & Bourgeron, P. S.. Springer verlag. ISBN 0-387-98583-2.
- SILVY, N.J., 2012. The Wildlife Techniques Manual – Research (Vol. 1). 7th edition. Nova J. Silvy, editor.. The Johns Hopkins University Press, Baltimore, MD, 686 pp.
- STEVENSON, T. & Fanshawe, J. 20220. *Birds of East Africa*. Second Edition. Christopher Helm, London. Consulted in July 2021.
- SPAWL, S., Howell, K., Hinkel, H., & Menegon, M. 2018. *Field guide to East African reptiles*. Bloomsbury Publishing, London. 624 pp.
- SSENTONGO, G.W., 1974. *On the fishes and fisheries of Lake Baringo*. African Journal of Tropical Hydrobiology and Fisheries, 3(1), pp.95-105.
- SEEGERS, L. 1997. *Killifishes of the world. Old World*. killis 1. A.C.S. Verlag. Morfelden-Walldorf, Germany. p. 39
- TALLE, A. 1988. *Women at a Loss: Changes in Maasai Pastoralism and Their Effects on Gender Relations*. Department of Social Anthropology, University of Stockholm.
- TAN. G.., B. AYUGI, H. NGOMA AND V. ONGOMA 2020: *Projections of future meteorological drought events under representative concentration pathways (RCPs) of CMIP5 over Kenya, East Africa*, Atmospheric Research, 246, 105112, https://doi.org/10.1016/j.atmosres.2020.105112.
- TAYLOR, J.C., DE LA REY, A. & VAN RENSBURG, L. 2005. *Recommendations for the collection, preparation and enumeration of diatoms from riverine habitats for water quality monitoring in South Africa*. African Journal of Aquatic Science, 30(1): 65–75.
- TAYLOR, J.C., HARDING, W.R. & ARCHIBALD, C.G.M. 2007. *An illustrated guide to some common diatom species from South Africa*. WRC Report No. TT 282/07. Water Research Commission, Pretoria, South Africa.
- THE WORLD BANK GROUP 2021. *Climate Change Knowledge Portal for Development Practitioners and Policy Makers*. Online: https://climateknowledgeportal.worldbank.org/ Consulted in March 2021.
- THOMPSON, A.O. and Dodson, R.G., 1963. *Geology of the Naivasha Area. Explanation of Degree Sheet 43, S.W. Quarter: Nairobi, Kenya.* Geological Survey, Report No. 55.

- TYLER, Stephanie. 2004. *"Family Motacillidae (Pipits and Wagtails)".* In del Hoyo, Josep; Elliott, Andrew; Christie, David (eds.). *Handbook of the Birds of the World*. Volume 9, Cotingas to Pipits and Wagtails. Barcelona: *Lynx Edicions*. pp. *689–743*. *ISBN* *84-87334-69-5*.

- UNEP – United Nations Environment Programme 2005. *Sensitivity, adaptability and vulnerability: GRID-Arenda*l. Retrieved October 7, 2020. Online: https://www.grida.no/resources/6893 Consulted in April 2021.

- UNESCO Institute for Satistics (UIS UNESCO). 2021. *Education and Literacy. Kenya*. Retrieved from: http://uis.unesco.org/en/country/ke.

- UN-Habitat and Cities Alliance Joint Work Programme. 2020. *Equitable Economic Growth in Cities. Venture Strategy and Structure. Magumu Wholesale Market and Logistics Centre, Nyandarua County, Kenya*. United Nations Human Settlements Programme, Nairobi. Retrieved from: https://www.citiesalliance.org/sites/default/files/2020-11/Nyandarua%20County%20Magumu%20Market%20Venture%20Strategy%20and%20Structure%20-.pdf.

- UNITED NATION HIGH COMMISSIONER FOR HUMAN RIGHTS (UNHCHR). 2008. *Report from OHCHR Fact-finding Mission to Kenya, 6-28 February 2008*. Retrieved from: https://www.ohchr.org/documents/press/oHCHRKenyareport.pdf

- UNIVERSITY OF PENNSYLVANIA. *East Africa Living Encyclopedia – Kenya Religion*. African Studies Center. Retrieved from: https://www.africa.upenn.edu/NEH/kreligion.htm

- UPSEIS, 2021. "*Modified Mercalli Intensity Scale*" http://www.geo.mtu.edu/UPSeis/Mercalli.html. Accessed 24 March 2021.

- U.S. DEPARTEMENT OF STATE, 2007. *Horn of Africa Natural Hazard Probability and Risk Analysis.* US Department of State - Humanitarian Information Unit. Downloaded from https://reliefweb.int/report/djibouti/horn-africa-natural-hazard-probability-and-risk-analysis, 24 March 2021.

- U.S. ENVIRONMENTAL PROTECTION AGENCY. 2010. *Exhaust and Crankcase Emission Factors for Nonroad Engineering Modeling--Compression-Ignition, Report No. NR-009d,* EPA-420-R-10-018,

- U.S. ENVIRONMENTAL PROTECTION AGENCY. 2016. *Greenhouse Gas Inventory Guidance.* Online: *https://www.epa.gov/sites/production/files/2016-03/documents/stationaryemissions_3_2016.pdf*. Consulted on March 2021.

- U.S. ENVIRONMENTAL PROTECTION AGENCY. 2020. *MOVES3 Technical Guidance,* EPA-420-B-20-052. Online: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010LY2.pdf. Consulted on March 2021.

- UCN SSC Amphibian Specialist Group. 2016b. *Phrynobatrachus kinangopensis*. *The IUCN Red List of Threatened Species* 2016: e.T58121A17168074. https://dx.doi.org/10.2305/IUCN.UK.2016-1.RLTS.T58121A17168074.en. Consulted July 2021.

- VAN BREUGEL, P., Kindt, R., Lillesø, J. P. B., & Graudal, L. 2015a. *An alternative simplified version of the VECEA potential natural vegetation map for eastern Africa.*

- VAN Breugel, P., Kindt, R., Lillesø, J.P.B. and van Breugel, M. 2015b. *Environmental Gap Analysis to Prioritize Conservation Efforts in Eastern Africa*. *PLoS ONE 10(4): e0121444. doi:10.1371/journal.pone.0121444*.

- VAN DER REE, R., Smith, D. J., & Grilo, C. (2015). Handbook of road ecology. John Wiley & Sons.

- VAN DAM, H., Mertens, A. & Sinkeldam, J. 1994. *A coded checklist and ecological indicator values of freshwater diatoms from the Netherlands*. Netherlands Journal of Aquatic Ecology, 28: 133-177.

- VAN OEL, PR, Odongo VO, Mulatu DW, Muthoni FK, Ndungu JN, Ogada JO and van der Veen A. 2014. *Supporting IWRM through spatial integrated assessment in the Lake Naivasha basin, Kenya, International Journal of Water Resources Development,* Vol. 30, No. 3, pp. 605-618.

- VAN Oijen, M.J.P., 1995. Appendix I. *Key to Lake Victoria fishes other than haplochromine cichlids.* p. 209-300. In F. Witte and W.L.T. van Densen (eds.) Fish stocks and fisheries of Lake Victoria. A handbook for field observations. Samara Publishing Limited, Dyfed, Great Britain.
- VAN VUUREN, D.P., J. EDMONDS, M. KAINUMA, K. RIAHI, A. THOMSON, K. HIBBARD AND T. MASUI. 2011. *The representative concentration pathways: an overview*. Climatic Change, 109(1-2): 5-31.
- WAMITI W. et al., 2020. *Kenya's first countrywide census of Grey Crowned Crane. Balearica regulorum,* February–March 2019. – The Bulletin of the African Bird Club. Vol 27 No 2 (2020)
- WATER RESOURCES AUTHORITY (WRA). 2018*: Guidelines for the Development of Water Allocation Plans in Kenya (draft). Prep. by: Rural Focus Ltd, Nairobi, November 2018.*
- WATER RESOURCES AUTHORITY (WRA). 2018. *Kenya Water Security and Climate Resilience Project; RIFT VALLEY BASIN PLAN.* Water Resources Management Authority (WRMA). *Sectoral report; The Development National Water Master Plan 2030,* Nairobi https://openjicareport.jica.go.jp/pdf/12146395_02.pdf
- WATER RESOURCES MANAGEMENT AUTHORITY (WRMA). 2010. *Groundwater Conservation Area -Naivasha Basin*, Nairobi, September 2010.
- WERGER, M.J.A. 1974. *On concepts and techniques applied in the Zurich-Montpellier method of vegetation survey*. Bothalia 11: 309-323.
- WHITE, F. 1983. *The vegetation of Africa*. UNESCO/AETFAT/UNSO, Paris.
- WHITEHEAD, P.J.P., 1959. The River Fisheries of Kenya I—Nyanza Province. The East African Agricultural Journal, 24(4), pp.274-278.
- WIJNGAARDEN, V. 2012. '*The Lion Has Become a Cow': The Maasai Hunting Paradox*. In W. E. A. van Beek & A. M. Schmidt (Eds.), African Hosts & Their Guests: Cultural Dynamics of Tourism (pp. 176–200). Boydell & Brewer Ltd.
- WILDLIFE CONSERVATION MANAGEMENT ACT 2013: *Kenya Wildlife Service*. http://www.kws.go.ke/downloads. July 2021.
- WORKU, A., 2014. *The status of basic design ground motion provisions in seismic design codes of sub-Saharan African countries, A critical review.* Journal of the South African Institution of Civil Engineering, Vol 56 No 1, April 2014, Pages 40–53, Paper 977.
- WORLDATLAS. *Ramsar Wetland of Kenya*. Online: https://www.worldatlas.com/articles/ramsar-wetlands-of-kenya.html. Consulted in May 2021.
- WORLD BANK. 2014. *Implementation Completion and Results Report (IDA-42770 TF-93520) on a Credit in the Amount of SDR 46.0 Million (US$ 68.5 Million Equivalent) to the Republic of Kenya for a Natural Resource Management Project*. Online: https://documents1.worldbank.org/curated/en/258721468276386585/pdf/ICR000028370IC0Box0385294B00PUBLIC0.pdf . Consulted in May 2021.
- WORLD BANK. 2021. World Development Indicators, Popular Indicators. Kenya and Poverty headcount ratio at national poverty lines (% of population). Retrieved from: https://databank.worldbank.org/indicator/SI.POV.NAHC/1ff4a498/Popular-Indicators.
- WORLD EDUCATION NEWS AND REVIEWS (WENR). 2015. Education in Kenya. Retrieved from: https://wenr.wes.org/2015/06/education-kenya.
- WORLD HEALTH ORGANISATION. 2010. *Kenya: Flood Hazard Distribution Map*. Online: https://www.humanitarianlibrary.org/sites/default/files/2013/08/ken-flood.pdf. Consulted in May 2021.

- WORLD CONSERVATION MONITORING CENTRE. 1998. *Prunus africana*. *The IUCN Red List of Threatened Species* 1998:e.T33631A9799059. https://dx.doi.org/10.2305/IUCN.UK.1998.RLTS.T33631A9799059.en. Downloaded on 30 June 2021.
- WSP. 2019. Mission Report of June – July Field Visit. Technical Note. 14 pages.
- WSP. 2019. Review of Pedestriand and Cattle Crossing Designs and Locations. Technical Note. 16 pages.
- WSP. 2019. Street Lighting. Technical Note. 9 pages.
- YIHDEGO, Yohannes, Robert Becht, *Simulation of lake–aquifer interaction at Lake Naivasha, Kenya using a three-dimensional flow model with the high conductivity technique and a DEM with bathymetry*,*Journal of Hydrology*,Volume 503,2013,Pages 111-122,ISSN 0022-1694, Online: https://doi.org/10.1016/j.jhydrol.2013.08.034.(https://www.sciencedirect.com/science/article/pii/S0022169413006215). Consulted in May 2021.
- ZOCCHI, D.M., Volpato, G., Chalo, D., Mutiso, P., & Fontefrancesco, M. F. (2020). *Expanding the reach: Ethnobotanical knowledge and technological intensification in beekeeping among the Ogiek of the Mau Forest, Kenya*. Journal of Ethnobiology and Ethnomedicine, 16(1), 57. https://doi.org/10.1186/s13002-020-00409-w