ZESCO

# ZAMBIA-TANZANIA INTERCONNECTOR PROJECT

## ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT UPDATE

### ZAMBIA

WSP REFERENCE: CA0027197.7329
30 AUGUST 2024

VOLUME 1 – MAIN REPORT
PRELIMINARY VERSION 2

ZESCO

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# SIGNATURES

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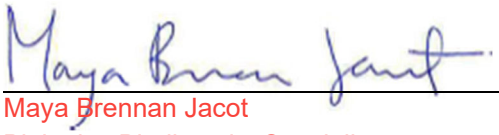

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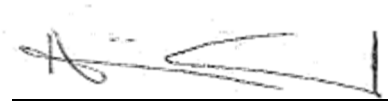

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## REFERENCE TO BE CITED

WSP. 2024. Zambia-Tanzania Interconnector Project, Environmental and Social Impact Assessment Update, Zambia. Report produced for Zesco. WSP Reference: CA0027197.7329. Multiple pages and appendices.

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AFDB: | African Development Bank |
| AIDS: | Acquired Immune Deficiency Syndrome |
| ALARA: | As Low as Reasonably Achievable |
| BESA: | Biodiversity Extended Study Area |
| BMP: | Biodiversity Management Plan |
| CBD: | Convention on Biological Diversity |
| CBNRM: | Community Based Natural Resource Management |
| CEDAW: | Convention on the Elimination of all Forms of Discrimination Against Women |
| CEEC: | Citizens Economic Empowerment Commission |
| C-ESMP: | Contractor's Environmental and Social Management Plan |
| CIGZambia: | Cities and Infrastructure for Growth Zambia |
| CITES: | Convention on International Trade in Endangered Species of Wild Fauna and Flora |
| CMS: | Convention on the Conservation of Migratory Species of Wild Animals |
| CoC: | Code of Conduct |
| COMESA: | Common Market for Eastern and Southern Africa |
| DOPE: | Development of People's Empowerment |
| DPNW: | Department of National Parks and Wildlife |
| EAPP: | Eastern Africa Power Pool |
| EHS: | Environment, Health and Safety |
| EHSGs: | Environmental, Health and Safety Guidelines |
| EIAs: | Environmental Impact Assessments |
| EIS: | Environmental Impact Statement |
| EMA: | Environmental Management Act |
| EMF: | Exposure to Electromagnetic Fields |
| EPPCA: | Environmental Pollution Prevention and Control Act |
| ERB: | Energy Regulation Board |

| | |
|---|---|
| ESCP: | Environmental and Social Commitment Plan |
| ESF: | Environmental and Social Framework |
| ESHS: | Environmental, Social, Health and Safety |
| ESIA: | Environmental and Social Impact Assessment |
| ESMP: | Environmental and Social Management Plan |
| ESS: | Environmental and Social Standards |
| EU: | European Union |
| FCDO: | UK Foreign, Commonwealth and Development Office |
| GBIF: | Global Biodiversity Information Facility |
| GBV: | Gender Based Violence |
| GIIP: | Good International Industry Practice |
| GISD: | Global Invasive Species Database |
| GMAs: | Game Management Areas |
| GRC: | Grievance Redress Committee |
| GRM: | Grievance Redress Mechanism |
| HIV: | Human Immunodeficiency Virus |
| IAS: | Invasive Alien Species |
| IBA: | Important Bird Area |
| ICNIRP: | International Commission on Non-Ionizing Radiation Protection |
| IFC: | International Finance Corporation |
| ILO: | International Labor Organization |
| IPPs: | Independent Power Producers |
| IRP: | Zambia's first Integrated Resources Plan |
| KPs: | Kilometer Posts |
| LMNP: | Lavushi Manda National Park |
| LSA: | Local Study Area |
| MDGs: | Millennium Development Goals |
| MGEE: | Ministry of Green Economy and Environment |
| MoE: | Ministry of Energy |

| | |
|---|---|
| MoH: | Ministry of Health |
| MTENR: | Ministry of Tourism, Environment and Natural Resources |
| MWDS: | Ministry of Water Development and Sanitation |
| NBI/NELSAP: | Nile Basin Initiative / Nile Equatorial Lakes Subsidiary Action Program |
| NEAP: | National Environmental Action Plan |
| NF: | Luitikila National Forest |
| NGOs/CBOs: | Non-Governmental Organizations |
| NGP: | National Gender Policy |
| NHCC: | National Heritage Conservation Commission |
| NLACW: | National Legal Aid Clinic for Women |
| NMG: | National Museums Board |
| NPCC: | National Policy on Climate Change |
| NPE: | National Policy on Environment |
| OHS: | Occupational Health and Safety |
| PAPs: | Project Affected Persons |
| PSEA: | Protection from Sexual Exploitation and Abuse |
| RAP: | Resettlement Action Plan |
| RCAP: | Resettlement and Compensation Action Plan |
| REA: | Zambia Rural Electrification Authority |
| ROW: | Right of Way |
| SADC: | Southern African Development Community |
| SAPP: | Southern African Power Pool |
| SBDs: | Standard Bidding Documents |
| SEA: | Sexual Exploitation Abused |
| SEP: | Stakeholder Engagement Plan |
| SESA: | Social Extended Study Area |
| SH: | Sexual Harassment |
| SOP: | Scope of Project |
| SPDs: | Standard Procurement Documents |

| | |
|---|---|
| SSF: | Social Safeguard Framework |
| SSPs: | Shared Socioeconomic Pathways |
| STDs: | Sexually Transmitted Diseases |
| STIs: | Sexually Transmitted Infections |
| TANESCO: | Tanzania Electric Supply Company Limited |
| TAs: | Traditional Authorities |
| ToRs: | Terms of Reference |
| UNESCO: | United Nations Educational, Scientific and Cultural Organization |
| UNFCCC: | United Nations Framework Convention on Climate Change |
| VCT: | Voluntary Counseling and Testing |
| VESCs: | Valorized Environmental and Social Components |
| VSU: | Victim Support Unit |
| WBG: | World Bank Group |
| WECSZ: | Wildlife and Environment Conservation Society of Zambia |
| WHO: | World Health Organization |
| WARMA: | Water Resources Management Authority |
| WWF: | World Wildlife Fund |
| ZAWA: | Zambia Wildlife Authority |
| ZDA: | Zambia Development Agency |
| ZDHS: | Zambia Demographic and Health Survey |
| ZEMA: | Zambia Environmental Management Agency |
| ZESCO: | ZESCO Limited |
| ZFAP: | Zambia Forestry Action Plan |
| ZTIP: | Zambia-Tanzania Interconnector Project |
| ZTK: | Zambia-Tanzania-Kenya |

# EXECUTIVE SUMMARY

## INTRODUCTION

Abundant, diverse energy resources in Southern and Eastern Africa underpin significant potential benefits from regional energy sector integration. The growing need to address national electricity supply and demand imbalances, in the most cost-effective manner, boosted interest in cross-border electricity trade and resulted in the establishment of the Southern African Power Pool (SAPP) in 1995, and the Eastern African Power Pool (EAPP) in 2005, under the umbrellas of South African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA), respectively.

The objectives of the SAPP and EAPP are to coordinate power pool operations and implement regional power trade. Increasing interconnections among the EAPP countries and the link to SAPP will create a large subcontinental market that could pave the way for greater regional integration in other sectors. While there are a few possible corridors for interconnecting SAPP and EAPP, the most advanced one is connecting Zambia-Tanzania-Kenya (also called "ZTK"). The link between Zambia and Tanzania (or Zambia-Tanzania Interconnector Project, or ZTIP) remains the last section to enable the SAPP and EAPP to be interconnected. Doing so will lead towards market expansion for participating countries, improvement in their energy security, facilitate the diversification of energy sources, enable the sharing of generation reserves, and optimize the cost of electricity supply through trade, both regionally and for participating countries such as Zambia, specifically.

ZESCO, as an intended implementing agency for the SOP2 Project, has started preparation of the Project and is supported by Cities and Infrastructure for Growth Zambia (CIGZambia) and the World Bank to finalize project planning with associated required technical, environmental and social studies. The World Bank has agreed in principle to provide the majority of the financing for the Project, with a budgetary estimate of $280M including associated project management and capacity building costs. The Project is likely to be co-financed with smaller contributions from EU and UK Government through FCDO.

## PROJECT DESCRIPTION

The Zambia-Tanzania Interconnector Project (ZTIP) has evolved considerably since its initiation in late 2013. The design of the ZTIP Project involves optimization directly aligned with the avoidance and reduction of associated impacts in combining the ZTIP alignment with existing transmission line (in between Pensulo and Kasama) or in combining two single circuit lines in a single wayleave and mounted on the same pylons (combined with the Kasama-Nakonde single circuit 330kV line). The ZTIP main components are now:

- The Kasama-Nakonde section which consists of:
  - 212 km of a 330kV double-circuit transmission line from Kasama to Nakonde ;
  - A new 330/132/66kV substation at Nakonde (including dynamic voltage support device [±250 MVAr SVC or STATCOM);
  - 15 km of a 400kV double-circuit transmission line from Nakonde to the Zambia – Tanzania border, operated at 330kV;
  - 12 km of a 132kV double circuit from Nakonde to cut into the Isoka-Nakonde line (loop in and out of 66kV Isoka - Nakonde line).

- The Pensulo-Kasama section which consists of:
  - 386 km of a 330kV single-circuit transmission line between the Pensulo and Kasama Substations, via the Mpika Substation; this line will be more or less parallel to an existing 330kV single-circuit transmission line (Pensulo to Mpika 186 km and Mpika to Kasama 200 km);
  - Expansion works on the existing substations at Pensulo, Mpika and Kasama;
  - Installation of Dynamic Voltage Support Device (±250 MVAr SVC or STATCOM) and associated substation works at Pensulo Substation.

The configurations above have been confirmed by ZESCO and are presented in detail in the Project's Final Design Documents.

Pylon heights will vary in function of voltage level and technical requirements caused by local constraints such as topography, line spans, crossings of infrastructure, etc. Tower heights will range from 18m (minimal tower height for the 132kV line) to 60.8m (maximum height for the 400kV line).

Width of the right-of way had to be determined to satisfy minimum technical requirements and comply with the standards by the Energy Regulation Board (ERB) Wayleave Code of Practice standards which ZESCO uses. ROW will vary according to the voltage level. However, width of the acquired wayleave varies along the alignment, depending on whether the project is paired with another ZESCO wayleave or not. The additional wayleaves required can be summarized as follows:

- 60 m for the double-circuit 400kV line between Nakonde and the Tanzanian border ;
- 50 m when the new 330kV line wayleave is not paired with another existing wayleave ;
- 35 m for 330kV line segments paired with the existing 330kV line present between Pensulo and Kasama ;
- 32 m for the 132kV between the Nakonde substation and linking to the 66kV Isoka-Nakonde line.

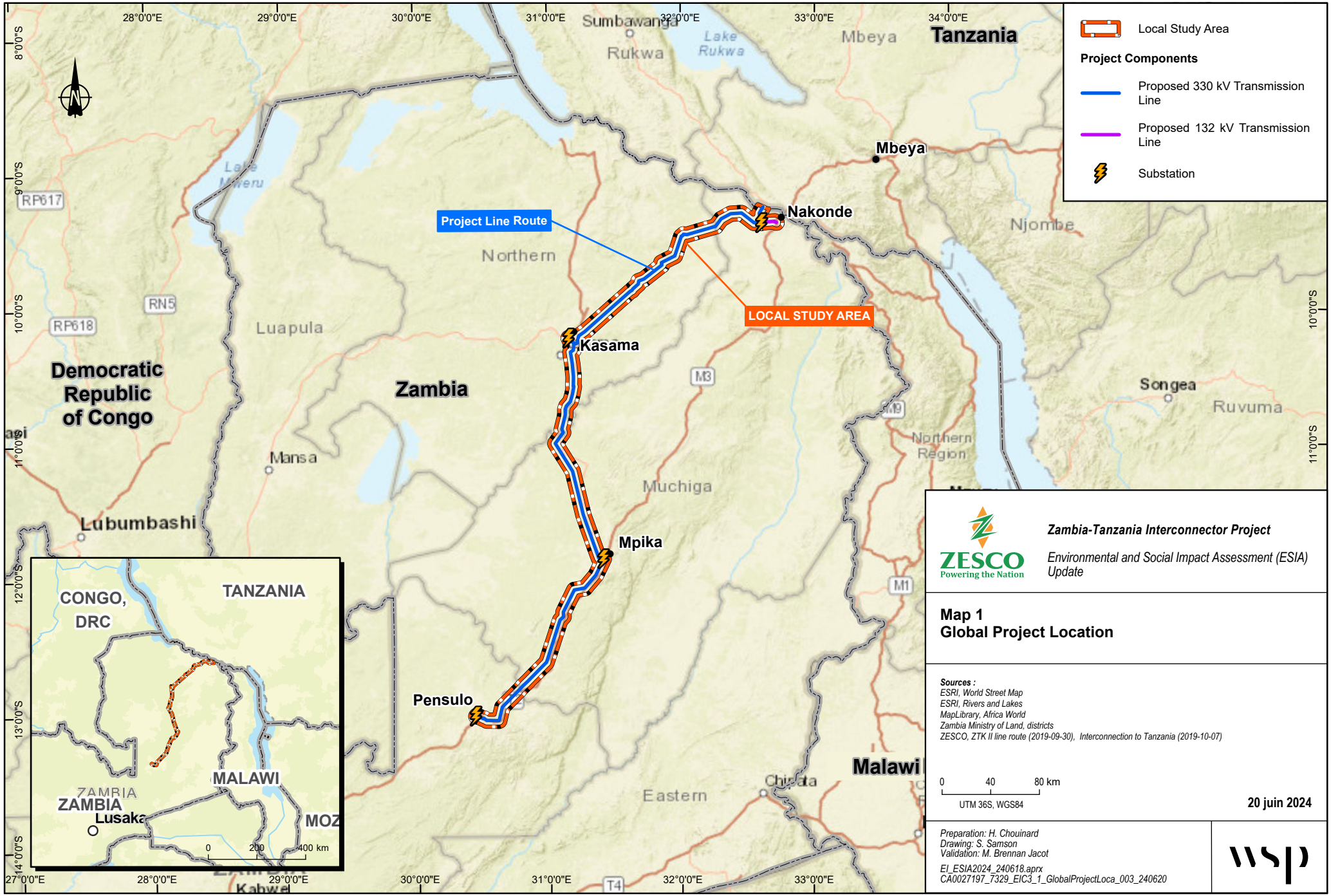
## LOCATION

The transmission line will stretch between the Tanzanian border to Pensulo, crossing Serenje, Chitambo, Lavushimanda, Mpika, Kanchibiya, Kasama, Mungwi, Senga Hill and lastly Nakonde districts.

Global Project location is illustrated on the Map below.

## INVESTMENT COST

The budgetary estimate for the Project is USD 285M, including associated project management and capacity building costs. As for implementation schedule, activities starting from the start-up meeting of the construction contract to commissioning, are planned to require 24 months. Field construction activities are planned to begin at month 7, and therefore it will last 17 months.




ZESCO Powering the Nation

*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

## Map 1
## Global Project Location

***Sources :***
*ESRI, World Street Map*
*ESRI, Rivers and Lakes*
*MapLibrary, Africa World*
*Zambia Ministry of Land, districts*
*ZESCO, ZTK II line route (2019-09-30), Interconnection to Tanzania (2019-10-07)*

0 40 80 km
UTM 36S, WGS84

**20 juin 2024**

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*CA0027197_7329_EIC3_1_GlobalProjectLoca_003_240620*

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*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.*

## REPORT OBJECTIVES AND CONTENT

All project ZTIP components are covered by a valid Decision letter by ZEMA. The completion of an updated Environmental and Social Impact Assessment and Environmental and Social Management Plan that meets the Zambian and World Banks requirements is the main pre-condition for the submission to the Board of the World Bank for the funding of the ZTIP. A full update of these documents will be completed to meet the requirements of the Zambian standards (primarily set by the Zambian Environmental Management Agency (ZEMA)) and the most recent applicable World Bank Environmental and Social Standards (ESS) and associated environment, health and safety (EHS) guidelines (general and Electric Power Transmission and Distribution). The current ESIA integrates findings and results from both the previous ESIA associated with the ZTIP and the ESIA associated with the Kasama-Nakonde 330kV line.

The main objectives of the ESIA are to:

- Identify key Project environmental and social impacts;
- Guide the development of an Environmental and Social Management Plan (ESMP) that will outline measures to avoid, reduce or compensate adverse impacts, enhance positive Project impacts, and provide mechanisms for their implementation.

## STAKEHOLDER ENGAGEMENT

The various environmental and social studies completed for the ZTIP have been supported by a robust stakeholder engagement strategy. General stakeholder engagement objectives were to:

- Ensure prior and informed consultation of stakeholders at key stages of the ESIA and RAP, to improve results and increase the credibility of the process;
- Enable stakeholders' views to be taken into account in project design and environmental and social management strategies;
- Promote effective, accessible and inclusive engagement activities with affected stakeholders throughout the project cycle on issues that could affect them;
- Ensure that appropriate project information, including on environmental and social risks and impacts, is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format;
- Ensure compliance with national and international requirements, including those stipulated by the world bank's environmental and social framework and relevant standards, on stakeholder information and consultation during ESIA and RAP studies for major development Projects;
- Ensure that the ESIA helps to consolidate efforts made by ZESCO to establish lasting relationships with affected communities and other stakeholders.

The approach for stakeholder engagement during project preparation, construction, and operation, based on ZESCO's SEP, includes activities to be conducted throughout the project lifespan in terms of information disclosure and communication.

Results from the stakeholder engagement activities have been considered in the identification and optimisation of the most optimal line route alignment as well as in the impacts identification and development of associated environmental and social management strategy.

## MAJOR POTENTIAL IMPACTS THAT MAY ARISE FROM THE PROPOSED PROJECT, BOTH POSITIVE AND NEGATIVE

### *Negative Impacts*

Impacts on the physical environment during construction and operation are minor and may include temporary air quality deterioration and increased noise levels due to dust and machinery. Risks of pollutions to soil and water are minor.

Although the Project is set in a largely modified landscape there are scattered areas of natural habitat. The main impact on the biological environment will be the permanent loss of 307.5 ha of natural habitat found within the wayleave, which include secondary and mature woodland, as well as riverine forest. The mitigation strategy involves a compensation plan to ensure no net loss of natural habitat. Furthermore, two flora species triggering critical habitat may potentially be affected by the Project: *Disa aequiloba*, an Endangered species growing in well-preserved wetlands, and *Euphorbia perplexa var. kasamana,* a restricted range species known from rock outcrops in the Kasama Forest Reserve. As both species are short or low-lying, with the application of appropriate mitigation measures, their presence within the right-of-way can be protected and maintained during construction and operation of the line and the residual impacts on these species should not be significant. Seven forest reserves are crossed by the transmission line, they include Kanona (30.7 km), Amenshi (0.3 km), Chitimukulu (3.2 km), Mungwi (0.4 km), Nkole Mfumu (4.4 km), Kasama (2.9 km) and Nakonde (1.4 km) Forest Reserves. Some of these forest reserves have been degraded from human activities and infrastructure to varying degrees. Natural habitat to be cleared in these Forest Reserves is as follows: Kanona (63.9 ha), Amenshi (0 ha), Chitimukulu (6.8 ha), Mungwi (0.7 ha), Nkole Mfumu (20.4 ha), Kasama (9.1 ha) and Nakonde (0 ha). These more natural forests constitute disjunct patches interlaced with agricultural areas and other degraded woodland. Other potential impacts that may occur during operation and maintenance works include potential increase in bird and bat fatalities through collisions or electrocution, as well as modification and alteration of wildlife habitats and potential introduction of invasive plant species under the wayleave. A Biodiversity Management Plan (BMP) has been developed to adequately apply the mitigation hierarchy and develop mitigation and compensation measures to manage the impacts on biodiversity, including natural and critical habitat.

The most significant impact on the human environment will be the relocation of households and other assets located within the wayleave. The number of houses located within the wayleave for the Kasama-Nakonde section was of 647. These have already been compensated by ZESCO. Few additional houses may have been built within the wayleave since the cut-off date. In the Pensulo-Kasama section, the transmission line will be parallel to the existing 330 kV, further reducing the number of affected households. A number of 87 structures have been identified within the additional wayleave required for this section, based on satellite imagery interpretation. Other impacts include the loss or disturbance of arable land due to vegetation clearing in the wayleave, loss of fruit trees and timber trees, land use restrictions in the wayleave due to specific wayleave management requirements, potential damage to crops by machinery during wayleave maintenance. The Project may also impact cultural heritage. Impacts can include disturbance or destruction or archaeological sites and objects, including within the Mwela Rock Art site, or of burial and sacred sites.

Other social risks could arise. The Project may increase gender imbalances and particularly risks of gender-based violence, including sexual abuse by construction workers, unwanted pregnancies among young girls and child labour. Project implementation could affect community health and security due to risks of increased traffic within communities' areas and incidences of HIV/AIDS transmission from job seekers and workers.

### *Positive Impacts*

The new transmission line may also lead to positive impacts for neighbouring communities such as temporary employment and business opportunities during the construction phase, including revenues from the sale of food and other consumable goods to workers. Positive impacts also include regional economic development, improved access to electricity leading to better agricultural infrastructure, increased development, and improvement of education and health systems.

## ENVIRONMENTAL AND SOCIAL MANAGEMENT STRATEGY TO MANAGE NEGATIVE AND POSITIVE IMPACTS IDENTIFIED

The environmental and social management strategy associated with the ZTIP is aligned with the mitigation hierarchy. Optimal project alternatives for each line route section have been selected, avoiding and reducing anticipated environmental and social impacts. Indeed, the ZTIP is planned to use the corridor earlier earmarked for the single circuit Kasama-Nakonde 330kV line and shares part of its wayleave with the existing Pensulo-Kasama 330kV line, reducing the required additional land take.

The environmental and social management strategy for the implementation of the ZTIP is also based on the development of ZESCO's Safety, Health, Environment & Quality (SHEQ) Management System incorporating :

- Safety, Health, Environment & Quality policy.
- Identification of risks and impacts.
- Various specific management plans covering notably the following : biodiversity, cultural heritage, community health and safety, occupational health and safety, emergency preparedness and response, residual material and hazardous products, pollution prevention and gender based violence.
- Resettlement Action Plan for the Pensulo-Kasama section.
- Resettlement and Compensation Action Plan for the Kasama-Nakonde section.
- Detailed management measures for all project phases.
- Stakeholder Engagement Plan.
- Community and Worker Grievance Mechanism.
- Environmental and social performance monitoring.

This system is aligned with mitigation hierarchy and will allow to assess risks and impacts and to manage them in compliance with national and World Bank requirements.

During pre-construction and construction phase, the Contractors will be responsible to implement most of the proposed management plans and measures and also to monitor environmental and social performance.

To reduce the negative effects of anticipated impacts, an Environmental and Social Management Plan (ESMP) was developed as a stand-alone document, presenting mitigation measures to be applied as part of this project during the preconstruction, construction and operation phases. The ESMP also contains specific management plans, institutional arrangements for its implementation, as well as an environmental and social monitoring program. Additionally, it assesses institutional capacity and identifies training needs to make sure institutions in charge of implementing the ESMP have sufficient organizational capacities. Estimated costs for ESMP implementation during the pre-construction and construction phase include a lump sum of 1,660,000 USD as well as yearly costs of 360,000 USD (those yearly costs will be incurred during the expected 12 months of preconstruction as well as 27 months of construction). Estimated costs during the operation phase include a lump sum of 630,000 USD as well as yearly costs of 252,000 USD.

### *Environmental and Social Risk Classification*

Based on the key environmental and social risks identified in the impact assessment and the mitigation measures detailed in the ESMP, the ZTIP can be classified as High Risk, since potential impacts on sensitive environmental and social components, including critical habitat and site of importance for cultural heritage, have been identified. As part of the World Bank Environmental and Social Framework (ESF), the environmental and social risk classification is done by the World Bank and updated regularly throughout the Project cycle.

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# 1 INTRODUCTION

## 1.1 REGIONAL BACKGROUND

Regional integration plays a vital role in Southern and Eastern Africa's economic growth and ability to weather economic downturns, and remains a political priority in both Southern and Eastern Africa, where the regional integration agenda has been driven by several regional economic cooperation and trade initiatives and blocs established since the 1990s. Abundant, diverse energy resources in Southern and Eastern Africa underpin significant potential benefits from regional energy sector integration. The growing need to address national electricity supply and demand imbalances, in the most cost-effective manner, boosted interest in cross-border electricity trade and resulted in the establishment of the Southern African Power Pool (SAPP) in 1995, and the Eastern African Power Pool (EAPP) in 2005, under the umbrellas of Southern African Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA), respectively.

The objectives of the SAPP and EAPP are to coordinate power pool operations and implement regional power trade. The SAPP is now the most advanced power pool on the continent and its role aligns with the SADC 1996 Protocol on Energy, which acts as a policy framework for effective use and development of energy in the region. The EAPP on the other hand, compared to SAPP, is nascent in its development but is making rapid advances to interconnect and reap the benefits of stronger regional integration. Increasing interconnections among the EAPP countries and the link to SAPP will create a large subcontinental market that could pave the way for greater regional integration in other sectors. With the planned interconnection of the EAPP and SAPP, both power pools are working on the harmonization of rules and procedures to enable mutually beneficial trade across the potentially largest interconnected geography in the world. Increased power trade between countries will work to deepen regional integration and build trust among countries.

## 1.2 PROJECT BACKGROUND

While there are a few possible corridors for interconnecting SAPP and EAPP, the most advanced one is connecting Zambia-Tanzania-Kenya (also called "ZTK"). The ZTK corridor is a long stretch, but many sections of the transmission corridor have already been constructed, or have the financing secured and are awaiting construction. For example, the backbone section in Tanzania is completed, and the interconnection between Kenya and Tanzania is under construction. Therefore, the link between Zambia and Tanzania (or Zambia-Tanzania Interconnector Project, or ZTIP) remains the last section to enable the SAPP and EAPP to be interconnected. ZTIP is being contemplated as a series of the following two related projects:

- Scope of Project 1 (SOP1) is the first Project and its aim is to enhance the power transmission infrastructure within the southern regions of Tanzania, up to the border with Zambia, and the institutional capacity of the Tanzania Electric Supply Company Limited (TANESCO), it was approved on June 18, 2018, and is expected to be completed by 2025.
- Scope of Project 2 (SOP2) is the current Project (Zambia-Tanzania Interconnector Project) which aims to increase the firm capacity of the interconnection with Tanzania and enhance the transmission and distribution network capacity in the northern regions of Zambia, enabling access expansion. The full integration of SAPP and EAPP would create the largest geographic energy market in the world, from Cape to Cairo. The Zambia-Tanzania Interconnector Project will lead towards market expansion for participating countries, improvement in their energy security, facilitate the diversification of energy sources, enable the sharing of generation reserves, and optimize the cost of electricity supply through trade, both regionally and for participating countries such as Zambia, specifically.

ZESCO, as an intended implementing agency for the SOP2 Project, has started preparation of the Project.

Cities and Infrastructure for Growth Zambia (CIGZambia) is a facility set up with the objective of providing high quality independent technical advice and assistance to Zambian government bodies and private sector organisations engaged in projects and programmes that will help harness the potential of Zambia's cities and towns to act as drivers for economic growth and job creation. CIGZambia is funded by the UK Foreign, Commonwealth and Development Office (FCDO). CIGZambia is currently assisting the Ministry of Energy to prepare Zambia's first Integrated Resources Plan (IRP) for the electricity sector and to close the financing gap to realise the IRP's objectives. A set of energy projects have been identified as requiring CIGZambia's support and the ZTIP is one of them, which are expected to raise financing and are aligned to the IRP.

The World Bank has agreed in principle to provide the majority of the financing for the Project, with a budgetary estimate of $280M including associated project management and capacity building costs. The Project is likely to be co-financed with smaller contributions from EU and UK Government through FCDO.

### 1.2.1 PROJECT DEVELOPMENT PROCESS

The Zambia-Tanzania Interconnector Project (ZTIP) has significantly evolved since its initiation in late 2013. The Project was then coordinated by the Nile Basin Initiative / Nile Equatorial Lakes Subsidiary Action Program (NBI/NELSAP). The original design aimed at connecting the cities of Mbeya (Tanzania) and Kasama (Zambia). This design was later reconsidered to reach the city of Kabwe in Zambia, allowing for improved interconnection of the respective countries' electrical networks. This alternative design kept the Mbeya to Kasama link but also included a link between Nakonde (in Zambia, near the Tanzania-Zambia border) and Mpika (Zambia), and an additional link between Mpika and Kabwe.

In 2015-16, the design was again revised for the section in Zambia, abandoning the Nakonde-Mpika link and replacing it by a link between Kasama and Mpika. In 2017, the design was further refined to reduce the length of the line without reducing the power transmission capacity. The Mpika-Kabwe section was shortened by relocating the end point of the line in Pensulo.

An environmental and social scoping report was then prepared in early 2017, to present the retained design for the Zambian section of the Project to the Zambia Environmental Management Agency (ZEMA). This scoping report included the proposed terms of reference for conduction of the present Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP), covering the retained Project design, and was submitted to ZEMA on June 1, 2017. The Scoping Report and corresponding Terms of Reference (ToRs) were then approved by ZEMA through a letter to the Zambia Electricity Supply Corporation Limited (ZESCO) dated June 27, 2017. A draft ESIA and Environmental and Social Management Plan (ESMP) were then produced and submitted to ZESCO in October 2017.

The design was again revisited in 2019 and the following adjustments were made:

- A new alignment proposed between Mpika and Pensulo to reduce the overall length and the amount of required vegetation clearing. The revised alignment does not encroach on Kasanka National Park's bird migration area, avoids planned development land within the Lavushi Manda District Council, and avoids a farm block of concern;
- A new alignment proposed to avoid wetlands/dambo areas and farm holdings;
- A route adjustment south of Kasama to reduce the number of river crossings and to follow existing linear disturbance.

An ESIA, an ESMP and a revised RAP were produced to reflect the 2019 route refinement and updates related to decommissioning, cumulative impacts, gender-based violence, sexual exploitation and abuse, and aspects of the biological environment (i.e., birds, large mammals, bats, protected areas, etc.). These updates were completed in compliance with national requirements and with the outdated World Bank's Operational Policies. The ESIA was submitted to ZEMA on October 25, 2023, and a decision letter (ref.: ZEMA/EIA/EIS/EAC17/924) was delivered by ZEMA on March 19, 2024 (see Appendix 1-1).

In parallel, ZESCO conducted an Environmental Impact Statement (EIS) and a Resettlement and Compensation Action Plan (RCAP) of a second line from Kasama to Nakonde, as part of a Project under a Chinese contractor (ICBC funding) based on a single circuit 330kV line design which was approved by ZEMA in 2017 (see Decision letter of August 1, 2017, ref.: ZEMA/EIA/EIS/540 in Appendix 1-2). Structures affected by the Project were compensated for, and the owners have since been relocated.

At that time, there were thus two proposals for the Kasama-Nakonde stretch running parallel, the ICBC Project and the ZTIP Phase II Project. The contract under the ICBC funding was cancelled in 2022 and it was therefore proposed that the ZTIP shall use the wayleave for the Kasama-Nakonde single circuit 330kV line under ICBC funding. The revised scope shall have both lines as a double circuit 330kV line on single structure. ZEMA, on August 8, 2023, has granted ZESCO a No Objection to the extension of the validity of the Decision Letter for this line section (see Appendix 1-3). The alignment for the section in between Pensulo and Kasama remains the same.

The ZTIP main components are now:

- The Kasama-Nakonde section which consists of:
  - 212 km of a 330kV double-circuit transmission line from Kasama to Nakonde;
  - A new 330/132/66kV substation at Nakonde (including installation of dynamic voltage support devices [±250 MVAr SVC or STATCOM]);
  - 15 km of a 400kV double-circuit transmission line from Nakonde to the Zambia – Tanzania border;
  - 12 km of a 132kV double circuit from Nakonde to Isoka (loop in and out of 66kV Isoka-Nakonde line).
- The Pensulo-Kasama section which consists of:
  - 386 km of a 330kV single-circuit transmission line between the Pensulo and Kasama Substations, via the Mpika Substation; this line will be more or less parallel to an existing 330kV single-circuit transmission line (Pensulo to Mpika 186 km and Mpika to Kasama 200 km);
  - Expansion works on the existing substations at Pensulo, Mpika and Kasama;
  - Installation of Dynamic Voltage Support Device (±250 MVAr SVC or STATCOM) and associated substation works at Pensulo Substation.

## 1.3 REPORT OBJECTIVES AND CONTENT

All project components are covered by a valid Decision letter by ZEMA. The completion of an updated Environmental and Social Impact Assessment and Environmental and Social Management Plan that meets the Zambian and World Banks requirements is the main pre-condition for the submission to the Board of the World Bank for the funding of the ZTIP. A full update of these documents will be completed to meet the requirements of the Zambian standards (primarily set by the Zambian Environmental Management Agency (ZEMA)) and the most recent applicable World Bank Environmental and Social Standards (ESS) and associated environment, health and safety (EHS) guidelines (general and Electric Power Transmission and Distribution). The current ESIA integrates findings and results from both the previous ESIA associated with the ZTIP and the ESIA associated with the Kasama-Nakonde 330kV line.

As required by the ZEMA, the ESIA is accompanied by a standalone ESMP, which is an integral part of the overall impact identification and management strategy.

The main objectives of the ESIA are to:

- Identify key Project environmental and social impacts;
- Guide the development of an Environmental and Social Management Plan (ESMP) that will outline measures to avoid, reduce or compensate adverse impacts, enhance positive Project impacts, and provide mechanisms for their implementation.

The main objectives of the ESMP are to:

- Describe management of mitigation measures and other environmental and social (E&S) measures to enhance E&S protection;
- Define specific environmental and social management plans and associated commitments to be developed by contractors and ZESCO;
- Identify responsibilities and timing for implementation of E&S management measures as well as costs for their implementation.

The analyses presented in the ESIA were developed based on the selected Project design which is described in greater detail within the Project Description (see Chapter 3 of the ESIA). The ESIA and associated analysis are based on applicable primary data collected during the previous ESIAs and RAPs, updated secondary data from various sources and database, consultation with stakeholders at the decentralised levels (see Chapter 7 of the ESIA) and experts judgements who have similar project experience or have worked on the ZTIP in the past.

## 1.4 REPORT STRUCTURE

The ESIA is presented within seven chapters, the content of each is described as follows:

- **Chapter 1 – Introduction:** outlines the context for the Project and ESIA;
- **Chapter 2 – Regulatory and Institutional Framework:** describes the institutional and regulatory frameworks applicable to the Project;
- **Chapter 3 – Project Description:** provides a detailed description of Project components and activities;
- **Chapter 4 – Project Alternatives Analysis:** provides an analysis of the various corridor options considered, and provides the process and justification for the selection of a preferred route;
- **Chapter 5 – Baseline Environmental and Social Conditions:** describes the existing conditions for the physical, biological, and human environments;
- **Chapter 6 – Impact Assessment:** provides an assessment of Project impacts on the physical, biological and socioeconomic environments. Assessment of transboundary and cumulative impacts are also presented, as well as an overview of mitigation measures and ESMP implementation budget estimates;
- **Chapter 7 – Stakeholder Engagement:** provides a revised Stakeholder Engagement Plan and a summary of consultation and information disclosure activities completed.
- **Chapter 8 – References**

As required by Zambian regulations, the ESMP is submitted as a standalone report.

## 1.5 METHODOLOGIES USED IN THE ESIA STUDY

Various methods were used to complete the ESIA, these include stakeholder consultations, gathering of baseline data and information, consideration of potential mitigation measures to identify and assess anticipated and residual impact. An overview of methodologies is presented below, and detailed methodologies are provided in the appropriate sections of the report. The ESIA has been conducted in accordance with an updated legal and institutional framework (including the MoE Social Safeguards) as well as the most recent applicable World Bank Environmental and Social Standards (ESS) and associated environment, health and safety (EHS) guidelines (general and Electric Power Transmission and Distribution).

## 1.5.1 STAKEHOLDER CONSULTATIONS

### 1.5.1.1 IDENTIFICATION OF STAKEHOLDERS

Stakeholders are defined as those individuals, groups, communities, or organizations that:

- Are directly or indirectly affected by the Project in a positive or negative way (affected parties);
- Are not affected by the Project but have an interest in the Project or the ability to contribute to its development and influence its outcomes because of their responsibilities, jurisdictions, or knowledge in relation to the project area (interested parties).

Some of the stakeholders, such as national regulatory authorities, district authorities, and village authorities, were pre-determined based on the nature of the activities while others, such as interest (NGOs/CBOs) and affected groups, were identified during the consultation process.

Table 7-3 (Section 7.4.2 of the present report) provides a list of groups and individuals consulted over different stages of the engagement process.

### 1.5.1.2 INVOLVEMENT OF STAKEHOLDERS

Chapter 7 provides details of the stakeholder engagement approach and activities and lists stakeholders that have been consulted. For each round of consultation, the approach in terms of mobilizing stakeholders as well as the content of activities are detailed.

A summary of issues raised and proposed recommendations is presented in Section 7.4.3 of the present report.

## 1.5.2 BASELINE DATA AND INFORMATION

### PROJECT DESCRIPTION

The development of the Project components was an iterative process that extended over several years and involved collaboration between the ESIA and Feasibility Study consultants, to understand Project components, operation philosophy, and agree on an optimal design. This was accomplished through:

- Review of Project documents provided by ZESCO (see Chapter 3);
- Discussions with the Feasibility Study Consultant team (particularly those dealing with engineering design of the various Project components) over the course of Feasibility Study preparation, for identification of alternative routing;
- Review of final Feasibility Study and following technical scoping reports to allow for description of the agreed Project design;
- Discussions with NELSAP staff associated with the Project, specifically the Project design team in the 2013-2017 period;
- Discussions with the SAPP staff associated with the Project in the 2019 period;
- Consideration of input received during consultations;
- Site visits and physical observations at the proposed Project site and offsite locations.

### POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Preparation of the Policy, Legal and Institutional Framework chapter involved the following steps:

- Relevant national policies, legislation and regulations, international treaties and agreements, were reviewed to assess their relevance to the Project (see Chapter 2);
- Detailed analysis of relevant sections and provisions (see Chapter 2);
- Discussions with government officials at local, regional and national levels regarding roles and mandates in ESIA processes.

### BIOPHYSICAL AND SOCIOECONOMIC CONDITIONS

Baseline data and information was collected within the study area, the area of direct influence, and the area of indirect influence from secondary sources, and primary sources through site visits, physical observations and discussions with local informants at the Project site. Specifically, data collection involved the following activities:

- A review of secondary information sources (see Chapter 4);
- Visits to the study area to make spot verifications of the status of environmental and socioeconomic conditions;
- A biophysical data collection campaign;
- Focus group meetings and discussions were held with men, women, and other stakeholders in the Project area. Key informant interviews were conducted with the local leaders, administrators, and village elders of the affected areas;
- A census was carried out by ZESCO for both Pensulo-Kasama and Kasama-Nakonde sections with questionnaires being administered to potentially affected households in the Project footprint. Survey data was analyzed by ZESCO and WSP. Outputs were used to make inferences and compiled for the ESIA report.

The detailed methodology for the baseline is presented in Chapter 5 for all relevant components.

## *1.5.3 IMPACT IDENTIFICATION AND ASSESSMENT*

Details of the impact identification and assessment methodology used in the ESIA are presented in Section 6.1 of the present report. This includes the identification of impact sources and valued environmental and social components, as well as the methodology for assessment of impacts' importance.

### IMPACT IDENTIFICATION

Impact identification was based on knowledge of activities involved and experience of the ESIA experts in similar projects. Identification of potential impacts is performed by identifying interactions between the Project's potential impact sources and environmental and social components in the Project area, with guidance from stakeholder consultation results. Potential impact sources can either be Project activities, or components, and were identified and described for each Project phase (pre-construction, construction, operation, and decommissioning). Environmental and social components are all elements of the physical, biological and human environments that are likely to be affected by one or more sources of impact.

Potential impacts are identified using an "impact identification matrix" that links environmental and social components and sources of impact at each Project phase. The importance of potential impacts identified by these means is then assessed.

### IMPACT ASSESSMENT

Impact assessment involves determining the importance of potential impacts on physical, biological and human environments at each phase of the Project. Impacts are either positive or negative. A positive impact is considered to represent an improvement on the baseline conditions of the environmental and social components affected by the Project, while a negative impact is considered to contribute to its deterioration. The importance of each residual impact identified is evaluated according to three main criteria: intensity, extent, and duration following the implementation of mitigation measures. Residual impact intensity indicates the degree of disturbance observed on an environmental or social component affected by the Project and is measured as high, medium, or low. The extent of residual impacts refers to the extent of the area, or the proportion of the population affected by the Project, and is qualified as regional, local, or limited.

The duration of the residual impact refers to the period during which changes in the environment are likely to occur and is qualified as long, medium, or short. Finally, the importance of each residual impact is determined based on the correlation between its intensity, extent, and duration. Compliance with existing laws, standards, conventions, and treaties are also considered.

The probability of an impact occurring is a measure of the likelihood of an impact occurring and is classified as high, moderate, or low. The analysis of the impact's probability of occurrence is conducted separately from the importance, since they are independent criteria that do not influence one another.

The occurrence of incidences related to GBV, safety and public health, and occupational health are discussed in terms of risk rather than importance of impact.

The methodology for impact assessment is detailed in Section 6.1.3, including the residual impact assessment matrix presented in Table 6-5.

## *1.5.4 IDENTIFICATION OF MITIGATION MEASURES*

A wide range of measures have been proposed to prevent, reduce, remedy, or compensate for each adverse impact or to enhance positive impacts. These are detailed in the stand alone ESMP.

# 2 REGULATORY AND INSTITUTIONAL FRAMEWORK

This section presents the institutional actors and legal texts that are relevant to the preparation of the ESIA and RAP, as well as an outline of the applicable EIA process.

## 2.1 CONSTITUTIONAL REQUIREMENTS FOR ENVIRONMENTAL PROTECTION

Environmental Protection in Zambia is one of the main responsibilities of its citizens. The Zambian Constitution (as amended by Act No. 2 of 2016) lists the citizens' main responsibilities in Article 43 clause (1) as follows:

"*A citizen shall: (a) be patriotic to Zambia and promote its development and good image;(b) pay taxes and duties lawfully due and owing to the State; (c) protect and conserve the environment and utilize natural resources in a sustainable manner; d) maintain a clean and healthy environment; (e) provide national, defence and military service when called upon by the State; and (f) co-operate with law enforcement agencies for the maintenance and enforcement of law and order.*"

Therefore, clause (1) (c) and (d) emphasizes the importance of environmental protection in Zambia.

The Constitution also assigns environmental protection duties to people within the borders of Zambia under Article 256 as follows:

*"A person has a duty to co-operate with State organs, State institutions and other persons to: (a) maintain a clean, safe and healthy environment; (b) ensure ecologically sustainable development and use of natural resources; (c) respect, protect and safeguard the environment; and (d) prevent or discontinue an act which is harmful to the environment."*

## 2.2 INSTITUTIONAL ACTORS

Table 2-1 presents the relevant institutional actors in the Project's environmental assessment and resettlement process. Details regarding the relevance of these institutional actors to the Project are provided below.

**Table 2-1 Relevant Institutional Actors in the Project's Environmental Assessment and Social Resettlement Process**

| Sector | Institutional Actors |
|---|---|
| Environmental and Social | – Ministry of Green Economy and Environmental Protection;<br>– Ministry of Water Development and Sanitation;<br>– Zambian Environmental Management Agency;<br>– Water Resources Management Authority;<br>– Department of Forestry (Ministry of Green Economy and Environmental Protection);<br>– Gender Division (Ministry of Community Development and Social Services);<br>– Department of National Parks and Wildlife (Ministry of Tourism and Art);<br>– Ministry of Lands and Natural Resources. |
| Population resettlement and compensation | – Department of Resettlement under the Office of the Vice President;<br>– Lands Department of the Ministry of Lands and Natural Resources;<br>– Ministry of Local Government and Rural Development;<br>– Ministry of Community Development and Social Welfare;<br>– Traditional Chiefs. |

| Sector | Institutional Actors |
|---|---|
| Physical cultural resources | – National Heritage Conservation Commission;<br>– National Museums Board. |
| Energy | – Ministry of Energy;<br>– ZESCO;<br>– Rural Electrification Authority. |
| Occupational Health and Safety | – Occupational Safety and Health Services Department of the Ministry of Labour and Social Security;<br>– Occupational Health and Safety Institute. |

### 2.2.1 ENVIRONMENTAL AND SOCIAL SECTORS

#### MINISTRY OF GREEN ECONOMY AND ENVIRONMENT

The Ministry of Green Economy and Environment (MGEE) in Zambia was established recently to champion the country's transition toward a green growth and the governments vision is to create "A Smart Green Economy and Sustainable Environment." The ministry's mission is to promote environmentally sustainable practices and foster economic growth through green initiatives.

The MGEE is not directly involved in the EIA process but supports the Zambian Environmental management Agency (ZEMA) with strategic aspects related to environment, natural resources and pollution control in the country. The MGEE includes the following government departments:

- Environment Management Department;
- Forestry Department;
- Engineering and Technology Department;
- Planning and Information Department;
- Human Resources and Administration;
- Finance Department.

#### MINISTRY OF WATER DEVELOPMENT AND SANITATION

The Ministry of Water Development and Sanitation (MWDS) is responsible for the development and management of water resources, provision of clean water supply and sanitation for all. Water is a finite resource like any other natural resource but critical for sustainable development of the country. The mandate of the MWDS is to provide policy guidance in the water sector.

The MWDS offers various services, including:

- Geophysics: Utilizing geophysical techniques to explore and manage water resources.
- Dam Construction: Building and maintaining dams for water storage and flood control.
- Water Schemes: Developing and managing water supply systems.
- Sanitation: Promoting proper sanitation practices and facilities.

#### ZAMBIAN ENVIRONMENTAL MANAGEMENT AGENCY

Originally, six statutory bodies were set up under the Ministry of Tourism, Environment and Natural Resources (MTENR). These were the following:

- Zambia Wildlife Authority;

- Environmental Council of Zambia;
- Zambia National Tourist Board;
- National Heritage Conservation Commission;
- National Museum Board;
- Hotel and Tourism Training Institute Trust.

The Environmental Council of Zambia was renamed the Zambian Environmental Management Agency (ZEMA) within the Environmental Management Act (EMA), No. 12 of 2011. ZEMA's board comprises members from a wide range of ministries, such as the Ministry of Health, and academics, business and non-governmental organizations.

By administering the EMA, ZEMA is the major environmental institution in Zambia and the lead agency on matters pertaining to environmental impact assessments (EIAs). It is empowered by the EMA to identify projects, plans and policies for which EIA is necessary.

The former Environmental Council of Zambia was made responsible for facilitating the EIA process and for quality control of environmental assessment statements through Statutory Instrument No. 28 of 1997 – the Regulations made in terms of the now repealed Environmental Pollution Prevention and Control Act (EPPCA). It is assumed that any new Regulations made under the EMA will give ZEMA similar responsibilities.

ZEMA functions are set out in Section 9 of the Act, which states that the Agency's mandate is to "do all things as are necessary to ensure the sustainable management of natural resources and protection of the environment and the prevention and control of pollution". ZEMA's functions include:

- Advising the Minister on policy;
- Coordinating the implementation of environmental management activities in other ministries;
- Developing and enforcing measures to prevent and control pollution;
- Developing guidelines and standards relating to environmental quality;
- Promoting research and studies, including the impact of climate change on humans and the environment;
- Integrating environmental concerns into national planning;
- Reviewing EIAs and strategic environmental assessments;
- Collaborating with other government agencies, authorities and institutions to control pollution and protect the environment;
- Advising stakeholders on projects, programs, plans, and policies for which environmental assessments are necessary;
- Publicizing information on any aspect of environmental management and pollution control;
- Conducting studies and making recommendations on standards related to the improvement and maintenance of sound ecological systems;
- Monitoring trends in the use of natural resources and their impact on the environment;
- Requesting information on the quality, quantity, and management methods of natural resources and environmental conditions in Zambia.

The services provided by ZEMA in relation to this EIA study include:

- Assisting the developer in determining the scope of EIA studies;
- Reviewing Project Briefs, Terms of Reference, and Environmental Impact Statements (EIS) and decision-making;

- Disclosing the EIS to the public through the media;
- Holding public meetings to discuss the EIS;
- Conducting verification surveys of the affected environment;
- Monitoring the Project once implemented;
- Conducting Project compliance audits between 12 and 36 months after implementation;
- Generally administering the EIA Regulations.

## WATER RESOURCES MANAGEMENT AUTHORITY

The Water Resources Management Authority (WRMA) is a newly instituted entity charged with the management, development, conservation, protection, and preservation of water resources and aquatic ecosystems in Zambia. It aims at providing for the equitable, reasonable, and sustainable utilization of water resources; the WRMA ensures the right to draw or take water for domestic and non-commercial purposes, and that the poor and vulnerable members of the society have an adequate and sustainable source of water free from any charge (Government of Zambia, 2011).

The Authority can provide advice on specific aspects of the EIA at ZEMA's request.

## DEPARTMENT OF FORESTRY

The Department of Forestry is responsible for the management of forest resources in Zambia.

The Department of Forestry's mandate includes management of state forest reserves and the enforcement of national regulations related to the use and harvesting of forest resources on state and customary lands. Other functions include providing guidelines and supervision for the management, restoration and establishment of forests, as well as facilitating and regulating forest industries, providing extension services and research.

The Department of Forestry has representatives in each of the country's 10 provinces (MLNREP, 2012). The Department can provide advice on specific aspects of the EIA at ZEMA's request.

## GENDER DIVISION

The Gender Division (Cabinet Office) is committed to protecting and promoting women's rights, curbing gender-based violence and reducing gender inequalities by making progressive changes to legislation to strengthen the protective environment. It aims to prioritize the advancement of women and strengthen their capacity to influence decision-making at the highest level on matters pertaining to gender equity and equality.

The Gender Division does not have structures at provincial or district levels, they depend on NGOs.

The Gender Division coordinates and monitors the implementation of:

- The National Gender policy;
- The Matrimonial Causes Act;
- The Anti-Gender Based Violence Act No. 1 of 2011;
- The Gender and Equity Act;
- The National Strategy on ending child marriage.

The Gender Division operates several programs, including:

- Gender Policy Formulation;

- Gender Mainstreaming;
- Economic Empowerment of Women;
- Prevention of gender-based violence and the multidisciplinary management of survivors;
- Monitoring and Evaluation;
- Communication and Advocacy;
- Technical Backstopping or institutional Capacity Building.

#### DEPARTMENT OF NATIONAL PARKS AND WILDLIFE

The Zambia Wildlife Authority (ZAWA) was established in 1999 under the Zambia Wildlife Act, No. 12 of 1998 as an autonomous body, in replacement of the former Department of National Parks and Wildlife Service. ZAWA was managed by its own board of directors under the policy guidance of the recently established Ministry of Tourism and Arts. ZAWA was responsible for the management of wildlife in protected areas such as National Parks, Game Management Areas (GMAs), wildlife sanctuaries, private wildlife sanctuaries and conservancies.

ZAWA had a legal mandate to form partnership agreements with local communities to manage wildlife and natural resources, known as Community Based Natural Resource Management (CBNRM), where management responsibilities and revenue from wildlife services and concessions are shared between ZAWA and local communities[1].

In 2015 the Zambia Wildlife Authority was replaced with the Department of National Parks and Wildlife (DNPW) under the ministry of tourism. Its roles include:

- To improve the quality of the life among communities in wildlife estates and maintenance of sustainable biodiversity in national parks and game management areas;
- To reverse the decline in wildlife resources;
- To improve wildlife resource management to a level which will secure sustainable flow of benefits from the resources;
- To considerably improve the wildlife resource base investment in co-operation with the private sector and local communities.

### 2.2.2 POPULATION RESETTLEMENT AND COMPENSATION

#### DEPARTMENT OF RESETTLEMENT UNDER THE OFFICE OF THE VICE PRESIDENT

The Department of Resettlement falls under the Office of the Vice President. Its role is to resettle targeted citizens both on a voluntary and involuntary basis to provide them with an alternate livelihood while improving living standards in rural communities. As such, it performs the following functions:

- Identification and acquisition of land for resettlement;
- Planning of resettlement schemes;
- Demarcation of farm plots;
- Processing applications for resettlement;
- Allocation of settlement farm plots to suitable applicants;

[1] http://theredddesk.org/countries/actors/zambia-wildlife-authority.

- Recommending deserving settlers to acquire certificates of title to their farm plots from the Ministry of Lands;
- Coordinating provision of infrastructure in resettlement schemes;
- Managing the resettlement program and resettlement schemes.

The Department of Resettlement is also responsible for providing infrastructure in resettlement schemes, including access roads, schools, health facilities, boreholes and agricultural storage sheds. It is also responsible for collecting and analysing data on the implementation of resettlement programs.

## LANDS DEPARTMENT, MINISTRY OF LANDS AND NATURAL RESOURCES

The Lands Department is charged with land administration on behalf of the people of Zambia and is responsible for the following portfolio functions:

- Land Policy;
- Land Administration;
- Land surveys and mapping;
- Land and Deeds Registry;
- Provision of land for all purposes.

In addition to the portfolio functions highlighted above, the Lands Department is also responsible for the following statutory bodies:

- Lands Tribunal;
- Survey Control Board.

The Department of Lands administers the Land Act, 1995 (CAP 292, CAP 289, CAP 288) and the Lands Acquisition Act, 1995, for the allocation and alienation of land under statutory leaseholds. The Department is also responsible for the administration of lands and deeds registration and land surveys and mapping.

The Ministry will provide advice on the RAP at ZEMA's request and will be responsible for the reviewing and approval of compensation measures and costs.

## MINISTRY OF LOCAL GOVERNMENT AND RURAL DEVELOPMENT

The Ministry of Local Government and Rural Development is charged with the promotion of decentralized local government system and with ensuring the people of Zambia are provided with the necessary municipal services to contribute to sustainable socioeconomic development. It oversees the implementation of delegated functions and responsibilities by the local authorities by managing the social, economic, and political spheres of governance. According to the Government Gazette no 547 of 2004, the ministry has been assigned the following functions:

- Co-ordination of Local Government Administration;
- Urban Planning and Regional Planning;
- Provision of municipal infrastructure services and support services;
- Co-ordination of the implementation of the National Decentralization Policy;
- Provision of feeder, community, and urban roads.

The Ministry will provide advice on the EIA and RAP at ZEMA's request.

### MINISTRY OF COMMUNITY DEVELOPMENT AND SOCIAL WELFARE

The Ministry of Community Development and Social Welfare was established through an Act of Parliament in 2012. The mission of the ministry is to provide and facilitate socioeconomic empowerment of the poor and vulnerable, and promote the development and preservation of culture, notably via primary Health Care and Social Protection. This ministry is a key provider and facilitator of social protection to the less privileged and vulnerable groups in society.

The Ministry will provide advice on the EIA and RAP at ZEMA's request.

### TRADITIONAL CHIEFS

Under Customary Land tenure systems, the chief is responsible for land under his jurisdiction, which is communally owned. The chief, through its headmen, provides lands to their subjects and clansmen without title.

However, should one wish to convert such land to leasehold tenure, one seeks consent from the chief who recommends to the council using prescribed forms, who in turn recommends to the commissioner of lands for title.

## 2.2.3 PHYSICAL CULTURAL RESOURCES

### NATIONAL HERITAGE CONSERVATION COMMISSION

The Institution mandated by Cap 173 of the Laws of Zambia, to manage and Conserve Zambia's outstanding Cultural and Natural Heritage resources, is the National Heritage Conservation Commission (NHCC) which has its headquarters in Lusaka. It lists over 3,000 heritage sites in Zambia, including:

- Historic/architectural buildings (over 380 sites);
- Historic sites (over 180 sites);
- Anthropological sites (over 180 sites);
- Engineering industrial structures (over 60 sites);
- Archaeological sites (over 2,000 sites);
- Geomorphological, geophysical, paleontological, ecological, and other sites.

The NHCC will provide advice on the EIA and RAP at ZEMA's request.

### NATIONAL MUSEUMS BOARD

The National Museums Board (NMB) is a statutory body created by an Act of Parliament, Chapter 174, of the Laws of Zambia.

The Board's principal role is to contribute to the national development effort through the establishment, development and management of sustainable museums for the preservation, presentation and promotion of Zambia's movable heritage. Through its museums, the Board researches into, collects, documents, preserves, interprets, presents, and promotes Zambia's movable cultural and natural heritage.

The Board comprises a Secretariat and four National Museums through which it carries out its mandate. The National Museums are: Copperbelt Museum in Ndola, Livingstone Museum in Livingstone, Lusaka National Museum in Lusaka, and Moto Moto Museum in Mbala. The Board also provides support to two community museums, namely, Choma Museum and Crafts Centre in Choma and Nayuma Museum in Mongu[2].

[2] http://www.museumszambia.org/.

The NMB will provide advice on the EIA and RAP at ZEMA's request.

### 2.2.4 ENERGY

#### MINISTRY OF ENERGY

The Ministry of Energy will provide advice on the EIA and RAP at ZEMA's request.

#### ZESCO

ZESCO Limited is a parastatal company under the Companies Act. It was established in 1970, and its governance has evolved over time to one that defines an arms-length relationship with Government.

This relationship is defined in the Performance Contract that was signed between the Government and ZESCO in 1996. The contract defines the commercialization issues and other operational benchmarks for ZESCO over the contract period of three (3) years[3].

ZESCO is the main promoter and operator of energy production, transport and distribution projects in Zambia. ZESCO is involved in all activities related to the EIA and RAP studies. This organization is the focal point of the Project with the SAPP.

#### RURAL ELECTRIFICATION AUTHORITY

The Zambia Rural Electrification Authority (REA) is a statutory body created through Act No. 20 of 2003, to spearhead development of electricity infrastructure in rural areas to facilitate access. REA's objective is to increase access to electricity for most of Zambians over the next 13 years. It is also committed to improving the quality, efficiency and performance of the electricity industry in Zambia, through both established and more contemporary modes of power generation[4].

The REA will provide advice on the EIA and RAP at ZEMA's request.

#### ZAMBIA DEVELOPMENT AGENCY

The Zambia Development Agency (ZDA) was established in 2006 under Act No. 11 of 2006. The ZDA is responsible for fostering economic growth and development in Zambia through promoting trade and investment and an efficient, effective, and coordinated private sector led economic development strategies. The ZDA principally furthers the economic development by promoting efficiency, investment, and competitiveness in businesses, as well as promoting exports. It also addresses the high cost of doing business in the country by simplifying the processing of various business formalities, such as licensing[5].

#### INDEPENDENT POWER PROVIDERS

In the generation sub-sector, Independent Power Producers (IPPs) include Lunsemfwa, Maamba and Ndola Energy, whose entire capacity is off taken by ZESCO, as well as those operating mini-hydro generating stations, such as the Hydro Power Station (Chinsali District), Kasanjiku Hydro Mini Grid (Mwinilunga District), and Zengamina Hydro Mini Grid (Ikelenge District), whose off-grid power systems cater to more localised needs. There are also solar mini grids, including Mpata Solar Mini Grid (Samfya District), Engie Power Conner Solar Mini Grid (Kasengwa District), Standard Micro Grid (Ngwerere and Chongwe Districts), Sorera Micro Grid (Luangwa District) and Muhanya Solar Micro Grid (Sinda District)[6]. These entities own facilities to generate electric power; they will provide power to the grid and will rely on the TL for power evacuation.

3 http://www.zesco.co.zm/AboutUs.html.
4 http://www.africanbusinessreview.co.za/reports/rural-electrification-authority.
5 http://www.zda.org.zm.
6 https://www.moe.gov.zm/?page_id=2198.

## 2.2.5 OCCUPATIONAL HEALTH AND SAFETY

### OCCUPATIONAL SAFETY AND HEALTH SERVICES DEPARTMENT OF THE MINISTRY OF LABOUR AND SOCIAL SECURITY

The Occupational Safety and Health Services Department of the Ministry of Labour and Social Security's overriding policy goal is to promote and enforce occupational health and safety standards and ensure safe and healthy working environments. As such, the programs and activities of the Department are focused on the prevention of occupational diseases and accidents in the workplace. Through implementation of the Factories Act, Chapter 441 of the laws of Zambia, the Department aims to protect workers, factories, communities and the environment from occupational hazards[7].

The Factories Act stipulates that employers must provide clean working environments, adequate ventilation, access to first aid, sufficient lighting, sanitary facilities and access to a fire extinguishing equipment. The Factories Act also requires that employers take steps to prevent overcrowding in the workplace and includes provisions on Health, Safety and Welfare[8].

### OCCUPATIONAL HEALTH AND SAFETY INSTITUTE

As established within the Occupational Health and Safety Act 2010[9], the Occupational Health and Safety Institute has the following key functions:

- Develop and implement programs to provide incentives for employers to implement measures to eliminate or reduce risks to health or safety or to improve occupational hygiene, occupational health and safety;
- Investigate and detect occupational diseases and injuries at workplaces;
- Conduct medical examinations for occupational health and safety purposes catering for all industries including agriculture and construction;
- Provide an occupational laboratory service;
- Promote studies and carry out investigations and research on occupational health and safety;
- Prepare and maintain statistics on employee`s morbidity and mortality;
- Conduct and encourage awareness educational programs relating to the promotion of occupational health and safety; and
- Carry out such other functions as are necessary or incidental to the performance of its functions under the Occupational Health and Safety Act.

Under the Occupational Health and Safety Act, it is a duty of the employer to ensure the health, safety and welfare of employees while they are at the workplace.

The Act requires that an employee be placed and kept in a work environment that aligns with the employee's physical, physiological and psychological ability. The employer must provide a work environment that is safe and without risk to the health and safety of the employees within their workplace[10].

[7] https://www.mlss.gov.zm/?page_id=4826.
[8] https://www.mlss.gov.zm/?page_id=4826.
[9] https://zambialaws.com/principal-legislation/occupational-health-and-safety-act.
[10] https://zambialaws.com/principal-legislation/occupational-health-and-safety-act.

# 2.3 POLICY FRAMEWORK

## 2.3.1 ENVIRONMENTAL AND SOCIAL SECTORS

### NATIONAL POLICY ON ENVIRONMENT

In view of the various environmental challenges the country faces, Zambia launched its National Policy on Environment (NPE) in 2007. The environmental policy document identifies deforestation, land degradation, wildlife depletion, soil erosion, loss of land productivity, inadequate sanitation, and air and water pollution as the main environmental challenges the country is facing.

The NPE calls upon all institutions, Non-Governmental Organizations (NGOs), and community based or people's organizations whose activities affect the environment in any way, to carry out their activities judiciously in order to maintain the productivity and integrity of the environment.

Further, the NPE recognizes the need for EIA studies in all development projects in order to eliminate or mitigate adverse environmental impacts and enhance the benefits of the projects. The National Policy on Environment states that "EIAs will be required as deemed necessary to ensure that public and private sector development options are environmentally sound and sustainable and that any environmental consequences are recognized early and taken into account during Project design and implementation".

### NATIONAL ENVIRONMENTAL ACTION PLAN (1994)

The National Environmental Action Plan describes Zambia's environmental problems, legislation and institutions; and provides strategic options for improving environmental quality. The plan culminated from a review of relevant studies, reports, and local knowledge and wide stakeholder consultation. The plan includes updated environmental policies and actions; it was also the basis for the subsequent development of the environmental investment plan.

### NATIONAL RESETTLEMENT POLICY

The National Resettlement Policy, 2015, attempts to address the number of challenges that have been experienced over the years including lack of a coordination mechanism at higher levels of the Government in the implementation of the land resettlement program as the country has continued to witness an increased number of involuntary displacements and resettlements in the recent past, due to the following factors:

- Natural and Human induced disasters;
- Land disputes;
- Development projects;
- Encroachment of populations on land meant for other activities;
- Conflicts along national boarder areas;
- Differences in social /religious affiliations.

### NATIONAL POLICY ON CLIMATE CHANGE

This National Policy on Climate Change (NPCC) (2016) was developed to support and facilitate a coordinated response to climate change issues in the country. It will enable Zambia to realign its climate-sensitive sectors of the economy, and its society, to meet development goals through adaptation and mitigation interventions.

At the same time, it will contribute to the achievement of the overall objective of the United Nations Framework Convention on Climate Change (UNFCCC) which is "*stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*". Zambia signed and ratified the UNFCCC on June 11, 1992, and May 28, 1993, respectively.

### NATIONAL LAND POLICY

The National Lands Policy was launched on May 11, 2021, aiming to streamline land administration and management services for the country's development. Prior to this comprehensive policy, Zambia had only fragmented land-related pronouncements by the government.

The policy has eight strategic objectives, each contributing to improved land management and administration:

- Strengthening Land Allocation Mechanisms: Enhancing security of tenure.
- Enhancing Land Registration: Increasing registered properties' volume, accuracy, capacity, affordability, and convenience.
- Effective Land Dispute Management: Reducing caseloads and associated costs.
- Promoting Zambian Citizens' Land Ownership: Supporting decent livelihoods and socio-economic development.
- Regulating Non-Zambians' Land Ownership: Ensuring reasonable access to land.
- Boosting the Land Market: Making the sector more beneficial to the economy.
- Mainstreaming Climate Change and Environmental Protection: Integrating sustainability principles.
- Creating an Inclusive Land Sector: Focusing on gender sensitivity, youth inclusivity, and marginalized groups.

## 2.3.2 SECTOR POLICIES

### NATIONAL FORESTRY POLICY

The National Forestry Policy falls under the Ministry of Lands, Natural Resources and Environmental Protection. The general objectives of the policy are stated as follows:

- To put in place effective forest management systems and operating structures;
- To formulate and implement appropriate forest policies and programs for sustainable management and use of forest resources;
- To promote sustainable, participatory management and use of forests such that all stakeholders take an active and sustainable interest towards effective conservation, production, management and utilization of the nation's forest assets.

The government adopted the Zambia Forestry Action Plan (ZFAP) as part of the National Environmental Action Plan (NEAP) developed in 1994. The plan is designed to address the problems of deforestation and to enhance the contribution of the forestry sector to national social economic development. A chronic shortage of information about Zambia's forests, including inventories and ecological profiles, has limited development of action plans.

One outcome of the plan was the adoption of a new National Forest Policy (1998), which addressed national policy objectives of socioeconomic development, poverty alleviation and food security. The new policy recognizes the role of traditional leaders and communities in production, sustainable management, and utilization of forest resources, and emphasizes the need to use traditional structures and the private sector in preparing management plans for Joint Forest Management Areas.

## NATIONAL WATER POLICY

The policy aims at promoting sustainable water resources development in order to facilitate equitable provision of adequate quantity and quality of water for all competing uses at acceptable cost, and to ensure security of supply under varying conditions. Among the policy measures contemplated to achieve long term sustainability of water resources, there is:

- Vesting ownership of water resources in the country under state control. One identified strategy to achieve this is the revision of weak legislation and development of conventions and protocols in accordance with the Helsinki Rules which embody the concept of best joint utilization of internationally shared waters.
- Promoting water resources development through an integrated management approach. One strategy to achieve this is the performance of environmental impact assessments prior to implementation of any development project.
- Developing an appropriate institutional and legal framework for effective management of water resources. The policy recognizes the Environmental Protection and Pollution and other pieces of legislation relating to water quality.

Five main categories are identified in discussing possible conflict in the use of water. These are: domestic, industrial, agricultural including irrigation, livestock watering, and freshwater aquaculture, recreational and ecosystem management.

## AGRICULTURAL POLICY

The National Agricultural Policy (2004) states five objectives of the agricultural sector including the assurance of national and household food security, creation of income and employment, maintenance and improvement of the agricultural resource base, contribution to the national balance of payments and to sustainable industrial development. To achieve these objectives, various sector strategies are outlined and include the following:

- Strengthening and monitoring the liberalization of markets and facilitating private sectors;
- Promoting and securing access of agricultural products to both local and international markets;
- Diversification of agricultural production and utilization;
- Strengthening and facilitating the provision of agricultural services;
- Facilitating availability and accessibility of land for agriculture and development of infrastructure in potentially productive areas;
- Development and promotion of appropriate technology;
- Promotion of sustainable, environmentally sound agricultural practices. This includes the promotion of conservation farming, agro-forestry and greater use of irrigation;
- Strengthening emergency preparedness through provision of timely crop forecasts and early warning information, where necessary, while also maintaining strategic reserves.

## NATIONAL POLICY ON WETLANDS CONSERVATION, SEPTEMBER 2001

This Policy was formulated in response to the fragmented sectoral policies and Acts. It aims to provide a holistic program of action to promote the conservation and wise use of wetland ecosystems. It acknowledges the importance of wetland ecosystems in Zambia in providing major fisheries, and important habitats for various wildlife species.

### NATIONAL INDUSTRIAL POLICY, MARCH 2018

This Policy is motivated by the aspirations of the Country's Vision 2030 which aims at transforming Zambia into a prosperous middle-income economy. The Policy sets out Government's approach to the industrial development of the country.

### NATIONAL POLICY ON DECENTRALIZATION, MARCH 2023

This Policy provides a strategic direction for the implementation of decentralization in Zambia. It endeavours to build on the successes of past implementation and seeks to address the challenges encountered. It prioritises community engagement, citizen-driven local development and inclusiveness in the implementation of programs. Further, the Policy empowers the citizens to hold their representatives accountable for service delivery and local development. It also prioritises the strengthening of sub-national institutions and improving relationships at all levels of governance.

### NATIONAL GENDER POLICY (NGP) 2014

The NGP is aimed at ensuring the attainment of gender equality in the development process by redressing the existing gender imbalances. It also provides for equal opportunities for women and men to actively participate and contribute to their fullest ability and equitably benefit from national development.

The policy emphasizes issues of poverty, noting that women and children are differentially affected compared to men. Females are singled out as experiencing more poverty than any other social group in the country, while the HIV and AIDS pandemic and violence against women are exacerbating the situation. The policy addresses gender issues such as poverty, decision making, gender-based violence, HIV and AIDS.

Furthermore, Zambia has signed the following international governing documents on gender:

- The Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW) in 1984;
- The Beijing Declaration and Platform of Action in 1995;
- The Millennium Development Goals (MDGs) in 2000.

## 2.4 REGULATORY FRAMEWORK

The table below presents a list of legal texts related to environmental assessments and resettlement processes. The ones relevant to the Project are described in detail in the following sections.

**Table 2-2 Relevant Legal Documents in the Environmental and Social Assessment and Resettlement Process of Electricity Transmission Projects**

| Sector | Relevant documents |
|---|---|
| Environmental and social assessment | – Environmental Management Act, No. 12 of 2011 as amended by the Environmental Management (Amendment) Act, No. 10 of 2013 and No. 8 of 2023;<br>– Environmental Management (Strategic Environmental Assessment) Regulations, S.I. 48 of 2021;<br>– Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, Statutory Instrument No. 28 of 1997 as amended by the Environmental Protection and Pollution Control (Environmental Impact Assessment) (Amendment) Regulations, S. I. No. 87 of 2009. |

| Sector | Relevant documents |
|---|---|
| Land and resettlement | – Lands Act, 1995 (Cap. 292, Cap. 289, Cap. 288) as amended by the Lands (Amendment) Act, No. 20 of 1996;<br>– Land Acquisition Act (Cap. 296);<br>– Agricultural Lands Act (Cap. 187);<br>– Lands and Deeds Registry Act (Cap. 185) as amended by the Lands and Deeds Registry (Amendment) Act, 2021;<br>– Housing (Statutory and Improvement Areas) Act (Cap 194) as amended by the Housing (Statutory and Improvement Areas) (Amendment) Act, 2010;<br>– Land Survey Act (Cap. 188) as amended by the Land Survey (Amendment) Act, No. 40 of 2021;<br>– Public Roads Act, No. 12 of 2002 as amended by the Public Roads (Amendment) Act, 2022;<br>– Arbitration Act, No. 19 of 2000. |
| Environment | – Water Resources Management Act, 2011;<br>– Forest Act, No. 4 of 2015;<br>– Forest (Carbon Stock Management) Regulations, S. I. No. 66 of 2021;<br>– Environmental Management (Licensing) Regulations, S. I. No. 112 of 2013;<br>– Natural Resources Conservation Act, Cap 315, 1970;<br>– Zambia Wildlife Act No.14 of 2015;<br>– Zambia Wildlife (Protected Animals) Order, S. I. No. 42 of 2016;<br>– National Parks and Wildlife (Game Animals) Order, S. I. No. 41 of 2016;<br>– Fisheries Act, No.22 of 2011;<br>– Zambezi River Authority Act, No. 17 of 1987 as amended by the Zambezi River Authority (Amendment) Act, No. 12 of 2011;<br>– Water Supply and Sanitation Act No. 28 of 1997. |
| Social issues | – Gender Equity and Equality Act, No. 22 of 2015;<br>– Anti Gender-Based Violence Act, No. 1 of 2011;<br>– National HIV/AIDS/STI/TB Council Act, No. 10 of 2002 as amended by the National HIV/AIDS/STI/TB Council (Amendment) Act, No. 8 of 2021;<br>– National Health Insurance Act, No. 2 of 2018;<br>– Anti-Human Trafficking Act, No. 11 of 2008;<br>– Citizen Economic Empowerment Act, No. 3 of 2006;<br>– Persons with Disabilities Act, No. 6 of 2012;<br>– National Youth Development Council Act, No. 13 of 1994. |
| Energy | – Electricity Act, No. 11 of 2019;<br>– Energy Regulation Act, No. 12 of 2019;<br>– Rural Electrification Act, No. 5 of 2023;<br>– Wayleave Code of Practice, 2022. |
| Physical cultural resources | – National Heritage Conservation Commission Act, No. 23 of 1989 as amended by the National Heritage Conservation Commission (Amendment) Act, No. 19 of 2021. |
| Local government | – Local Government Act, No. 2 of 2019;<br>– Urban and Regional Planning Act, No.3 of 2015;<br>– Chiefs Act, No. 13 of 1994. |
| Employment and occupational health and safety | – Occupational Health and Safety Act, 2010;<br>– Employment Code Act, No. 3 of 2019;<br>– Industrial and Labour Relations Act, No. 27 of 1993;<br>– Worker's Compensation Act, No. 10 of 1999. |

### 2.4.1 ENVIRONMENTAL ASSESSMENT

#### ENVIRONMENTAL MANAGEMENT ACT, No. 12 OF 2011 AS AMENDED BY THE ENVIRONMENTAL MANAGEMENT (AMENDMENT) ACT, No. 10 OF 2013 AND No. 8 OF 2023

The Environmental Management Act, No. 12 of 2011 repealed the Environmental Protection and Pollution Control Act (Cap. 204), Act No. 12 of 1990. It defines the term "environment" as "natural or manmade surroundings at any place, comprising air, water, land, natural resources, animals, buildings and other constructions (sic)".

This act provides for integrated environmental management and the protection and conservation of the environment and the sustainable management and use of natural resources. It also provides for the prevention and control of pollution and environmental degradation to provide for the health and welfare of persons, animals, plants and the environment.

The Act covers the management of water, air, waste (hazardous and municipal), pesticides and toxic substances, noise, ionizing radiation, natural resources, etc.

Section 23 of the Act states that a strategic environmental assessment must be conducted for any draft policy, program or plan that could have an adverse effect on environmental management or the sustainable management and utilization of natural resources. Section 23(3) specifies the contents of such an assessment. Where a strategic environmental assessment recommends amendments to a policy, plan or program, ZEMA will ensure the amendments have been brought about before approving such a document.

Section 44 of the Act provides a framework for the control and restriction of any contaminants that may have a regional or global effect. Section 85 of the Act relates to transboundary environmental programs and transboundary impacts. Section 85(1) specifies that the Minister, in consultation with other sectors, must enter a dialogue with the relevant authorities of neighbouring countries where transboundary impacts may occur.

The amendment Act provides Addition of a new principle governing the Act in article 6, that is:

- The need to integrate low carbon emissions, resource efficiency and social inclusiveness in the proposed development programs.
- The following new functions are added to the Agency in article 9:
- Promote actions on climate change adaptation and mitigation in collaboration with an appropriate authority;
- Undertake inventory of greenhouse gas emissions;

In consultation with an appropriate authority, promote fair and equitable sharing of the benefits arising out of exploitation and utilization of the environment and natural resources among the people.

- Insertion of a new Section 29A of the amendment Act stipulating that:
  - A person shall not prepare an environmental assessment report without registering with the Agency as an environmental assessment expert in accordance with Section 29B;
  - 29B defines the requirements for registering.

All other changes are either related to specific industries distinct from electrical line transmission or to specific administrative aspect internal to the Agency.

### ENVIRONMENTAL PROTECTION AND POLLUTION CONTROL (ENVIRONMENTAL IMPACT ASSESSMENT) REGULATIONS, S. I. NO. 28 OF 1997

In terms of Sections 6 and 96 of the 1990 EPPCA, the EIA process was formalized in the Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, which were promulgated through Statutory Instrument No. 28 of 1997. Although the 2011 EMA repeals the 1990 EPPCA, the Regulations are still being enforced. However, Section 30 of the EMA makes provision for the Minister, on the advice of ZEMA, to promulgate new Regulations relating to the administration and enforcement of both strategic environmental assessments and EIAs.

The environmental assessment procedure put in place by the EPPCA is detailed in Section 2.7.

## 2.4.2 LAND AND RESETTLEMENT

### LANDS ACT, 1995 (CAP. 292, CAP. 289, CAP. 288)

This Act provides for the continuation of leaseholds and leasehold tenure as well as for the continued vesting of all lands in the President, who has the power of alienation (land held under customary tenure is subject to certain conditions) (Section 3). It also provides for the statutory recognition and continuation of customary tenure (Section 7), for the conversion of customary tenure into leasehold tenure (sect. 8) and establishes a Land Development Fund and Lands Tribunal (Parts III and IV). The Department of Lands administers the Land Act, 1995 (CAP 292, CAP 289, and CAP 288). The Department is also responsible for the administration of lands and deeds registration and land surveys and mapping.

### LAND ACQUISITION ACT (CAP. 296)

Section three of the Lands Acquisition Act empowers the President of the Republic to compulsorily acquire property. Sections 5 to 7 of the Act provide for the issuing of notices to show the intention to acquire, notice to yield up property, and to take up possession.

Section 10 of the Act provides for compensation as consisting of such moneys as may be agreed from moneys appropriated for the purpose by Parliament. Furthermore, this section provides that where the property to be compulsorily acquired is land, the President, with the consent of the person entitled to compensation, shall in lieu or in addition to any compensation payable under the section, grant other land not exceeding the value of the land acquired.

Under the Lands Acquisition Act, the value of the property for purposes of compensation shall be the value of the amount which the property might be expected to realize if sold on the open market by a willing seller at the time of the publication of the notice to yield up possession of the property. Section 11 of the Lands Acquisition Act provides for the settlement of the disputes relating to the amount of compensation in the High Court.

Part IV of the Act describes compensation modalities for unutilised and undeveloped land and absentee owners. Section 15 states that no compensation shall be payable in respect of undeveloped land or unutilised land, save where the land acquired is unutilised land to which and absentee owner is beneficially entitled. In this case compensation shall be payable in respect of the unexhausted improvements on unutilised land. In the case of land in rural areas, the land shall not be deemed undeveloped unless such land has not been used in the past two years.

Part VI of the Lands Acquisition Act provides for the establishment of a Compensation Advisory Board to advise and assist the Minister in the assessment of any compensation payable under the Act. Other functions of the board, its operations and constitution are also prescribed.

## AGRICULTURAL LANDS ACT (CAP. 187)

This Act provides for the establishment of the Agricultural Lands Board for tenant farming schemes. The act empowers the Minister, by statutory notice, to declare any state land and, with the consent of the registered owner, any freehold land, and to alienate any declared land in any of the following ways:

- By state grant;
- By the lease of holdings;
- By any other state lease or tenancy.

Subsection 5 of Section 21 provides that a lessee shall use his holding primarily for agricultural purposes, for purposes ancillary thereto and for the personal residence of himself and his family and necessary staff and for no other purpose.

Subsection 1 of Section 40 permits a tenant who obtains approval from the Agricultural Lands Board to make improvements to a holding at his own expense. Improvements which are permitted are those which are reasonably required for the management, improvement or development of the holding. Only improvements which are approved by the Agricultural Lands Boards qualify for compensation.

Section 43 provides that, if any dispute shall arise relating to:

1. The amount of any compensation, not being an ex-gratia payment;
2. Any valuation for an option to purchase a holding;
3. Any valuation for a state grant.

Such disputes may be referred to arbitration under the provisions of the Arbitration Act.

## LANDS AND DEEDS REGISTRY (AMENDMENT) ACT NO. 39 OF 2021 READ WITH THE LANDS AND DEEDS REGISTRY ACT (CAP. 185)

The Act amends Section 4 of the principal Act to acknowledge the submission of electronic land documents and digital signatures. With this amendment, a document required to be lodged with or delivered to the Registrar may be lodged or delivered by means of a device or facility that records or stores information electronically as prescribed. “A signature for the purposes of this Act includes an electronic and digital signature.”

This Act makes provision for the registration of documents relating to land, the certification of title, the legal proceedings and effects of the transfer of land, and other matters relating to registration of titles in land.

A Registry of Deeds is established under Section 3 for purposes of the Act. The registration of documents shall be performed by a Registrar appointed under that section. Every document purporting to grant, convey or transfer land or any interest in land, or to be a lease or agreement for lease or permit of occupation of land for a longer term than one year, or to create any charge upon land, whether by way of mortgage or otherwise, or which evidences the satisfaction of any mortgage or charge, and all bills of sale of personal property whereof the grantor remains in apparent possession, shall be subject to registration, unless already registered pursuant to other legislation (sect. 4). Section 9 specifies the registers that shall be kept.

## HOUSING (STATUTORY AND IMPROVEMENT AREAS) (AMENDMENT) ACT NO. 42 OF 2010

The Housing (Statutory and Improvement Areas) (Amendment) Act No. 42 of 2010 amends Section 3, Section 33 and Section 46. The amendment makes provision for a person aggrieved by the decision of the minister or registrar to appeal to the land tribunal.

The Housing (Statutory and Improvement Areas) (Amendment) Act No. 42 of 2010 read with the Housing (Statutory and Improvement) Act Cap 194 of the Laws of Zambia provides for the control and improvement of housing in land owned by the local council and declared by the minister as a statutory housing area. Section 44 of the Act makes it an offence to occupy land in a statutory improvement area without the authority of the relevant local authority.

## LAND SURVEY (AMENDMENT) ACT NO. 40 OF 2021

The Act amends Sections 2 and 31 of the Land Survey Act Cap 188 of the Laws of Zambia. The amendment makes provision for electronically submitting, signing and maintaining survey diagrams in electronic form. When read together with the Land Survey Act Cap 188 of the Laws of Zambia, the Act provides for the registration and licensing of land surveyors and the carrying out of land surveys. It further provides for the establishment and powers of a Survey Control Board which will be responsible for the registration and licensing of land surveyors and the exercise of disciplinary control over such surveyors. Sections 15, 16 and 25 set the principles for original surveys, re-surveys, agreement as to beacons and boundaries and lawfully established beacon. Section 29(1) makes it an offence to alter, move or damage a beacon erected by a lawful survey operation.

## PUBLIC ROADS (AMENDMENT) ACT NO. 9 OF 2022

The Act amends the membership and functions of the board of the Road Development Agency and outlines the appointment procedures. It protects the assets of the agency from being issued against by the courts of law. It also provides for the immunity of board members and the raising and administration of the funds of the agency. When read together with the Public Roads Act No. 12 of 2002, the Act establishes the Road Development Agency and defines its functions, provides for the care, maintenance and construction of public roads in Zambia and regulates maximum weights permissible for transmission on roads.

Section 18 (3) of the Act gives authority to the envisaged Road Development Agency to enter upon any land for purposes of extraction of materials for road formation. It also provides for notification to the property/land owner before preparation for commencement of extraction of materials starts. Under Section 18 (4) of the Act, compensation should be paid to the affected land owner/occupier if such land is on title. Section 64 (1) makes it an offence to drive a vehicle on a public road whose maximum laden weight or maximum axle weight is more than the maximum laden weight or maximum axle weight prescribed in regulations made under Section sixty-three commits.

Section 18 (5) of the Act allows the land owner/occupier to submit written request to the Agency for any expense or loss that may be incurred if such land is appropriated. Section 18 (6) states that in the event of failure to agree upon the amount of compensation the matter shall be decided by arbitration in accordance with the Arbitration Act. The Act under Section 18 (7) provides many conditions which shall form the basis for assessment of properties or envisaged losses that are the subject of disagreements.

## ARBITRATION ACT, NO. 19 OF 2000

This Act provides for arbitration in cases where the land owner/occupier does not agree with the amount of compensation being offered. Under Section 12 (2) of the Act, the parties to arbitration are free to determine the procedure for appointing the arbitrator or arbitrators. Section 12 (3) (b) states that if the parties are unable to agree on the arbitration, another arbitrator shall be appointed, upon request of a party, by an arbitral institution.

## LAND TENURE TYPES

As land alienation will be a crucial part in the implementation of the Project, it is useful to outline the Zambian land tenure system in order to appreciate the alternative ways in which land can be accessed for Project purposes.

Under the 1995 Land Act and draft constitution, all land in Zambia vests in the President. Table 2-3 presents the tenure types recognized by the various acts described above.

**Table 2-3 Land Tenure Types**

| Type of Tenure | Characteristics | Legal Basis[11,12] |
|---|---|---|
| Customary | Obtained through the permission of the local chief. Most of the land in Zambia (estimated at 84% in 2005) is held under customary tenure. Under customary law, the land is held by individuals, families, clans, or communities from generation to generation, without temporal limitation. Customary tenure applies to individual plots, forest land, common land within a village, and communal grazing land. Most small-holder subsistence farmers cultivate customary land held in common ownership with the community, although the rights of farmers are individualized. The land does not have formal documentation (e.g., certificates and titles), landholders do not pay land tax, and information on land is often solely orally held.<br>Customary land tenure is, depending on the Chiefdom, gender biased since women headed households often face several traditional norms that are not in their favour. Female headed households sometimes face limited access to new land, poor tenure rights to land, and property grabbing from family members. | Governed by customs and traditions of various ethnic groups. Sections 2 and 7 (ii) of the Lands Act. |
| Leaseholds of State land | All land not held under customary tenure is deemed to be state land. Most urban areas, mining areas, protected areas, land along rail lines, and land that was free of the tsetse fly infestation during colonial times tend to be state land, much of which has been privatized through leaseholds. The state grants four types of leases: (1) a 10-year Land Record Card; (2) a 14-year lease for unsurveyed land; (3) a 25- to 30-year Land Occupancy License for residential settlements; and (4) a 99-year leasehold for surveyed land. The conversion of customary land to leaseholds requires approval of the chief and any individual whose interests will be affected by the conversion. | Lands and Deeds Registry Act (Cap 185).<br>Housing (Statutory and Improvement) Act (Cap 194). |
| Unregistered lease or rental | Regulated by a tenancy contract signed and witnessed by both parties which need not be a registered document. In practice this form of agreement applies to dwelling houses in the high and medium cost formal residential areas. | Rent Act, 1972. |
| Informal rights in informal illegal settlements | Informal renting and subletting based on unwritten (verbal) agreement. Illegal subdivision and occupation of land in expanding illegal settlement.<br>Most of the population in urban areas lives in informal settlements. In areas where settlements are built on primarily public land and the structures meet building standards, residents can regularize their rights with 30-year renewable Land Occupancy licenses. In other informal settlements the residents do not have rights to their residential land under formal law. Customary law often recognizes occupancy rights of residents, which may protect their interests against other potential occupants but offers no protection from eviction by government officials | None. |

## 2.4.3 ENVIRONMENT

### WATER RESOURCES MANAGEMENT ACT, 2011

The Act provides for the ownership, control and use of water. It delegates management of water resources through Catchment Councils established under the Act, consisting of the water users of the catchment. It further provides for the equitable, reasonable and sustainable use of water resources in Zambia.

This Act establishes a regulatory and administrative framework for the management, development, conservation, protection and preservation of the water resource in Zambia and provides with respect to water rights and the equitable and sustainable use of water resources and related matters.

### FOREST ACT, NO. 4 OF 2015

An Act to provide for the establishment and declaration of National Forests, Local Forests, joint forest management areas, botanical reserves, private forests and community forests; provide for the participation of local communities, local authorities, traditional institutions, non-governmental organizations and other stakeholders in sustainable forest management; provide for the conservation and use of forests and trees for the sustainable management of forest ecosystems and biological diversity; establish the Forest Development Fund;

[11] UN Habitat 2005, Law, Land Tenure and Gender Review Series: Southern Africa.
[12] USAid 2010. Land Tenure Profile, Zambia. http://usaidlandtenure.net/sites/default/files/country-profiles/full-reports/USAID_Land_Tenure_Zambia_Profile.pdf.

provide for the implementation of the United Nations Framework Convention on Climate Change, Convention on International Trade in Endangered Species of Wild Flora and Fauna, the Convention on Wetlands of International Importance, especially as Water Fowl Habitat, the Convention on Biological Diversity, the Convention to Combat Desertification in those Countries experiencing Serious Drought and/or Desertification, particularly in Africa and any other relevant international agreement to which Zambia is a party; repeal and replace the Forests Act, 1999; and provide for matters connected with, or incidental to, the foregoing.

This Act concerns the management and conservation of forest resources and, to some extent, the protection of biological diversity and generally the environment in Zambia. It consists of 107 sections divided into 11 Parts: Preliminary (I); Forestry Department (II); Forest Management and Development (III); Forest Management Plans and Conservation Orders (IV); Protected Flora (V); Regulation of Forest Produce (VI); Marking of Timber (VII); The Forest Development Fund (VIII); Enforcement (IX); Offence.

### FOREST (CARBON STOCK MANAGEMENT) REGULATIONS, S. I. NO. 66 OF 2021

The regulations provide a framework for participating in forest carbon stock management and define activities eligible for projects in carbon stock management. Section 19 prohibits double counting of emission targets. Section 22 requires a permit order to include environmental, social and fiduciary safeguards in the Project design. The regulations further prescribe the obligations of orders of forest carbon stock management permits.

### ENVIRONMENTAL MANAGEMENT (LICENSING) REGULATIONS, S. I. NO. 112 OF 2013

The Regulations provide for the licensing of pollution sources. These include established plants or movement of materials. It repeals and replaces Statutory Instrument No. 71 of 1993; Statutory Instrument No. 125 of 2001; Statutory Instrument No. 72 of 1993, and all other permitting requirements.

### NATURAL RESOURCES CONSERVATION ACT (CAP. 315), 1970

The Act relates to the monitoring of natural resource conservation and utilization outside forest reserves and national parks, as well as control of bush fires and powers of Minister to make regulations.

### ZAMBIA WILDLIFE ACT, NO. 14 OF 2015

An Act to governing the affairs of the Zambia Wildlife Authority; establish the Department of National Parks and Wildlife in the Ministry responsible for tourism; provide for the establishment, control and management of National Parks, bird and wildlife sanctuaries and for the conservation and enhancement of wildlife eco-systems, biological diversity and objects of aesthetic, pre-historic, historical, geological, archeological and scientific interest in National Parks; provide for the promotion of opportunities for the equitable and sustainable use of the special qualities of public wildlife estates; provide for the establishment, control and co-management of Community Partnership Parks for the conservation and restoration of ecological structures for non-consumptive forms of recreation and environmental education; provide for the sustainable use of wildlife and the effective management of the wildlife habitat in Game Management Areas; enhance the benefits of Game Management Areas to local communities and wildlife; involve local communities in the management of Game Management Areas; provide for the development and implementation of management plans; provide for the regulation of game ranching; provide for the licensing of hunting and control of the processing, sale, import and export of wild animals and trophies; provide for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Convention on Wetlands of International Importance especially as Waterfowl Habitat, the Convention on Biological Diversity, the Lusaka Agreement on Cooperative Enforcement Operations Directed at Illegal Trade in Wild Fauna and Flora and other international instruments to which Zambia is party; repeal the Zambia Wildlife Act, 1998; and provide for matters connected with, or incidental to, the foregoing.

## ZAMBIA WILDLIFE (PROTECTED ANIMALS) ORDER, S. I. NO. 42 OF 2016

The Wildlife (Protected Animals) order SI No. 42 of 2016 revokes the National Parks and Wildlife (Protected Animals) Order of 1993 and lists the animals which should not be hunted without a licence. The order has been made in accordance with the provisions of Section 36 of the Zambia Wildlife Act No. 14 of 2015 which gives the minister responsible for wildlife to specify animals which are protected and thus cannot be hunted without a licence.

## NATIONAL PARKS AND WILDLIFE (GAME ANIMALS) ORDER, S. I. NO. 41 OF 2016

The Zambia Wildlife (Game Animals) Order, S. I. No. 41 of 2016 specifies animals considered as game management animals and prohibits hunting such animals without a licence. The order further revokes the Zambia Wildlife (Game Animals) Order No. 10 of 2015.

## FISHERIES ACT, NO. 22 OF 2011

An Act to provide for the appointment of the Director of Fisheries and fisheries officers and provide for their powers and functions; promote the sustainable development of fisheries and a precautionary approach in fisheries management, conservation, utilization and development; establish fisheries management areas and fisheries management committees; provide for the regulation of commercial fishing and aquaculture; establish the Fisheries and Aquaculture Development Fund; repeal and replace the Fisheries Act, 1974; and provide for matters connected with, or incidental to, the foregoing.

## ZAMBEZI RIVER AUTHORITY (AMENDMENT) ACT NO. 12 OF 2001

Sections 1 and 2 of the amendment act requires contracting states to facilitate the free movement of employees, motor vehicles and equipment within and between their respective territories. Exempt contracting parties from paying import and excise duty for the things bought for use by the authority in its executing of its duties. It further provides for the sharing of water between the contracting parties in equal proportions. When read together with the Zambezi River Authority Act No. 17 of 1987, the Act provides for the interstate agreement between Zambia and Zimbabwe relating to the utilization of the Zambezi River (Kariba Dam).

## WATER SUPPLY AND SANITATION ACT, NO. 28 OF 1997

The Act provides for the establishment of the National Water Supply and Sanitation Council and defines its functions among which include protecting consumers from unjustified tariffs; to provide for the establishment, by local authorities, of water supply and sanitation utilities; to provide for the efficient and sustainable supply of water and sanitation services under the general regulation of the National Water Supply and Sanitation Council, and to provide for matters connected with or incidental to the foregoing. Section 31 of the Act prohibits any person from interfering with any water and sanitation utility company facilities or making unauthorized connections with any transmission lines belonging to the utility company. Where a water supply or sanitation installation on private property malfunctions and interferes with any system of a utility company, Section 32 gives the right to the utility company to enter the facility and remedy the situation. Suppose the interference has been caused due to an action by the property owner. In that case, the Act empowers the utility company to instruct the owner of such property to remedy the situation.

## SOCIAL ISSUES GENDER EQUITY AND EQUALITY ACT, NO. 22 OF 2015

The Gender Equity and Equality Act provides the establishment of the Gender Equity and Equality Commission and sets out principles and powers of the Minister for achieving gender equity and equality. Generally, it helps achieve gender equality and elimination of economic and social discrimination in Zambia. The Minister, through consultations with relevant Ministers, implements special measures on gender equity and equality to meet challenges faced by women living in rural and peri-urban areas.

As the Anti Gender-Based Violence Act, this Act describes the type of discrimination that women face, including GBV, and describes the rights of GBV victims and the procedure for filing complaints.

## ANTI GENDER-BASED VIOLENCE ACT, NO. 1 OF 2011

The Anti Gender-Based Violence Act provides for:

- The protection of victims of gender-based violence;
- The constitution of the Anti Gender-Based Violence Committee;
- The establishment of the Anti Gender-Based Violence Fund;
- Matters connected with, or incidental to, the foregoing.

This Act also provides the legal background to file GBV complaints, provides support to victims and prosecutes perpetrators. It provides the legal basis for legal actions to be carried out by the police (Police Victim Support Unit).

## NATIONAL HIV/AIDS/STI/TB COUNCIL ACT OF 2002

The act provides for the establishment of the HV/AIDS/STI/TB council whose main function is, according to Part ii Section 4 (1) of the Act, to coordinate and provide support to the development, monitoring and evaluation of the multi-sectoral response for the prevention and combating of the spread of HIV/AIDS, in order to reduce the personal, social and economic impacts of HIV/AIDS, STI, and TB.

## NATIONAL HEALTH INSURANCEE ACT, NO. 2 OF 2018

The Act to provide for sound financing for the national health system; provide for universal access to quality insured health care services; establish the National Health Insurance Management Authority and provide for its functions and powers of the National Health Insurance Management Authority. Part II, Section 12 (2) to provide universal access to quality insured health care services to the Zambian Citizens. Section 14 (1) provides that foreign nationals who enters the Republic shall have valid health insurance for the period that they stay in the country.

## ANTI-HUMAN TRAFFICKING ACT, NO. 11 OF 2008

The Act to provide for the prohibition, prevention and prosecution of human trafficking and provide for the filing of and dealing with matters related to human trafficking. Part II, Section 9 (1) of the Act provides that a person who smuggles another person into or out of Zambia, participates in smuggling commits an offence and is liable, upon conviction, to imprisonment for a term of not less than fifteen years and not exceeding twenty years.

Section 11 further provides that a person who aids, abets, counsels, procures, incites or solicits the commission of an offence under this Act, commits an offence and is liable, upon conviction, to the same penalties as if the person had been convicted of the offence.

## CITIZEN ECONOMIC EMPOWERMENT ACT, NO. 3 OF 2006

The Act aims to promote economic empowerment and reduce income inequalities through the Establishment of the Citizens Economic Empowerment Commission (CEEC), Citizens Economic Empowerment Fund, Promotion of Economic Empowerment, Gender Equality, Employment Opportunities, Procurement Contracts and Services and Greenfield Investment as provided in Part III of the Act.

## PERSONS WITH DISABILITIES ACT, NO. 6 OF 2012

The Act provides for the continuation of the existence of the Zambia Agency for Persons with Disabilities and promotion of the participation of persons with disabilities with equal opportunities in the civil, political, economic, social and cultural spheres. The Act further provides for mainstreaming of disability issues as an integral part of national policies and strategies of sustainable development; incorporation of a gender perspective in the promotion of the full enjoyment of human rights and fundamental freedoms by persons with disabilities; ensure accessibility by persons with disabilities to the physical, social, economic and cultural environment, and to health, education, information, communication and technology.

### NATIONAL YOUTH DEVELOPMENT COUNCIL ACT, NO. 13 OF 1994

The Act establishes the National Youth Development Council in Zambia and the Act aims to promote youth development by defining the functions and powers of the Council, facilitating the registration of youth organizations, and addressing related matters. The Council's functions include promoting youth development, advising the government on youth-related matters, and coordinating youth programs and activities. It also oversees the registration of youth organizations.

## 2.4.4 ENERGY

### ELECTRICITY ACT, NO. 11 OF 2019

Provides for the regulation of the generation, transmission, distribution and supply of electricity; and provides guidance on the matters connected with or incidental to the foregoing, and to ensure ZESCO power projects and operations are carried out in line with the provisions of the Electricity Act.

### ENERGY REGULATION ACT, NO. 12 OF 2019

The Act creates the Energy Regulation Board (ERB). The role of the ERB, among other functions, is to ensure all energy utilities in the sector are licensed, to monitor levels and structures of competition, and to investigate and remedy consumer complaints.

### RURAL ELECTRIFICATION ACT, NO. 5 OF 2023

This Act establishes the Rural Electrification Authority (REA) and the Rural Electrification Fund and defines their functions. It also provides for matters connected with or incidental to the foregoing. The Act redefines the functions of the REA. These functions include planning, coordinating, and implementing rural electrification projects. The REA collaborates with various stakeholders to achieve its objectives

### ERB WAYLEAVE CODE OF PRACTICE 2022

The ERB Wayleave Code of Practice 2022 provides guidelines and regulations related to wayleaves in Zambia. The code outlines the purpose, general provisions, specifications, and requirements related to wayleaves. It applies to activities within the road reserve and addresses various aspects of wayleave management. The code specifies minimum wayleave requirements in both urban and rural areas. Key aspects include wayleave width, distances between conductors and the edge of the wayleave, clearances from transmission or distribution overhead lines (OHL) to tower structures and spacing of OHL conductors. The code also covers wayleaves in recognized forestry areas and provides guidelines for managing wayleaves within these specific contexts.

## 2.4.5 PHYSICAL CULTURAL RESOURCES

### NATIONAL HERITAGE CONSERVATION COMMISSION ACT, NO. 23 OF 1989

The Act provides for the conservation of ancient, cultural and natural heritage, relics and other objects of aesthetic, historical, pre-historical, archaeological or scientific interest, by preservation, restoration, rehabilitation, reconstruction, adaptive use and good management.

The Commission also provides regulations for archaeological excavation and export of relics. If a development is unable to proceed without affecting an item of heritage, permission must be sought from the National Heritage and Conservation Commission.

## 2.4.6 LOCAL GOVERNMENT

### LOCAL GOVERNMENT ACT, NO. 2 OF 2019

This new Act provides for an integrated local government system; gives effect to the decentralization of functions, responsibilities and services at all levels of local government; ensure democratic participation in, and control of decision making by the people at the local level; revises the functions of local authorities; provides for the review of tariffs, charges and fees within the area of a local authority; provides for the proceedings of the council and committees; provides for the role of traditional leadership in democratic governance; repeal and replace the Local Government Act, 1991; and provide for matters connected with, or incidental to, the foregoing. The Act provides for the establishment of City, Municipal and Town Councils. It further prescribes the functions of local authorities and the local government system. Part II of the Act provides for the establishment of the councils within Zambia, while Part III provides for the functions of the local authorities, some of which relate to pollution control and the protection of the environment in general and keeping cities and districts in good sanitary conditions. Section 17 of the Act shows that the local authorities are the agents of the government in delivering development within the areas of their jurisdiction.

### URBAN AND REGIONAL PLANNING ACT, NO. 3 OF 2015

This Act provides a framework for administering and managing urban and regional planning in Zambia by providing for development, planning and administration principles, standards and requirements for urban and regional planning processes and systems. Furthermore, this Law establishes a democratic, accountable, transparent, participatory and inclusive process for urban and regional planning that allows broad based participation of communities, private sectors, interest groups and other stakeholders in the planning, implementation and operation of human settlement development.

This Act not only establishes procedures for integrated urban and regional planning in a devolved system of governance but also guarantees sustainable urban and rural development by promoting environmental, social and economic sustainability in development initiatives and controls at all levels of urban and regional planning. Interestingly, this regulation gives the relevant Ministerial head the power to constitute a planning appeals tribunal in each Zambian Province to hear and determine appeals from the decisions of planning authorities in the Province.

Finally, this Law repeals the Town and Country Planning Act of 1962, and the Housing (Statutory and Improvement Areas) Act of 1975.

### CHIEFS ACT, NO. 13 OF 1994

The Act makes provision for the recognition and appointment of Chiefs and Deputy Chiefs in specified areas in the interests of public order. Section 12(b) makes it an offence to do anything that undermines the power of a chief. The Chiefs have been given authority to preside over customary land under the Lands Act Cap 184 of the Laws of Zambia. This Act is relevant to the Project as the Kasama-Nakonde stretch crosses chiefdoms of Chief Mwamba and Nkolemfumu in Kasama, Chief Makasa in Mungwi, and Chiefteness Nawaitwika in Nakonde district. This Act makes provision for the recognition, appointment and functions of Chiefs and Deputy Chiefs.

## 2.4.7 EMPLOYMENT AND OCCUPATIONAL HEALTH AND SAFETY

### OCCUPATIONAL HEALTH AND SAFETY ACT, 2010

This Act provides for the following: establishment of the Occupational Health and Safety Institute and its functions; establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work; the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; the protection of persons, other than persons at work, against risks to health or safety arising from, or in connection with, the activities of persons at work; and related matters.

The Occupational Health and Safety (OHS) Act is divided into seven parts, namely: Part I – Preliminary; Part II – The Occupational Health and Safety Institute; Part III – Health and Safety Committees; Part IV – Health and Safe Workplaces; Part V – Enforcement Provisions; Part VI – The Occupational Health and Safety Services; and Part VII – General Provisions. In this Act, duties of employers, employees and other persons with a part in occupational safety and health have been spelt out in parts III and IV of the Act.

#### EMPLOYMENT CODE ACT, NO. 3 OF 2019

The Act makes provisions to regulate the employment of persons, prohibit discrimination at an undertaking; engage persons on contracts of employment and provide for the form and enforcement of the contracts of employment. It further repeals and replaces the Employment Act, 1965, the Employment (Special Provisions) Act, 1966, the Employment of Young Persons and Children Act, 1933 and the Minimum Wages and Conditions of Employment Act, 1982.

Regarding employment of expatriates, part III, Section 14 directs employers to only employ an expatriate when citizens do not possess the needed level of skills or do not apply for the job. Section 66 (2) requires the employer to pay wages at regular intervals not being later than the fifth day following the date on which the wages fall due. Furthermore, Section 81(1) prohibits employment of a child either in a public or private undertaking.

#### INDUSTRIAL RELATIONS (AMENDMENT) ACT NO. 19 OF 2017

The Industrial and Labour Relations (Amendment) Act No. 19 of 2017 amended the Industrial and Labour Relations Act No. 27 of 1993 by introducing payment of fees for union and association activities such as change of names or amalgamation of two unions or associations. The Industrial and Labour Relations Act No. 27 of 1993 read together with the amendment Act of 2027 recognizes collective agreements, settlement of collective disputes, strikes, lockouts, the Industrial Relations Court and repeals and replaces the Industrial Relations Act. Section 5 recognizes that every worker has a right to join and participate in union activities. Section 6 requires employees to cooperate with management in promoting industrial peace, harmony, efficiency and productivity. Section 37 gives employers rights to participate in the formation of, and to join, an association and to participate in the lawful activities of such association.

#### WORKER'S COMPENSATION ACT, NO. 10 OF 1999

The Act revises the law relating to the compensation of workers for disabilities suffered or diseases contracted during employment and makes provisions for the merger of the functions of the Workers' Compensation Fund Control Board and the Pneumoconiosis Compensation fund for the compensation of workers disabled by accident occurring, or diseases contracted in the course of employment. The Act further provides for the payment of compensation to dependents of workers who die because of accidents or diseases. Section 41 under Part V of the Act provides that if an accident to a worker arising out of and during his employment happens after the date of commencement and results in such worker's disablement or death, he or if she dies, his dependants shall become entitled to compensation in accordance with the provisions of this Act.

### *2.4.8 CHILD LABOUR*

The Constitution and the Employment Act set the minimum age for employment at 15. The Apprenticeship Act regulates the employment of minors as apprentices but does not include a minimum age for apprenticeships or specify the types of work that apprentices can perform. The Employment of Young Persons and Children Act bars children under age 18 from engaging in hazardous labour. While the Government has drafted a statutory instrument that would define the types of hazardous labour prohibited to children, it has yet to be adopted. The Government provides free education up to the seventh grade and has reported to the UNESCO Institute of Statistics that education is compulsory until age 14.

Zambian law prohibits the use of children in military hostilities, and children under 18 years cannot be recruited into the military. However, children over age 16 can be recruited with the consent of a parent, guardian or the local District Secretary.

The Employment of Young Persons and Children Act specifically prohibits the worst forms of child labour, including child prostitution, slavery, forced military recruitment of children, and work harmful to the safety, health or morals of children and young people. The Juveniles Act specifically prohibits the use or procurement of children under age 16 for the purpose of begging. However, this leaves children ages 16 to 18 vulnerable to be procured for begging. The Constitution, the Penal Code and the Anti Human Trafficking Act of 2008 prohibit forced labour and the trafficking of children, while the Constitution and Penal Code both prohibit slavery. The Penal Code also prohibits pornography, prostitution and the sexual harassment of a child in the workplace. However, the penalties for child prostitution violations in the Employment of Young Persons and Children Act are different from those in the Penal Code[13].

# 2.5 ENVIRONMENTAL STANDARDS

## 2.5.1 NOISE

According to the Environmental Management Act (2011), ZEMA is responsible for establishing noise level and noise emission standards for construction sites, plants, machinery and industrial activities, among others. However, those standards have not yet been developed. In this context, the IFC's Environmental, Health, and Safety (EHS) Guidelines (2007) regarding noise levels will be considered. It limits noise levels near residential, institutional, and educational receptors to 55 dBA during daytime (7:00 a.m. to 10:00 p.m.) and 45 dBA during nighttime (10:00 p.m. to 7:00 a.m.). Near industrial or commercial receptors, the noise limit is set at 70 dBA throughout the day.

## 2.5.2 AIR QUALITY

Air quality threshold values are provided in Table 2-4 for the following parameters: $SO_2$, $NO_x$, CO, $PM_{10}$ (particulates with aerodynamic parameter <10 µm), $PM_{2.5}$ (particulates with aerodynamic parameter <2.5 µm), total suspended particulates (TSP), lead (Pb), dust fall, and ozone as per the Second Schedule of the Environmental Management (Licensing) Regulations (S.I. No. 112 of 2013). The World Health Organization (WHO) 2021 Global Air Quality Guidelines are also presented. When national and international standards differ, the most stringent will be applied.

**Table 2-4 Guideline Limits for Ambient Air Pollutants**

| Parameter | Reference time | | Environmental Management (Licensing) Regulations (S.I. No 112 of 2013) | WHO 2021 Global Air Quality Guidelines |
|---|---|---|---|---|
| Sulfur dioxide ($SO_2$) (µg/m$^3$) | 10 minutes | | 500 | 500 |
| | 1 hour | | 350 | - |
| | 24 hours | | - | 40 |
| $SO_2$ in combination with total suspended particles (TSP) (µg/m$^3$) | $SO_2$ | 24 hours | 125 | - |
| | | 6 months | 50 | - |
| | TSP | 24 hours | 120 | - |
| | | 6 months | 50 | - |
| | $PM_{10}$ | 24 hours | 70 | - |
| $PM_{10}$ (µg/m$^3$) | 24 hours | | 70 | 45 |
| $PM_{2.5}$ (µg/m$^3$) | 12 months | | 15 | 5 |
| Oxides of nitrogen ($NO_x$) (µg/m$^3$) | 1 hour | | 400 | 200 |
| | 24 hours | | 150 | 40 |
| | 15 minutes | | 100 | 100 |

[13] United States Department of Labor's Bureau of International Labor Affairs, 2011. Zambia Country Profile. [online] http://www.dol.gov/ilab/reports/child-labor/findings/2011TDA/zambia.pdf. Consulted on October 8th, 2015.

| Parameter | Reference time | Environmental Management (Licensing) Regulations (S.I. No 112 of 2013) | WHO 2021 Global Air Quality Guidelines |
|---|---|---|---|
| Carbon monoxide (CO) ($\mu g/m^3$) | 30 minutes | 60 | - |
| | 1 hour | 30 | 35 |
| | 8 hours | 10 | 10 |
| Ambient lead (Pb) ($\mu g/m^3$) | 3 months | 1.5 | - |
| | 12 months | 1.0 | - |
| Dust fall ($mg/m^2/day$) | 30 days | Residential: 250 | - |
| | | Non-residential: 500 | - |
| Ozone ($O_3$) ($\mu g/m^3$) | 8 hours | 120 | 100 |

### 2.5.3 WATER QUALITY

There are two water quality standards in Zambia: the Ambient Water Quality – Specifications (ZS 1182) and the Ambient Water Quality – Guidelines (ZS 1183). Both address drinking water quality.

The Environmental Management (Licensing) Regulations (S.I. No 112 of 2013) establishes limits for effluents and waste water discharged into the aquatic environment in its Third Schedule. Standards are set for physical, bacteriological, chemical, metals, organics, and radioactive parameters. The standards for physical parameters are presented in Table 2-5 below. At all times, when work near water will be conducted, those parameters will be respected.

**Table 2-5 Physical parameter limits for effluents and waste water discharged into the aquatic environment**

| Physical parameter | Unit | Limit |
|---|---|---|
| Temperature | °C | 40 |
| Colour | Hazen units | 40 |
| Odour | - | Must not cause any deterioration in odour as compared with natural state. |
| Turbidity | Nephelometer turbidity units | 15 |
| Total suspended solids | mg/L | 100 |
| Settleable matter sedimentation in 2 hours | mg/L | 0.5 |
| Total dissolved solids | mg/L | 3,000 |
| Conductivity | mS/cm | 4,300 |

Source: Third Schedule, Environmental Management (Licensing) Regulations (S.I. No 112 of 2013)

## 2.6 MINISTRY OF ENERGY SOCIAL SAFEGUARDS FRAMEWORK

The Ministry of Energy (MOE) is committed to support public and private Developers in the development and implementation of energy infrastructure projects that are socially sustainable, and to enhance the capacity to assess and manage social risks and impacts of energy infrastructure projects. To this end, the MOE has developed social safeguard standards, designed to prevent or mitigate social risks and negative impacts of projects and to enhance opportunities and positive impacts.

The Social Safeguard Framework (SSF) has been developed to ensure that gender and social inclusion is effectively mainstreamed in all energy projects under the Integrated Resource Plan (IRP). Environmental and social safeguards refer to policies, procedures, and measures intended to prevent, reduce, and mitigate unintended negative impacts on people and the environment in development projects.

The social safeguards standards, and requirements presented in the below sections are targeting developers and contractors in the energy sector. They should be applied to all energy infrastructure projects that require an Environmental Impact Assessment (EIA) by Zambia Environmental Management Agency (ZEMA).

**Table 2-6 Objectives of the MoE Social Safeguard Standards**

| Social Safeguard Standards | Objectives |
|---|---|
| **SSS 1: Labour and Working Conditions** | – To promote fair treatment, decent working conditions and the health and well-being of workers<br>– To prevent the use of all forms of forced labour and child labour.<br>– To support the principles of freedom of association and collective bargaining of Project workers<br>– To provide Project workers with accessible means to raise workplace concerns |
| **SSS 2: Non-discrimination and Equal opportunities** | – To promote the fair treatment, non-discrimination, and equal opportunity of Project workers.<br>– To create employment opportunities for Zambians and targeted citizens.<br>– To ensure that recruitment practices are transparent and free from corruption and political interference.<br>– To create a conducive work environment free from sexism, gender bias and harassment,<br>– To ensure that policies and practices respond to the needs of different groups in the workplace. |
| **SSS 3: Sexual Exploitation, Abuse and Harassment (SEAH)** | – To identify risk of SEAH and undertake measures to prevent or minimize harm.<br>– To be survivor-centred and evidence-based in SEAH mitigation and response.<br>– To build on local knowledge and structures in identifying local-level risks and measures. |
| **SSS 4: Community Protection and Empowerment** | – To increase sustainability and maximize the positive impact of the Project on local businesses in the Project affected communities.<br>– To anticipate and avoid adverse impacts on the health and safety of Project-affected communities.<br>– To prevent social conflict, violation of social norms, and the undermining of trust in traditional leaders and institutions.<br>– To avoid or minimize community exposure to HIV/AIDS and other diseases, and to prevent increased use of alcohol and drugs.<br>– To prevent negative impacts on women and girls' sexual and reproductive health and rights, such as unwanted or unsupported pregnancies and unsafe abortions.<br>– To avoid school dropout and child labour. |
| **SSS 5: Resettlement** | – To avoid forced eviction and minimize involuntary resettlement by exploring Project design alternatives.<br>– To mitigate unavoidable adverse social and economic impacts from land acquisition or restrictions on land use by: (a) providing timely compensation for loss of assets a replacement cost 34 and (b) assisting displaced persons in their efforts to improve or restore their livelihoods and living standards.<br>– To ensure that resettlement schemes are economically productive, socially secure and environmentally sustainable for persons settled voluntarily or involuntarily.<br>– To improve living conditions of persons who are physically displaced, through provision of adequate housing, access to services and facilities, and security of tenure.<br>– To ensure that the perspectives of women, youth and PWD are obtained and their interests factored into all aspects of resettlement planning and implementation.<br>– To ensure that resettlement is planned and implemented after appropriate disclosure of information, meaningful consultation, and the informed participation of those affected. |
| **SSS 6: Stakeholder Engagement and Information Disclosure** | – To establish a systematic and inclusive approach to stakeholder engagement throughout the Project life cycle.<br>– To take stakeholders' views on issues that could potentially affect them into account in Project design and social and gender performance.<br>– To involve stakeholders in the community in championing the participation of women, youth and PWD and supporting the monitoring of the project.<br>– To ensure that appropriate Project information is disclosed to stakeholders in a timely, understandable, and accessible manner. |

## 2.7 ENVIRONMENTAL ASSESSMENT PROCEDURE

The following table presents an outline of the environmental assessment procedure in Zambia, as outlined within the Environmental Impact Assessment Regulations.

**Table 2-7 Environmental Assessment Procedure**

| Stage | Sub-Stage | Person in Charge | Action | Source |
|---|---|---|---|---|
| Application for Environmental Impact Assessment Certificate | Preparation of Project Brief | Promoter | Prepare according to Regulation Form No. 1 | EIAR, s.3-4 and Schedule 1, s.8 |
| | Submission of Project Brief | Promoter | Submit 6 copies to ZEMA | EIAR, s.5(1) |
| | Comments on the Project Brief | ZEMA | If Project Brief conforms to requirements, within 7 days ZEMA distributes to relevant ministries, institutions, local government structures, etc.<br>Fees: 100,000 Kwacha ($20) | EIAR, s.5(2) Fees: EIAR, s.36 and Annex 5 |
| | | Structures described above | Give comments on the Project Brief to ZEMA, within 30 days | EIAR, s.5(3) |
| | Consideration of Project Brief | ZEMA | Considers the Project Brief to determine whether Project is acceptable as such | EIAR, s.6(1) |
| | | | Decision is communicated to the Promoter within 40 days of submission of Project Brief. Possible decisions: right away or requirement to produce Environmental Impact Statement | EIAR, s.6(2), 7(1), 7(2)c) |
| Environmental Impact Statement | Approval of ToRs | Promoter | Prepare draft Scoping Report and ToRs based on EIAR, Schedule 3 | EIAR, s.8(3) |
| | | | Organize a public consultation process over the Scoping Report and study ToRs<br>To be consulted: Government Agencies, local authorities, NGO and community-based organizations, interested and affected parties | EIAR, s.8(2) |
| | | | Submit final result to ZEMA for approval | EIAR, s.8(3) |
| | | ZEMA | Within 5 days, determine whether ToRs are acceptable and may or may not ask for modifications At the end, ZEMA approves ToRs | EIAR, s.8(4) |
| | Approval of EIS staff | Promoter | Submit to ZEMA names and qualifications of persons that shall prepare the EIS | EIAR, s.9(1) |
| | | ZEMA | Approves or rejects candidacy of EIS professionals. In case of rejection, the reason for rejection must be stated and another name requested for submission | EIAR, s.9(2) and (3) |
| | EIS | Promoter | Conduct the EIS in accordance with guidelines set out in schedule 4 of EIAR or any other guidelines the Council considers appropriate | EIAR, s.9(4). Contents of EIS: EIAR, s.11-12 |
| | Public Consultations | | Publicize the intended Project, its effects and benefits, in the mass media, in a language understood by the community, for a period of not less than 15 days and subsequently at regular intervals throughout the process | EIAR, s.10(2)a) |
| | | | After expiry of the abovementioned 15-day period, hold meetings with affected communities in order to present information on the Project and obtain views of those consulted | EIAR, s.10(2)b) |

| Stage | Sub-Stage | Person in Charge | Action | Source |
|---|---|---|---|---|
| Environmental Impact Statement (cont'd) | Submission of EIS | | Submit EIS to ZEMA in 12 copies. Fees: 5% of Project Implementation cost | EIAR, s.14(1), s.36, Annex 5 |
| | Administrative Review of EIS | ZEMA | Transmit a copy of the EIS to the neighbouring State (Tanzania) for comments | EIAR, s.13(1) |
| | | | Enter the EIS in a Register | EIAR, s.14(2) |
| | | | Within 7 days, transmit copy of EIS to Authorizing agency for comments | EIAR, s.15(1) |
| | | Authorizing Agency | Within 30 days of receipt, make comments on the EIS and transmit them to ZEMA | EIAR, s.15(2) |
| | Consultations on the EIS | ZEMA | Distribute copies of EIS to relevant ministries, local government units, non-governmental and community-based organizations, interested and affected parties<br>Place copies in public in the vicinity of the Project area<br>Place a notification in at least 2 national newspapers | EIAR, s.16(1) |
| | | | May organize or cause to be organized, public meetings in the locality of the proposed Project | EIAR, s.16(2) |
| | | | Receives written comments on the EIS. 15-day period after last notification. May be extended by ZEMA in case | EIAR, s.16(3-4) |
| | | | Considers comments received and determines whether to approve EIS directly, or hold a public hearing | EIAR, s.17(1) criteria: EIAR, s.17(2) |
| | | | Rules or public hearings | EIAR, s.18-19 |
| | Decision | ZEMA | Takes whole process in consideration and issues a decision letter stating that:<br>(a) Project is approved;<br>(b) Project is rejected;<br>(c) Project is approved subject to certain conditions<br>The Decision Letter shall provide motives for any rejection or detailed conditions to be respected.<br>Deadline: ZEMA issues Decision Letter within 30 days after receipt of public hearing report or 20 days from the date an EIS was submitted under s.14 | EIAR, s.20-22 |
| | | | Communicates decision to all concerned parties within 15 days of decision | EIAR, s.23 |
| | Appeals | Aggrieved concerned party | Right of appeal to the Minister, and then to High Court | EIAR, s.24 |
| | Issuance of permit | ZEMA | Issues permit, license or permission, including Annex signed by Director of ZEMA stipulating conditions to be implemented | EIAR, s.25 |

# 2.8 WORLD BANK GROUP

## 2.8.1 WORLD BANK ENVIRONMENTAL AND SOCIAL FRAMEWORK (ESF)

The World Bank's (WB) Environmental and Social Framework (ESF) became effective on October 1, 2018. The ESF enhances the WB's commitment to sustainable development through ten Environmental and Social Standards (ESS) that are designed to support Borrowers' environmental and social (E&S) risk management.

Through the Environmental and Social Standards (ESS) presented in the ESF, the WB determines the requirements for Borrowers relating to the identification and assessment of environmental and social risks and impacts. The ESSs relevant to this study are the following:

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

It should be noted that ESS 9 on Financial Intermediaries is not deemed applicable to this project.

### 2.8.1.1 ESS 1 - ASSESSMENT AND MANAGEMENT OF ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

The ESS 1 should be applied to all projects supported by the WB through Investment Project Financing. It requires that the Borrower assess, manage, and monitor an environmental and social risks and impact of its Project throughout its life cycle, within a time frame acceptable to the WB. It also must meet all the ESS requirements applicable.

The Borrower must:

- Conduct an environmental and social assessment of the proposed project. The Stakeholder Engagement has to be included.
- Undertake stakeholder engagement and disclose appropriate information in accordance with ESS 10.
- Develop an Environmental and Social Commitment Plan (ESCP), and implement all measures and actions set out in the legal agreement including the ESCP.
- Conduct monitoring and reporting on the environment and social performance of the Project against the ESSs.

#### 2.8.1.2 ESS 2 - LABOUR AND WORKING CONDITIONS

The ESS 2 aims to:

- Promote health and safety in workplace environment.
- Promote the fair treatment, non-discrimination, and equal opportunity for the project's workers. It aims inclusivity and to protect Project workers such as women, children (of working age, according to this ESS), persons living with disabilities, etc.
- Prevent all uses of forced labour and child labour. A child under the minimum age should not be employed or engaged in the project. The labour management procedures, developed and implemented by the Borrower, must specify the minimum age of employment. The minimum age should be 14 years unless national law specifies a higher age.
- Support the principle of freedom of association and collective bargaining for the project's workers. It has to be applied in a manner consistent with national law.
- Provide the project's worker with mechanisms to raise any workplace concerns.

#### 2.8.1.3 ESS 3 - RESOURCE EFFICIENCY AND POLLUTION PREVENTION AND MANAGEMENT

The ESS 3 on resource efficiency and pollution prevention and management aims to:

- Promote the sustainable use of resources such as water, raw materials and energy.
- Avoid or minimize adverse impacts from the Project activities, project-related emissions of short- and long-lived climate pollutants, and generation of hazardous and nonhazardous waste.
- Minimize and manage the risks and impacts related to pesticide use.

It is required from the Borrower to consider the conditions of the Project area, and to apply resource efficiency and pollution prevention measures according to the mitigation hierarchy. The applied measures must be proportionate to the risks and impacts of the project, and consistent with the Good International Industry Practice (GIIP) and World Bank Group Environmental, Health and Safety Guidelines (EHSGs).

As part of the requirements, the Borrower must assess, as part of the ESIA process, the potential cumulative impacts of water use on communities, other users, and the environment. Mitigation measures will have to be identified and implemented when needed.

#### 2.8.1.4 ESS 4 - COMMUNITY HEALTH AND SAFETY

The ESS 4 recognizes that Project activities, equipment, and infrastructure can increase exposure to risks and impacts for the communities. Those that are already subject to impacts from climate change may also experience an acceleration or intensification of impacts due to Project activities.

The ESS 4 addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize the risks and impacts. A particular attention must be given to people characterized as vulnerable.

The ESS 4 aims to:

- Anticipate and avoid adverse impacts on the health and safety of project-affected communities during the Project life cycle.
- Promote quality and safety, and considerations relating to climate change in the design and construction of infrastructure.
- Avoid or minimize community exposure to project-related traffic and road safety risks, diseases, and hazardous materials.
- Have in place effective measures to address emergency events.
- Ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities.

#### 2.8.1.5 ESS 5 - LAND ACQUISITION, RESTRICTIONS ON LAND USE AND INVOLUNTARY RESETTLEMENT

The ESS 5 recognizes that project-related land acquisition and restrictions on land use can have adverse impacts on communities and persons. Project-related land acquisition or restrictions on land use may cause physical displacement, economic displacement, or both. The term "involuntary resettlement" refers to these impacts. Resettlement is considered involuntary when affected persons or communities do not have the right to refuse land acquisition or restrictions on land use that result in displacement.

#### 2.8.1.6 ESS 6 - BIODIVERSITY CONSERVATION AND SUSTAINABLE MANAGEMENT OF LIVING NATURAL RESOURCES

The ESS 6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development. Biodiversity is defined as the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems. Biodiversity often underpins ecosystem services valued by humans. Impacts on biodiversity can therefore often adversely affect the delivery of ecosystem services.

#### 2.8.1.7 ESS 7 - INDIGENOUS PEOPLES/SUB-SAHARAN AFRICAN HISTORICALLY UNDERSERVED TRADITIONAL LOCAL COMMUNITIES

The ESS 7 contributes to poverty reduction and sustainable development by ensuring that projects supported by the WB enhance opportunities for Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities to participate in, and benefit from the development process in ways that do not threaten their unique cultural identities and well-being.

According to information published on the website of the International Work Group for Indigenous Affairs, Zambia does not have groups identified as Indigenous. In addition, consultation activities have confirmed that no Indigenous group, as defined by the World Bank, is present in the study area. Therefore, ESS 7 is not applicable.

#### 2.8.1.8 ESS 8 - CULTURAL HERITAGE

The ESS 8 recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present, and future. People identify with cultural heritage as a reflection and expression of their constantly evolving values, beliefs, knowledge, and traditions. Cultural heritage, in its many manifestations, is important as a source of valuable scientific and historical information, as an economic and social asset for development, and as an integral part of people's cultural identity and practice. The ESS8 sets out measures designed to protect cultural heritage throughout the Project life cycle.

### 2.8.1.9 ESS 10 - STAKEHOLDER ENGAGEMENT AND INFORMATION DISCLOSURE

The ESS 10 recognizes the importance of open and transparent engagement between the Borrower and Project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance Project acceptance, and make a significant contribution to successful Project design and implementation.

### 2.8.1.10 INTEGRATION OF APPLICABLE ESS INTO UPDATED STUDIES

The applicable ESSs were integrated into the updated studies (ESIA, ESMP and RAP), as relevant. The following table outlines how each ESS was considered and translated into the update studies. More detail is provided regarding specific actions to fill gaps between the ESF and past environmental and social studies for this project in Appendix 2-3. References to relevant chapters are also included in the table below.

**Table 2-8 Integration of Applicable ESSs into Updated Studies**

| ESS | Actions Completed to Integrate ESS Requirements to the Updated Studies |
|---|---|
| ESS 1 – Assessment and Management of Environmental and Social Risks and Impacts | – Complete/enhance the impact assessment for aspects that were not sufficiently assessed in the previous ESIAs, including climate change and occupational health and safety (see Chapter 6).<br>– Assess GHG emissions associated with the Project's construction and operation phases (see Section 6.2.2.4) and propose adequate mitigation measures (see ESMP, Chapter 3).<br>– Address the resilience of the Project to climate change associated risks (see Section 6.2.2.4).<br>– Assess any new potential impacts on vulnerable groups in light of new line route and new definition of vulnerable groups (see Sections 6.2.4.4 and 6.2.4.6).<br>– Update of monitoring plan integrating new specific management plans and mitigation measures (see ESMP, Chapter 6).<br>– Assess ecosystem services (see Section 5.3.9) and consider priority ecosystem services in the impact assessment (see Section 6.2.3.1). |
| ESS 2 – Labour and Working Conditions | – Develop an Occupation Health, Safety and Security Management Plan, including requirements for worker camps, monitoring measures and indicators (see ESMP, Chapter 4).<br>– Develop a specific Grievance Redress Mechanism for workers, providing proper guidance for the coverage of workers' requirements (see ESMP, Chapter 4).<br>– Reference ZESCO's procedures in terms of labour management, selection of suppliers, forced labour and safety issues in appropriate specific management plans (see ESMP, Chapter 4). |
| ESS 3 – Resource Efficiency and Pollution Prevention and Management | – Reference ZESCO's procedures in terms of waste management and handling of chemicals in appropriate specific management plans (see ESMP, Chapter 4).<br>– Develop a Residual Material and Hazardous Products Management Plan, including pesticides, and a Pollution Prevention Management Plan (see ESMP, Chapter 4). |
| ESS 4 – Community Health and Safety | – Develop an Emergency Response Plan and a Community Health and Safety Management Plan in line with the requirements of ESS 4 (see ESMP, Chapter 4).<br>– Make sure that ZESCO's SEP include a Grievance Redress Mechanism compliant with ESS 4. |
| ESS 5 – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement | – Complete an audit of the implementation of the RCAP for the Kasama-Nakonde stretch (see RCAP Audit Report).<br>– Disclose RCAP and RCAP audit results along the Kasama-Nakonde stretch (see RCAP Audit Report).<br>– Update the RAP for the Pensulo-Kasama stretch based on a new census of affected persons and assets (see upcoming RAP Report).<br>– Update market studies and associated compensation rates (see upcoming RAP Report). |
| ESS 6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources | – Update mapping of habitat types along the line alignment (see Section 5.3.2.1).<br>– Complete a Critical Habitat Assessment in accordance with ESS 6 (see Section 5.3.8).<br>– Review Biodiversity Management Plan and management measures to ensure the project achieves no net loss and, where feasible, a net gain in biodiversity in the long-term (see ESMP, Chapters 3 and 4). |
| ESS 8 – Cultural Heritage | – Develop a Cultural Heritage Management Plan including a change find procedure (see ESMP, Chapter 4). |
| ESS 10 – Stakeholder Engagement and Information Disclosure | – Additional stakeholder engagement round conducted to update stakeholders on changes to the line alignment (see Chapter 7).<br>– Discuss information disclosure during project implementation (see Chapter 7). |

### 2.8.2 WORLD BANK GROUP ENVIRONMENTAL, HEALTH AND SAFETY GUIDELINES

WBG's Environmental, Health and Safety Guidelines are implementation tools for WBG standards. They are technical reference documents covering cross-cutting and specific issues raised by general and specific types of projects. Sixty-three (63) EHS guidelines (1 general guideline document, 62 sectoral guidelines) have been developed for various types of projects and contain performance levels and measures considered generally acceptable by the World Bank Group.

WBG's General EHS Guidelines are applicable to a broad range of projects and impacts. They include standard measures that should be implemented and are designed to be used in conjunction with industrial sector specific EHS guidelines. A key focus of the general guidelines is the early identification of hazards and associated risks, and the consideration of measures (i.e., site selection, product design, and layout or process changes) to reduce the overall risk to human health and the environment.

WBG's General EHS Guidelines recommend involving suitably competent and trained EHS professionals in the identification and management of EHS risks and impacts, and the development of specialized environmental management functions in response. Often, this takes the form of developing Project or activity specific plans and procedures that incorporate technical guidance provided within WBG's General EHS Guidelines and sector specific EHS Guidelines.

Where possible, the guidelines recommend incorporating strategies that eliminate the cause of the hazard at its source. When this is not possible, implementing engineering and management controls to reduce the likelihood and magnitude of the impact should be considered.

The General EHS Guidelines provide guidance on, and are organized according to, the following topics:

- Environmental:
  - Air emissions and ambient air quality;
  - Energy conservation;
  - Wastewater and ambient water quality;
  - Water conservation;
  - Hazardous materials management;
  - Waste management;
  - Noise;
  - Contaminated land.
- Occupational Health and Safety:
  - General facility design and operation;
  - Communication and training;
  - Physical hazards;
  - Chemical hazards;
  - Biological hazards;
  - Radiological hazards;
  - Personal protective equipment (PPE);

- Special hazard environments;
- Monitoring.
- Community Health and Safety:
- Water quality and availability;
- Structural safety of Project infrastructure;
- Life and fire safety;
- Traffic safety;
- Transport of hazardous materials;
- Emergency preparedness and response.

— Construction and Decommissioning:

- Environment;
- Occupation health and safety;
- Community health and safety.

### 2.8.3 ENVIRONMENT, HEALTH, AND SAFETY (EHS) GUIDELINES FOR ELECTRIC POWER TRANSMISSION AND DISTRIBUTION

The EHS Guidelines for Electric Power Transmission and Distribution include information relevant to power transmission between a generation facility and a substation located within an electricity grid, in addition to power distribution from a substation to consumers located in residential, commercial, and industrial areas. They are divided in two main sections: Industry-Specific Impacts and Management, Performance Indicators and Monitoring.

The EHS Guidelines for Electric Power Transmission and Distribution identify the main categories of environmental, community health and safety and occupational health and safety impacts to be expected from power transmission projects and propose avenues for properly managing those impacts. Performance indicators are also proposed to be used at the ESMP implementation stage.

The main potential impacts identified by the EHS guidelines are the following:

— Environmental impacts:

- Terrestrial habitat alteration (from construction and maintenance of right-of-way);
- Potential promotion of forest fires;
- Avian and bat collisions and electrocutions;
- Aquatic habitat alterations (from construction of corridors crossing aquatic habitats);
- Electric and magnetic fields;
- Potential spills of hazardous materials (pesticides for maintenance of right-of-way, transformer insulating oils, and liquid petroleum fuels).
- Community health and safety impacts:
- Risks of electrocution;
- Electromagnetic interference;

- Visual amenity;
- Noise and ozone emissions;
- Aircraft navigation safety.

— Occupational health and safety hazards:

- Electrocution from contact with live components during construction, maintenance, and operation activities;
- Occupational hazards when working at heights during construction, maintenance, and operation activities;
- Exposure to electric and magnetic fields;
- Exposure to hazardous materials.

Details of impacts and mitigation measures identified by the EHS Guidelines for Electric Power Transmission and Distribution are presented in Appendix 2-1. This framework, along with the EHS guidelines' recommendations for environmental performance indicators and monitoring have been considered in the ESIA and ESMP preparation.

### 2.8.4 INTERNATIONAL LABOUR ORGANIZATION COUNTRY PROFILES

Executive summary of International Labour Organization country profile for Zambia is appended to the present report in Appendix 2-2.

### 2.8.5 COMPARISON OF WORLD BANK ENVIRONMENTAL AND SOCIAL FRAMEWORK AND ZAMBIAN LEGISLATION

A comparison analysis between World Bank Environmental and Social Framework, the Social Safeguards from the Ministry of Energy and applicable Zambian legislation has been completed. The comparison did not include a detailed review of all legislation but aimed at evaluating general concordance of Zambian legislation with World Bank ESSs. The results of this analysis are summarized in Table 2-9. A detailed gap analysis analyzing compliance of the previous versions of the ESIA, ESMP and RAP reports associated with the ZTIP with the ESF and MoE Social Safeguards has been completed prior to the current documents update. The results of the gap analysis are presented in Appendices 2-3 and 2-4.

**Table 2-9 Concordance between World Bank ESF, MoE Social Safeguards and Zambian Legislation**

| World Bank ESS | MoE Social Safeguards | Zambian Legislation |
|---|---|---|
| **ESS 1** – Assessment and Management of Environmental and Social Risks and Impacts | — N/A | — Environmental Management Act, No. 12 of 2011.<br>— Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, Statutory Instrument No. 28 of 1997.<br>— Licensing Regulations (Statutory Instrument No. 112 of 2013). |
| **ESS 2** – Labour and Working Conditions | — **Standard 1** on Labour and Working Conditions<br>— **Standard 2** on Non-Discrimination and Equal Opportunity<br>— **Standard 3** on Sexual Exploitation, Abuse and Harassment | — Occupational Health and Safety Act, 2010.<br>— Employment Code Act, No. 3 of 2019.<br>— Industrial and Labour Relations Act, No. 27 of 1993.<br>— Worker's Compensation Act, No. 10 of 1999. |

| World Bank ESS | MoE Social Safeguards | Zambian Legislation |
|---|---|---|
| **ESS 3** – Resource Efficiency and Pollution Prevention | – N/A | – The Water Resources Management Act, 2011.<br>– Environmental Management (Licensing) Regulations, 2013 (SI No. 112 of 2013).<br>– The Water Resources Management Act, 2011.<br>– The Zambezi River Authority Act No. 17 of 1987.<br>– The Water Supply and Sanitation Act No. 28 of 1997. |
| **ESS 4** – Community Health and Safety | – **Standard 4** on Community Protection and Empowerment | – Arbitration Act No. 19 of 2000.<br>– Gender Equity and Equality Act (No. 22 of 2015).<br>– Anti-Gender Based Violence Act, 2010 (No. 1 of 2011). |
| **ESS 5** – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement | – **Standard 5** on Resettlement | – Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, Statutory Instrument No. 28 of 1997.<br>– Lands Act, 1995 (CAP 292, CAP 289, CAP 288).<br>– Land Acquisition Act Cap 296.<br>– Agricultural Lands Act.<br>– Lands and Deeds Registry Act (185).<br>– Housing (Statutory and Improvement) Act (Cap 194).<br>– Land Survey Act. |
| **ESS 6** – Biodiversity Conservation and Sustainable Management of Living Natural Resources | – N/A | – Forest Act No. 4, 2015.<br>– Natural Resources Conservation Act, Cap 315, 1970.<br>– Zambia Wildlife Act No.14 of 2015.<br>– Fisheries Act No.22 of 2011. |
| **ESS 7** – Indigenous People / Sub-Saharan African Historically Underserved Traditional Local Communities | – N/A | – N/A. |
| **ESS 8** – Cultural Heritage | – N/A | – National Heritage Conservation Commission Act No. 23 of 1989. |
| **ESS 10** – Stakeholder Engagement and Information Disclosure | – Standard 6 on Stakeholder Engagement and Information Disclosure | – Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, Statutory Instrument No. 28 of 1997. |

## 2.9 RELEVANT INTERNATIONAL CONVENTIONS

Zambia has signed and ratified several international agreements and conventions relating to the environment. The following are relevant to the Project:

- Convention on Biological Diversity (CBD);
- Convention on the Conservation of Migratory Species of Wild Animals (CMS);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention);
- African Convention on the conservation of Nature and Natural Resources, 2003;
- Abolition of Forced Labour Convention (C029 - Forced Labour Convention, 1930 (No. 29));
- Conventions on the Rights of the Child (C138 - Minimum Age Convention, 1973 (No. 138); C182 - Worst Forms of Child Labour Convention, 1999 (No. 182));
- African Charter on Human and Peoples' Rights;
- African Charter on the Rights and Welfare of the Child;

- Promotional Framework for Occupational Safety and Health Convention, 2006;
- Protection of Worker's Claims (Employer`s Insolvency) Convention, 1992;
- Rural Worker's Organizations Convention, 1975.
- Common Market for Eastern and Southern Africa (COMESA).
- Southern African Development Community (SADC).

These Conventions were considered during the preparation of the ESIA and RAP studies.

# 3 PROJECT DESCRIPTION

## 3.1 OVERVIEW

The Zambia-Tanzania Interconnector Project connects the Southern African Power Pool (SAPP) and Eastern Africa Power Pool (EAPP) for the first time. SAPP currently has 12 member countries, and EAPP has 13 member countries. The interconnection between Zambia and Tanzania is the critical point of connection between the two power pools and will in the future facilitate power trading transactions between countries as far south as South Africa and as far north as Libya.

Currently, powerlines cover only a few regions of different countries and several networks are not connected. Table 3-1 and 3-2 respectively indicates the existing and projected regional interconnection of the EAPP and SAPP.

**Table 3-1 Regional Interconnection for the EAPP (Existing and Planned)**

| Country | Voltage or MegaWatts | Status |
|---|---|---|
| Egypt and Jordania | 600 MW | Existing |
| Egypt and Saudi Arabia | 3000 MW | Proposed |
| Egypt and Sudan | 6000 MW | Proposed |
| Ethiopia and Sudan | 200 MW | Existing |
| Ethiopia and Sudan | 6400 MW | Proposed |
| Ethiopia and Djibouti | 180 MW | Existing |
| Ethiopia and Kenya | 2000 MW | Commissioned in 2022 |
| Uganda and Kenya | 220kV / 118 MW | Existing |
| Uganda and Kenya | 300 MW | Existing |
| Uganda and Kenya | 2060 MW | Proposed |
| Uganda and Tanzania | 59 MW | Existing |
| Uganda and Tanzania | 700 MW | Proposed |
| Uganda and Rwanda | 250 MW | Existing |
| Uganda and DR-Congo | 220kV / 520 MW | Proposed |
| Tanzania and Kenya | 400kV (1520 MW) | To be commissioned in 2024 |
| DR-Congo and Burundi | 220kV | Existing |
| DR-Congo and Rwanda | 220kV | Existing |
| DR-Congo and Tanzania | 220kV | Existing |
| Burundi, DR-Congo, and Rwanda | 220kV | Existing |
| DR-Congo and Burundi | 220kV | Existing |

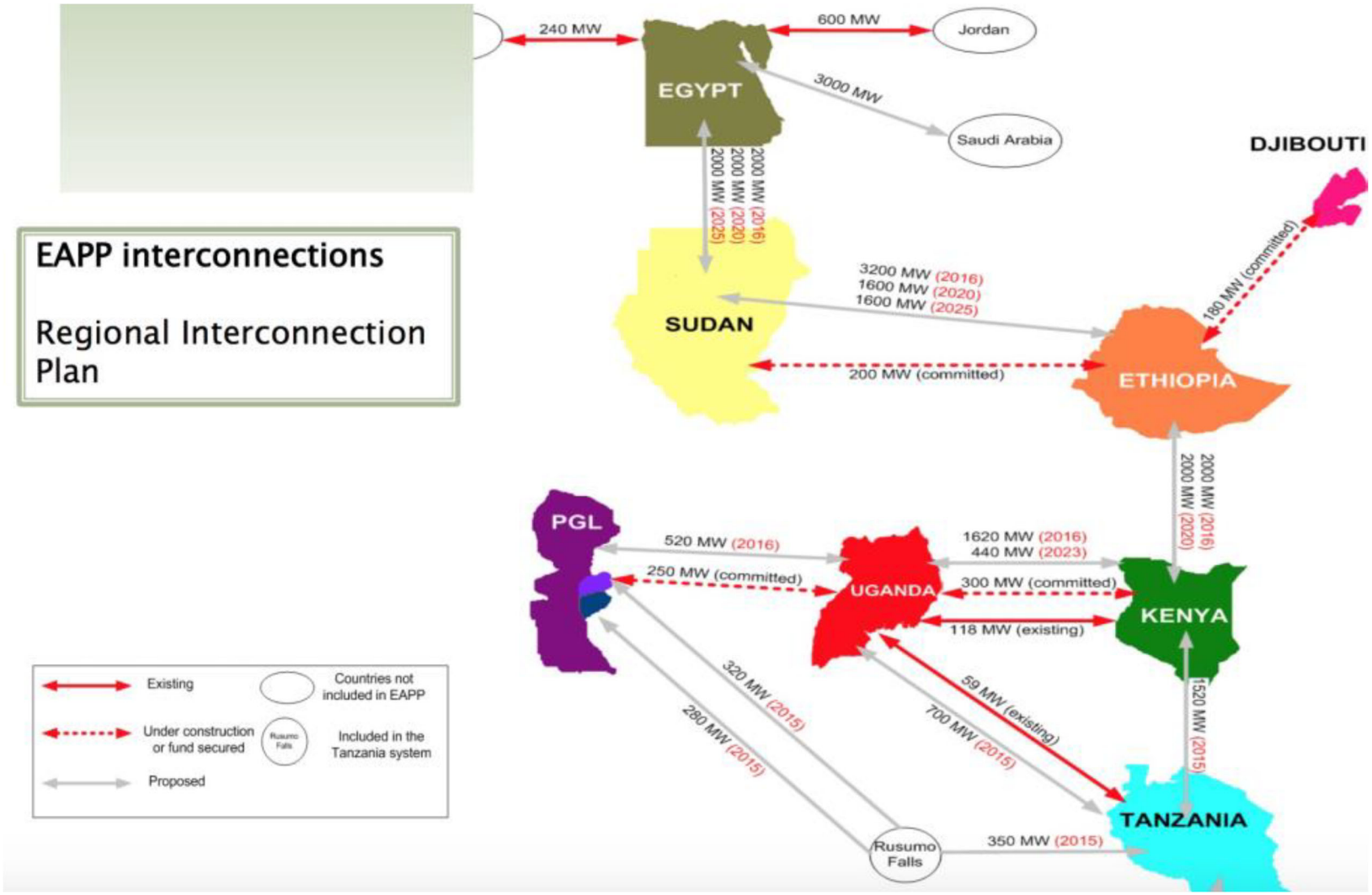
Reference: Medinilla et al. 2019.

**Table 3-2 Regional Interconnection for the SAPP (Existing and Planned)**

| Country | Voltage | Status |
|---|---|---|
| Angola and Democratic Republic of Congo | To be determined | Planned |
| Angola and Namibia | To be determined | Planned |
| Bostwana and South Africa | 3 X 132kV and 1 X 400kV | Existing |
| Bostwana and Zimbabwe | 1 X 132kV and 1 X 400kV | Existing |
| Eswatini and South Africa | 1 X 132kV and 1 X 400kV | Existing |
| Eswatini and Mozambique | 1 X 400kV | Existing |
| Lesotho and South Africa | 2 X 132kV | Existing |
| Malawi and Mozambique | 400kV | Planned |
| Mozambique and South Africa | 1 X 533kV, 1 X 220kV and 1X 110kV | Existing |
| Zambia and Democratic Republic of Congo | 3 X 220kV | Existing |
| Zambia and Democratic Republic of Congo | 2 X 330kV | Planned |
| Mozambique and Zambia | 2 X 400kV | Planned |
| Mozambique and Zimbabwe | 1 X 330kV | Existing |
| Namibia and South Africa | 1 X 400kV | Existing |
| Tanzania and Zambia | 2 X 330kV | Planned |
| Zambia and Zimbabwe | 2 X 330kV | Existing |

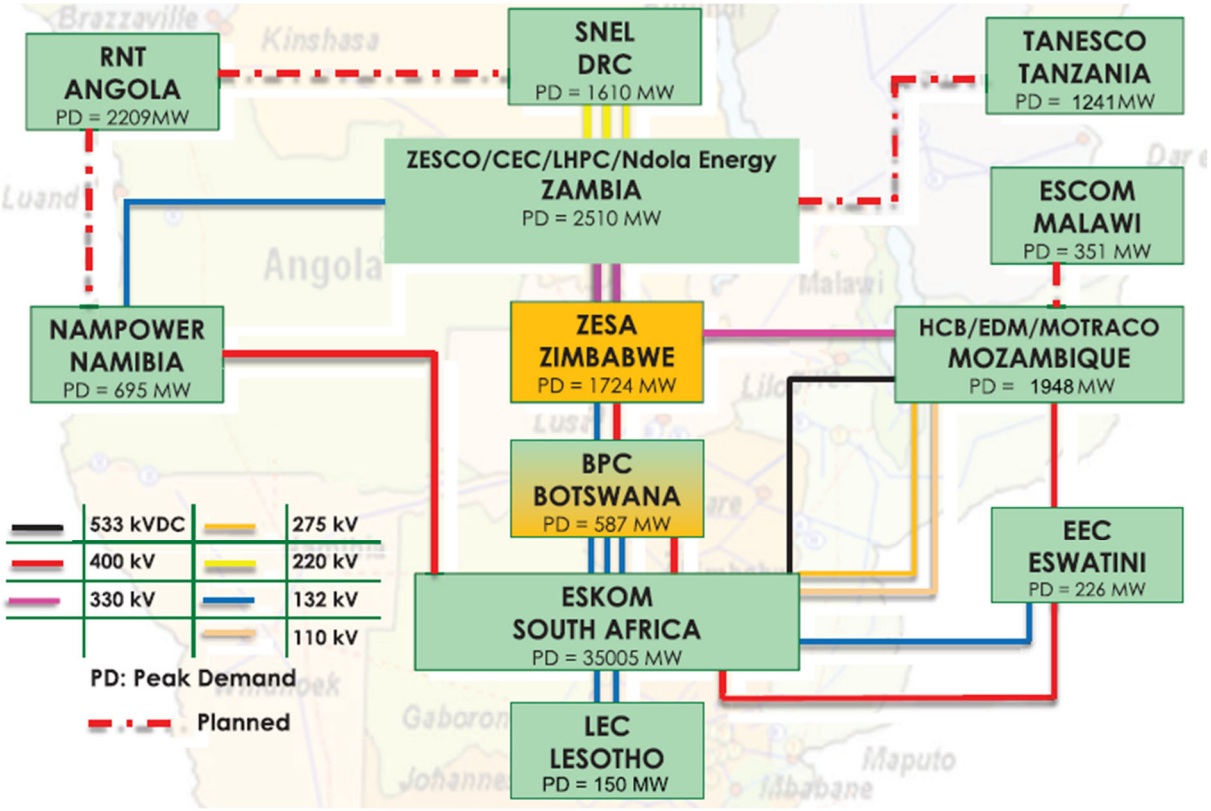
Reference: SAPP, 2021, with 2024 ZESCO LTD updates.

Figures 3-1 and 3-2 below respectively show the different interconnection projects between countries of the EAPP and the SAPP.




Reference: Medinilla et al. 2019.

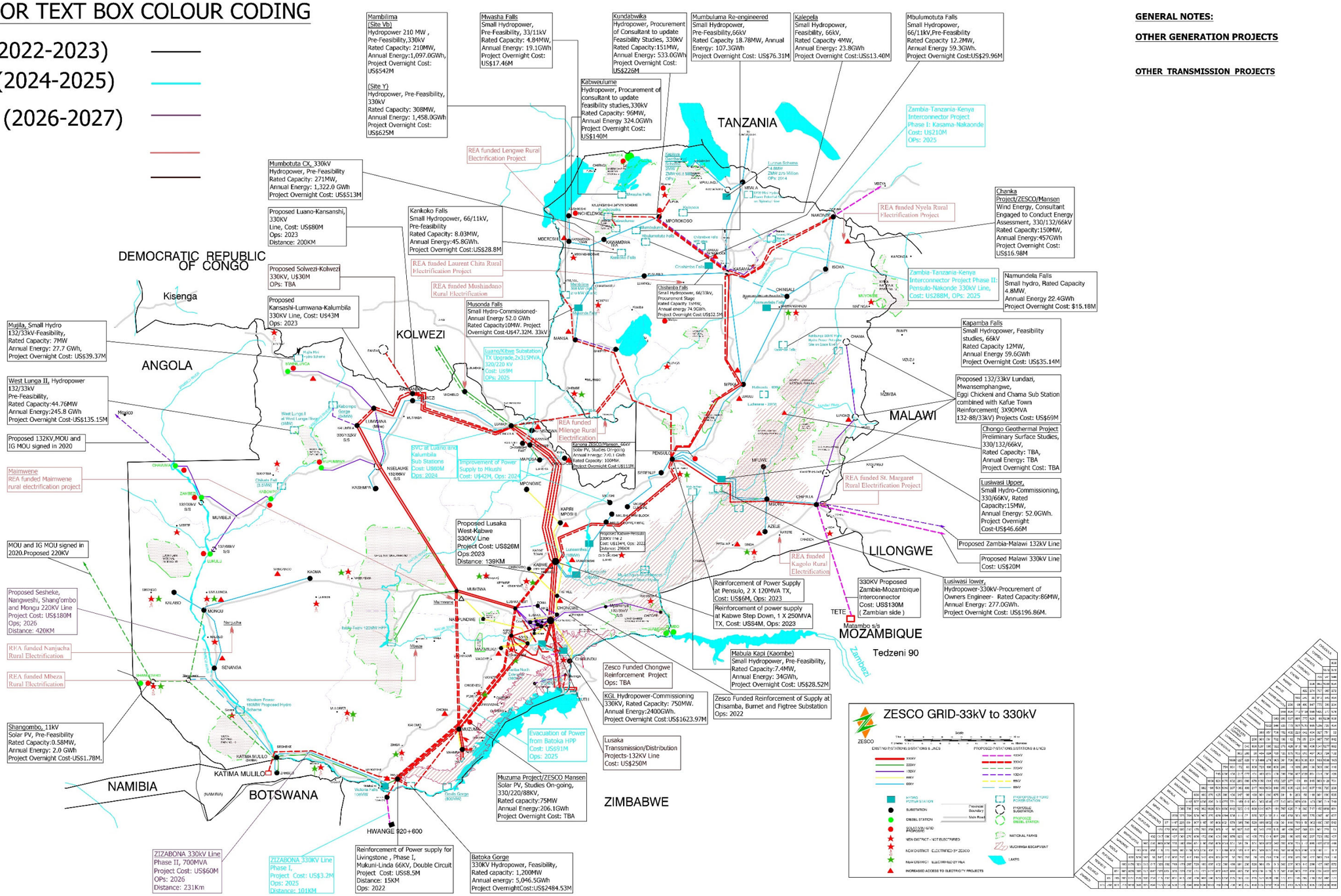
**Figure 3-1 Existing and Projected Interconnection Powerlines in the Eastern Africa Power Pool**




Reference: Southern Africa Power Pool, 2021.

**Figure 3-2 Existing and Planned Interconnector Projects of the Southern African Power Pool**

At the regional level, interconnections help strengthen networks' reliability. Figure 3-3 shows Zambia's networks, which will be connected with the ZTIP.




Reference: ZESCO.

**Figure 3-3 ZESCO Electricity Grid**

# 3.2 PROJECT DESCRIPTION AND CONFIGURATION

## 3.2.1 HISTORICAL OVERVIEW

The Zambia-Tanzania Interconnector Project (ZTIP) was initiated in September 2013, as well as a consulting services mandate awarded to WSP (at the time named GENIVAR) for the realization of the associated Environmental and Social Impact Assessment (ESIA) and Resettlement Action Plan (RAP). The global Project was initially limited to a 400kV interconnection between the substations of Mbeya (in Tanzania) and Nakonde in Zambia, and a 330kV line between Nakonde and Kasama (in Zambia) for a total approximate length of 300 km (100 km in Tanzania and 200 km in Zambia).

In 2014 and 2015, the scope of the global Project was revised to take into consideration an extension of the transmission line between Nakonde to Mpika and then to Kabwe in Zambia, which would allow for a better interconnection of the respective countries' electrical networks. Another revision completed in 2016 eliminated the link between Nakonde and Mpika and redirected it to link Kasama to Mpika. Another revision was performed in 2017 when technical studies concluded that a connection in Pensulo instead of Kabwe would yield comparable electricity transmission capacity and network interconnection, while also being approximately 250 km shorter. A last modification was made following acquired experiences and feedback from the implementation of a similar but separate 330kV transmission line project between Pensulo and Kasama and crossing the same area.

In 2021, when the most recent ESIA was completed by WSP, the Project considered the following global alignment:

- A double circuit 400kV line from Mbeya substation to a new substation in Tunduma in Tanzania, near the border with Zambia, where voltage will be stepped down to 330kVkV.
- A double circuit 330kV line that would continue south, crossing the border with Zambia and reaching the proposed Nakonde substation, in Zambia and continuing towards the southwest to the existing Kasama substation.
- A single circuit 330kV line that will continue further south to the existing Mpika substation, and finally to the existing Pensulo substation.
- A 132kV double circuit line from Nakonde substation which will loop in and out of the existing 66kV Isoka - Nakonde line.

This alignment amounted to 732.5 km of transmission line including 122.2 km at 400/330kV in Tanzania and 612 km at 330kV in Zambia.

The Project considered in the current ESIA update is similar to the above, except for the segment between the Nakonde and Kasama substations, which will now be a double circuit line inside the right-of-way acquired by ZESCO in between Kasama-Nakonde 330kV Project.

## 3.2.2 GENERAL PROJECT DESCRIPTION FOR ZAMBIA

### 3.2.2.1 CONTEXT

The ZTIP Project under study is developed through the facility set-up Cities and Infrastructure for Growth Zambia (CIGZambia). This organization's main objective is to provide high quality independent technical advice and assistance to Zambian government bodies and private sector organizations engaged in projects and programs that will help harness the potential of Zambia's cities and towns to act as drivers for economic growth and job creation. CIGZambia is funded by the UK Foreign, Commonwealth and Development Office (FCDO) and does not charge for its services.

Its main projects to date have been to support the electricity sector, with the main relevant completed projects being:

1 Assistance to the Ministry of Energy to prepare Zambia's first Integrated Resources Plan (IRP) for the electricity sector. The plan includes separate components relating to demand growth, generation, transmission, distribution and off-grid, and separate reports on cross-cutting impacts of climate, environment and social inclusion, implementation activities including financing and procurement, communications and monitoring and evaluation.

   The IRP has now entered the implementation phase. Its main recommendations contain valuable information with respect to the future investments in generation, transmission and distribution that will impact ZESCO's own strategic and business plans.

2 Assistance to ZESCO on the ZESCO Financial Sustainability Project through strategic advisory services to stabilize its financial performance and credit-worthiness to the point where it can be considered a viable commercial counterpart to raise funding for its own existing and planned projects in power generation, transmission and distribution, and to purchase power from Independent Power Producers ('IPPs') that have signed, or may in future sign a Power Purchase Agreement with ZESCO. In recent years, ZESCO has experienced financial distress arising from sector challenges including insufficient tariffs, the relatively high cost of new power generation from IPPs and power imports, and the effects of climate change on Zambia's main hydro plants, amongst other factors. As a result, there has been a need to regain the confidence of financiers and investors who in normal circumstances would be in a position to finance the majority of the projects recommended in the IRP, with a particular emphasis for this assignment on the projects to be implemented by, or connected to, ZESCO.

In the current context, CIGZambia is supporting the Government of Zambia to implement the IRP and close the financing gap to realize the IRP's objectives. A set of energy projects have been identified as requiring CIGZambia's support, which are expected to raise financing and are aligned to the IRP. One of the specific projects identified is the **Zambia-Tanzania Interconnector Project.**

### 3.2.2.2 PROJECT DESCRIPTION

The ZTIP Project involves construction and operation of 330kV electricity transmission lines mounted on steel lattice pylons linking the Nakonde substation with substations in Kasama, Mpika and Pensulo. The following configurations have been adopted for the entire Project:

- Nakonde – Kasama: two 330kV lines of alternating current mounted on one row of double circuit pylons over 212 km, for a 50 m ROW.
- Kasama – Mpika – Pensulo: one 330kV line of alternating current, mounted on one row of single-circuit pylons over 386 km (Pensulo to Mpika 186 km and Mpika to Kasama 200 km)., for a 50 m ROW when the new 330kV line wayleave is not paired with another existing wayleave and 35m ROW for 330kV line segments when paired with the existing 330kV line.

Other recommended ZTIP Project characteristics include:

- For the Kasama-Nakonde section:
  - A 330/132-66/33kV substation at Nakonde (including installation of dynamic voltage support device [±250 MVAr SVC or STATCOM]);
  - 15 km of a 400kV double-circuit transmission line from Nakonde to the Zambia – Tanzania boarder;
  - 12 km of a 132kV double circuit from Nakonde to Isoka (loop in and out of 66kV Isoka - Nakonde line);
  - Access and maintenance roads along wayleave, where necessary.
- For the Pensulo-Kasama section:
  - Expansion works on the existing substations at Pensulo, Mpika and Kasama;
  - Installation of Dynamic Voltage Support Device (±250 MVAr SVC or STATCOM and associated substation works at Pensulo Substation;
  - Access and maintenance roads along wayleave, where necessary.

The configurations above have been confirmed by the Project Implementation Unit and financiers and are presented in detail in the Project's Final Design Documents.

Unless specified otherwise, all Project description information in this chapter is based on the Line Route and Substation Reports and the Preliminary overhead line design Report prepared by WSP in November 2020 (WSP, 2020a, b, c) and the revised scope as submitted by ZESCO. Transmission line corner point coordinates and substation coordinates are provided in Appendix 3-1. . .

### 3.2.3 PROPOSED LINE ROUTES

The proposed line routes design took the following aspects into consideration:

- The preferred corridors selected in the analysis of alternatives (see Chapter 4);
- The location of the proposed Nakonde substation;
- The necessity to avoid, as much as possible, the crossing of built environment (villages, groups of buildings, etc.).

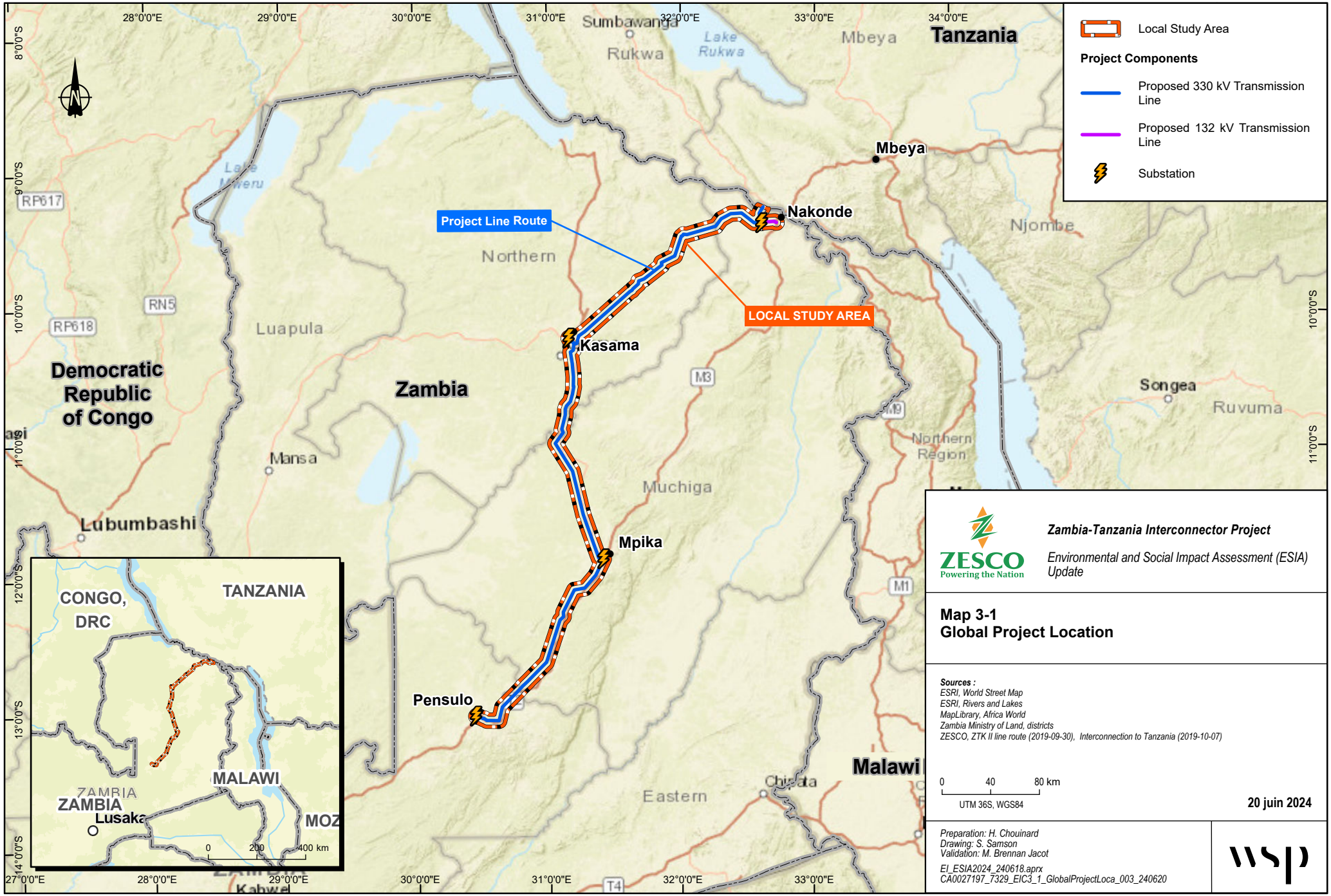
The proposed line route for the segment of the double-circuit 400kV line between the Nakonde substation and the Tanzanian border starts at the Nakonde substation and extends towards the northwest for approximately one kilometer and then turns north to cross the D1 Road. It continues towards the north for 7 km and then turns to the north-east and continues straight to the border.

The proposed 12 km double-circuit 132kV transmission line starts at the proposed Nakonde 330/132kV substation, extending east in a straight line traversing Nakonde ZAFFICO Pine Plantation for a distance of approximately 1.4 km before terminating on to the existing 66kV Isoka-Nakonde line. .

As for the main double-circuit 330kV line route, it starts at the proposed location of the Nakonde substation (see Map 3-1). It then follows a section of the south side of the D1 Road towards the northwest before turning west and following the southern side of the D3 Road. The proposed alignment then leaves the side of the D3 Road and descends in a straight line towards Kasama district traversing Mungwi, Chitimukulu and Kasama National Forests respectively. After crossing the D18 Road, the alignment turns towards the southwest to bypass Kasama's built area from the south and crossing the M1 Road before turning towards the northwest and reaches the Kasama substation.

From Kasama, the proposed line continues south following the western side of the M1 Road as well as the alignment of a recently built 330kV Pensulo-Kasama line for about 11 km, before diverging towards the west to avoid the Bwikashi farm, with which negotiations proved difficult during the Pensulo-Kasama 330kV Project construction. The line then goes in a southwestern direction for about 3 km, where it makes an angle to head in a south-south-western direction. It crosses the Pensulo-Kasama 330kV Project at kilometer point (KP) 24 and continues in the same direction until it reaches Road M1 at KP 35 and veers in a southern direction. The Project follows Road M1 for approximately 5 km before crossing to its eastern side and then crossing the TAZARA railway to get to its eastern side. It follows the TAZARA railway and M1 Road until PK 77, where it veers to the south-south-east to follow Road RD56, avoiding Chambeshi to the east and south. From there, it joins again with the Pensulo-Kasama 330kV Project, crosses it and follows its western side until reaching the Mpika substation located in the southern part of the community (see Map 3-1).

For the last segment between Mpika and Pensulo, the proposed alignment follows a southwestern route corresponding, for the most part, to the previously selected corridor 8 (see Map 3-1). It veers west after Lake Lusiwasi, at the level crossing of the town of Kanona within Kanona National Forest, to connect to the Pensulo substation from the north-east.




ZESCO Powering the Nation

*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 3-1**
**Global Project Location**

***Sources :***
*ESRI, World Street Map*
*ESRI, Rivers and Lakes*
*MapLibrary, Africa World*
*Zambia Ministry of Land, districts*
*ZESCO, ZTK II line route (2019-09-30), Interconnection to Tanzania (2019-10-07)*

0 40 80 km
UTM 36S, WGS84

**20 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC3_1_GlobalProjectLoca_003_240620*

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.*

# 3.3 PROJECT COMPONENTS

## *3.3.1 TRANSMISSION LINE*

### 3.3.1.1 VOLTAGE LEVEL

The Project will be operated at 330kV from the Pensulo substation to the Nakonde substation, which is the standard high-voltage tension level in Zambia. However, the last section between the Nakonde substation and the Tanzanian border will be designed and built at 400kV, but operated at 330kV.

Note that in addition to the above, the Project also includes the construction of a line segment designed at 132kV between the Nakonde substation and linking to the 66kV Isoka-Nakonde line; this is part of ZESCO's scope, to reinforce the existing network and increase reliability and security of energy supply.

### 3.3.1.2 NUMBER OF CIRCUITS

The Project involves three distinct line segments.

1. The section between the Tanzanian border and the Nakonde substation will be a double-circuit 400kV line.
2. The section between Kasama and Nakonde will be a double circuit 330kV line.
3. The section between Pensulo and Kasama will be a single circuit 330kV line and it will be operated in pair with an existing Pensulo-Kasama 330kV single circuit line.

Overall, these components will form a double-circuit interconnection with the Tanzanian network, mounted on two distinct one-circuit lines for the section between Pensulo and Kasama and on one double circuit line for the section between Kasama and Nakonde.

The pylons configuration along the line will be adapted based on voltage level and number of circuits for each section.

### 3.3.1.3 TOWER TYPES

Technical studies recommend selection of a combination of guyed and self-supporting lattice steel towers, as they are commonly used in Zambia. However, ZESCO is presently opting to predominantly use self-supporting steel lattice towers at the 330kV voltage level and this will be adopted for this Project. Tower characteristics that are planned in double-circuit and single-circuit scenarios are presented in the Table 3-3 below. It should be noted that pylon heights vary in function of technical requirements caused by local constraints such as topography, line spans, crossings of infrastructure, etc. Aspects of self-supporting and guyed 330kV single-circuit towers are illustrated on Figure 3-4 while Figure 3-5 illustrates a 330kV double-circuit DC suspension tower. Figure 3-6 shows an example of a 440kV double circuit transmission line. Pylons drawings are included in Appendix 3-2.

**Table 3-3 Tower Characteristics[1]**

| Characteristics | Single-circuit, Rigid suspension, 330kV | Double-Circuit DC suspension 330kV | Double-Circuit DC suspension 400kV | Double Circuit suspension 132kV |
|---|---|---|---|---|
| Tower heights (m from top of foundations to top of pylons) | Standard: 31<br>Minimum: 26.5<br>Maximum: 37 | Standard: 44.45 | Standard: 50.3<br>Minimum: 44.3<br>Maximum: 60.8 | Standard: 21<br>Minimum:18<br>Maximum: 30 |
| Average line span (m) | 400 | 375 | 400 | 300 |
| Locations | Kasama to Pensulo substations | Kasama to Nakonde substations | Nakonde substation to Tanzanian border | Nakonde new substation to Nakonde –Isoka(Loop in-Loop out) |

Reference: Field mission[2].

**Figure 3-4 Combined Use of Self-Supporting and V-Guyed Single-Circuit Towers**

1 Reference: AECOM, 2017. Feasibility Study and Conceptual Design of Tanzania-Zambia Power Interconnection Study. Final Feasibility Study.

2 Reference: AECOM, 2017. Feasibility Study and Conceptual Design of Tanzania-Zambia Power Interconnection Study. Final Feasibility Study.

Figure 3-5 Typical DC suspension double-Circuit Towers

Figure 3-6 Example of a 400kV Double-Circuit Transmission Line

### 3.3.1.4 PHASE CONDUCTORS

Conductors will be the Bison type (ACSR) for the single circuit (Pensulo-Kasama) and double circuit (Kasama-Nakonde) 330kV line. Their use is justified because of their high strength parameter, necessary for very long spans and heavy loads. A bundle of 2 conductors per phase is necessary.

For the 400kV double-circuit line between the Nakonde substation and the Tanzania border, the conductors will be BlueJay type (ACSR) in bundle of 2 conductor per phase.

For the 132kV double circuit line that will loop in and out of the 66kV Isoka-Nakonde line, the conductor will be a Wolf ACSR.

### 3.3.1.5 FOUNDATIONS

Foundation design will be subject to re-evaluation on completion of the site geotechnical investigations. Soil properties including actual quantities of foundations for each tower type located in these soil classifications will be estimated following a full review of the geotechnical results and quantified within the Price Schedules.

- Rock Socket / Rock Anchors where solid rock is encountered
- Concrete pad and chimney: generally based on the allowable bearing capacity of each soil type
- Special foundations either piled or raft type, where soils are particularly poor.

The contractor will be fully responsible for determining the soil classification at each tower location prior to installation.

A slab foundation with reinforced concrete body consists of reinforced concrete slabs buried about 3.0 m below the ground, one for each leg of the tower. Backfilling is done with dug up material excluding organic surface matter. This foundation is adequate for firm or rigid clay soils, firm or rigid laterite soils, medium to large grained alluvial formations lying above the water table, and diggable bedrock. In firm soils the slab may be poured directly into the dug-up soil to take advantage of the better capacity of intact soil. Wider footings will be required for foundations in loose soil or soil below the water table.

When bedrock is encountered that is too hard to be excavated by an excavator, rock-anchored concrete blocks will be required to support the towers. Reinforcement bars are driven and grouted into holes bored into the rock. This type of foundation is appropriate for locations where bedrock is found less than 3.0 m below the surface and is too hard for digging without hammer tools or blasting.

Concrete pylon foundations are commonly used in Zambia.

#### 3.3.1.6 RIGHT-OF-WAY

### REQUIRED RIGHT-OF-WAY

Width of the right-of way had to be determined to satisfy minimum technical requirements and comply with the standards used by ZESCO. ROW will vary according to the voltage level.

However, width of the acquired wayleave varies along the alignment, depending on whether or not the Project is paired with another ZESCO wayleave. The additional wayleaves required can be summarized as follows (AECOM, 2017):

- 60 m for the double-circuit 400kV line between Nakonde and the Tanzanian border;
- 50 m when the new 330kV line wayleave is not paired with another existing wayleave;
- 35 m for 330kV line segments paired with the existing 330kV line present between Pensulo and Kasama;
- 32 m for the 132kV between the Nakonde substation and linking to the 66kV Isoka-Nakonde line.

### RIGHT-OF-WAY MANAGEMENT

The current ROW management practices in Zambia, according to ZESCO officials, are described in the following table. (Table 3-4).

**Table 3-4 Current ROW Management Practices in Zambia**

| Item | Practices |
|---|---|
| ROW acquisition practices | The policy currently in place at ZESCO is to acquire the entire wayleave. |
| Uses allowed in the ROW | Growing of seasonal low laying crops; below 2 m in height (e.g., maize, wheat, etc.) is allowed. |
| Uses not permitted | Growing crops exceeding 2 m in height is not allowed. As per ZESCO policy, crop(s) destroyed during construction or maintenance will be compensated for. |
| Policy regarding service road minimization | The ZESCO environmental guidelines urge the Contractors to only create new access roads where there are no existing ones. They are always encouraged to use and maintain existing roads. |

Also, in order to maximize chances of achieving the above-mentioned ROW requirements and reduce theft of steel bracing and grounding materials from towers to a minimum, experience from other projects in the region has shown that engaging local communities along the line in maintenance and monitoring of the line can be effective.

The Consultant's other recommendations are the following:

- Within the wayleave, all structures that could be a nuisance to the safety and reliability of the network should be removed;
- In addition, ZESCO, who will be responsible for maintenance, may find it advantageous to be on good terms with the users of the ROW and to give them responsibility for vegetation control in their respective section of the ROW. This type of agreement allows the individual to continue to operate (e.g., agriculture, livestock, etc.), as long as they do not pose a risk to the network's operation. For the operations manager, these agreements help to reduce the risk of theft and vandalism on the line.

## 3.3.2 SUBSTATIONS

Only one substation will need to be built for the Project, that is: the Nakonde Substation. All other substations are already built but will require the addition of some new equipment in relation with the new interconnector Project. Substations configuration drawings are available in Appendix 3-3 and substations coordinates are available in Appendix 3-1.

### 3.3.2.1 NAKONDE SUBSTATION

The proposed substation in Nakonde District is located within Chitamba village in Chieftainess Nawaitwika area, at an altitude of 1,500 m. The proposed configuration of the 330kV and 66kV switchgear is double busbar, single circuit breaker with bypass disconnector. The 330kV busbar shall comprise of the following (WSP Scoping Report, 2020; rev. 3):

- Double 330kV Busbar with associated Busbar CVTs;
- Two (02) x 330kV / 66kV (132kV) Transformer Bays;
- One (01) x 30 MVAr 330kV Busbar Shunt Reactor Bay;
- One (01) x 330kV Bus Coupler Bay;
- One (01) x Kasama 1 - 330kV Feeder Bay with 1 x 30 MVAr 330kV Line Shunt Reactor;
- Space allocation for one (01) x Kasama 2 – 330kV Future Feeder Bay – part of ZTIP Phase 2 works;
- Space for two (02) additional Feeder Bays exiting to the west in the same direction as the two (02) Kasama bays;
- Space for two (02) 330kV feeder bays exiting to the east towards Tanzania – this will be for Tunduma 1 and Tunduma 2 feeders, which will also be included in the scope for ZTIP Phase 2.

High-level scope of works at Nakonde substation shall comprise of the following:

- Two (02) x Kasama - 330kV Feeder Bays each fully equipped with 1 x 30 MVAr 330kV Line Shunt Reactor Bay;
- One (01) x Tunduma 1 - 330kV Feeder Bay fully equipped;
- One (01) x Tunduma 2 - 330kV Feeder Bay fully equipped;
- Two (02) X 60MVA, 330/132kV transformer Bays;
- Isoka and Nakonde 66kV Feeder Bays ;
- 330 and 66kV Busbars complete with Buscouplers;
- One (01) x ±250 MVAr SVC or STATCOM.

### 3.3.2.2 KASAMA SUBSTATION

The existing Kasama substation is located close to Kasama Town within Simbeye village in Senior Chief Mwamba's area at an altitude of 1,335 m. The substation has sufficient space in the existing yard to accommodate the proposed ZTIP Phase 2; the substation yard is approximately 292 m x 251 m.

The configuration of 330kV switchgear is double busbar, single circuit breaker with bypass disconnector. The 330kV busbar comprises of the following (WSP Scoping Report, 2020; rev 3):

- Double 330kV busbar with associated busbar CVTs;
- Two (02) x 330kV/66kV Transformer Bays;
- One (01) x 30 MVAr 330kV Busbar Shunt Reactor Bay;
- One (01) x 330kV Bus Coupler Bay;
- One (01) x Mpika 1 - 330kV Feeder Bay with 2 x 30 MVAr 330kV Line Shunt Reactors;
- Space for multiple Feeder/Busbar Shunt Reactor Bays;

The Kasama substation scope shall be as follows:

- Two (02) x Nakonde 330kV Feeder Bays each fully equipped with 1 x 30 MVAr 330kV Line Shunt Reactor Bay;
- One (01) x Mpika 330kV Feeder Bay fully equipped with 1 x 30 MVAr 330kV Line Shunt Reactor Bay;
- Two (02) x Mporokoso 330kV Feeder Bays unequipped.

### 3.3.2.3 MPIKA SUBSTATION

The existing Mpika substation is located within Yowani village in Chief Chikwanda's area at an altitude of 1,375 m. The substation comprises of 330kV and 66kV (132kV) busbars. The substation yard is approximately 201 m x 204 m.

The configuration of 330kV switchgear is double busbar, single circuit breaker with bypass disconnector. The 330kV busbar comprises of the following (WSP Scoping Report, 2020; rev. 3):

- Double 330kV busbar with associated busbar CVTs;
- Two (02) x 330kV / 66kV (132kV) Transformer Bays;
- One (01) x 30 MVAr 330kV Busbar Shunt Reactor Bay;
- One (01) x 330kV Bus Coupler Bay;
- One (01) x Pensulo 1 - 330kV Feeder Bay with 30 MVAr Line Shunt Reactor;
- One (01) x Kasama 1 - 330kV Feeder Bay;
- Space for two (02) x 330kV Feeder Bays – reserved for Pensulo 2 and Kasama 2.

The Mpika substation scope shall be as follows:

- One (01) x Kasama 330kV Feeder Bay fully equipped with 1 x 30 MVAr 330 kV Line Shunt Reactor Bay;
- -One (01) x Pensulo 330kV Feeder Bay fully equipped with 1 x 30 MVAr 330kV Line Shunt Reactor Bay;.

### 3.3.2.4 PENSULO SUBSTATION

The existing Pensulo substation is located within Pensulo area of Serenje District in Chief Kabamba's Chiefdom at an altitude of 1,570 m. The Pensulo substation comprises of 330kV and 66kV busbars; the existing substation yard is approximately 240 m x 214 m.

Configuration of existing 330kV switchgear is double busbar, single circuit breaker with bypass disconnector. The existing 330kV double busbar system at Pensulo comprises of seven (7) useable bays (WSP Scoping Report, 2020; rev. 3):

- 330kV double busbar with associated 330kV CVTs;
- Three (03) x 330kV / 66kV Transformer Bays;
- One (01) x 330kV Bus Coupler Bay;
- One (01) x Msoro 330kV Feeder Bay with 1 x 30 MVAr Line Reactor;
- One (01) x Kabwe 330kV Feeder Bay;
- One (01) x Mpika 1 ("Kasama" on SLD) - 330kV Feeder Bay with 2 x 30 MVAr Line Reactors;
- One (01) x Spare 330kV Feeder Bay;
- Pensulo-Kabwe line 2.

Unlike Mpika and Kasama substations, the busbar phase spacing is 5 m.

- The Pensulo substation scope shall be as follows: One (01) x Mpika 330 kV Feeder Bay fully equipped with 1 x 30 MVAr 330kV Line Shunt Reactor Bay;
- One (01) x ±250 MVAr SVC or STATCOM .

### 3.3.2.5 EQUIPMENT ASSOCIATED WITH PROPOSED BAYS

The following describes the general characteristics for the substations. The electrical characteristics of the substations will be as shown in Table 3-5 below (WSP Scoping Report, 2020; rev. 3):

**Table 3-5 Substation electrical characteristics**

| Description | Characteristics | |
|---|---|---|
| Rated voltage | 330kV (RMS) | 400kV (RMS) |
| Highest system voltage | 362kV (RMS) | 420kV (RMS) |
| Neutral earthing | Solidly earthed | Solidly earthed |
| Nominal frequency | 50 Hz | 50 Hz |
| Rated switching impulse withstand voltage | Switchyard equipment: 950kV peak<br>Transformer and reactor: 1050kV peak | Switchyard equipment: 1050kV peak<br>Transformer and reactor: 1175kV peak |
| Rated lighting impulse withstand voltage | Switchyard equipment: 1175kV peak<br>Transformer and reactor: 1300kV peak | Switchyard equipment: 1425kV peak<br>Transformer and reactor: 1550kV peak |
| Power-frequency withstand voltage | Switchyard equipment: 510kV peak (RMS)<br>Transformer and reactor: 560kV peak (RMS) | Switchyard equipment: 570kV peak (RMS)<br>Transformer and reactor: 625kV peak (RMS) |

| Description | Characteristics | |
|---|---|---|
| Rated current | 2500 A except circuit breakers that are 4000 A | 1600 A except circuit breakers that are 4000 A |
| Rated short-term withstand current | 40 kA, 3 s/ 100 kA except circuit breakers that are 50 kA, 3 s/ 125 kA | 40 kA, 3 s/ 100 kA except circuit breakers that are 50 kA, 3 s/ 125 kA |
| Minimum insulator creepage distance | 31mm/kV (∅ - ∅) | 31mm/kV (∅ - ∅) |

The environmental characteristics, which will be stated in the substation general specification document, are the following (Table 3-6):

**Table 3-6 Substation environmental characteristics**

| Ambient air temperature | Indoor | Outdoor |
|---|---|---|
| Maximum | +35°C | +45°C |
| 24-hour average, max | +21°C | |
| Minimum | +5°C | -1°C |
| Humidity | 90% | 100% |
| Average annual rainfall | | 1100 mm |
| Altitude | 2000 m (design) | 2000 m (design) |

Table 3-7 lists the size and number of line, busbar shunt reactors and neutral compensator reactors (NCR) at each substation.

**Table 3-7 Number of line, busbar shunt reactors and neutral compensator reactors (NCR) at each substation**

| Substation | Line/Bay | Shunt reactors – single phase | | | Neutral compensator reactor | |
|---|---|---|---|---|---|---|
| | | Rated/highest system voltage (kV) | Rating (kVar) | Number of units | Rated system voltage (kV) | Rating (kVar/ approx. Ω) |
| Pensulo | Pen-Mpika 1 (existing) | 362/√3 | 3x10000 | 2 | 35kV | 15 kVAR / 3 Taps approx. 900 Ω +/- 10% |
| Pensulo | Pen-Mpika 2 (ZTIP phase 2) | 362/√3 | 3x10000 | 1 | 35kV | 15 kVAR / 3 Taps approx. 900 Ω +/- 10% |
| Mpika | Mpika-Pen 1 (existing) | 362/√3 | 3x10000 | 1 | 35kV | 15 kVAR / 3 Taps approx. 900 Ω +/- 10% |
| Mpika | Mpika-Pen 2 (ZTIP phase 2) | 362/√3 | 3x10000 | 1 | 35kV | 15 kVAR / 3 Taps approx. 900 Ω +/- 10% |
| Mpika | Mpika-Kasama 1 (existing) | 362/√3 | 3x10000 | 1 | 35kV | 15 kVAR / 3 Taps approx. 900 Ω +/- 10% |
| Mpika | Mpika-Kasama 2 (ZTIP phase 2) | 362/√3 | 3x10000 | 1 | 35kV | 15 kVAR / 3 Taps approx. 900 Ω +/- 10% |
| Mpika | Busbar shunt reactor 1 (existing) | 362/√3 | 3x10000 | 1 | N/A | N/A |
| Kasama | Kasama-Mpika 1 (existing) | 362/√3 | 3x10000 | 2 | 35kV | 16 kVAR / 3 Taps approx. 1000 Ω +/- 10% |
| Kasama | Kasama-Mpika 2 (ZTIP phase 2) | 362/√3 | 3x10000 | 1 | 35kV | 16 kVAR / 3 Taps approx. 1000 Ω +/- 10% |
| Kasama | Kasama-Nakonde 1 (ZTIP phase 2) | 62/√3 | 3x10000 | 1 | 35kV | 16 kVAR / 3 Taps approx. 1000 Ω +/- 10% |

| Substation | Line/Bay | Shunt reactors – single phase | | | Neutral compensator reactor | |
|---|---|---|---|---|---|---|
| | | Rated/highest system voltage (kV) | Rating (kVar) | Number of units | Rated system voltage (kV) | Rating (kVar/ approx. Ω) |
| Kasama | Kasama-Nakonde 2 (ZTIP phase 2) | 362/√3 | 3x10000 | 1 | 35kV | 16 kVAR / 3 Taps approx. 1000 Ω +/- 10% |
| Kasama | Busbar shunt reactor 1 (existing) | 362/√3 | 3x10000 | 1 | N/A | N/A |
| Nakonde | Nakonde-Kasama 1 (ZTIP phase 2) | 62/√3 | 3x10000 | 1 | 35kV | 16 kVAR / 3 Taps approx. 1000 Ω +/- 10% - TBC |
| Nakonde | Nakonde-Kasama 2 (ZTIP phase 2) | 362/√3 | 3x10000 | 1 | 35kV | 16 kVAR / 3 Taps approx. 1000 Ω +/- 10% - TBC |
| Nakonde | Busbar shunt reactor 1 (future) | 362/√3 | 3x10000 | 1 | N/A | N/A |

### 3.3.3 TEMPORARY FACILITIES

During construction, it will be necessary to establish temporary facilities and installations where required:

- Construction camps,
- Access roads,
- Laydown and storage areas,
- Concrete facilities, etc.

Construction activities are forecasted to include the following activities, as per detailed in Table 6-1: site preparation, transportation and traffic circulation, construction (including tower erection, stringing works, etc.), and waste management and hazardous materials management. Those broad categories will be defined in more detail by the Contractor at the beginning of the assignment, during the pre-construction phase, when the Contractor will develop various construction plans.

The location and extent of these components are not yet known and will be the Contractor's responsibility.

## 3.4 PROJECT COSTS AND SCHEDULE

The budgetary estimate for the Project is $285M, including associated project management and capacity building costs. The World Bank has agreed in principle to provide most of the financing for the Project.

The Project is likely to be co-financed with smaller contributions from the European Union (EU) and United Kingdom (UK) Government through the Foreign, Commonwealth and Development Office (FCDO). The Project will be implemented by ZESCO and incorporated within ZESCO's Transmission Division.

As for implementation schedule, activities starting from the start-up meeting of the construction contract to commissioning, are planned to require 24 months. The first months will be dedicated to preparation activities such as detailed survey, preparation of construction schedule, detailed design, etc. Field construction activities are planned to begin at month 7, and therefore it will last 17 months. Details of the construction schedule are provided in Appendix 3-5.

Some uncertainty remains however, regarding the preparation time that will be needed to reach the effective date of contract commencement. Among others, are delays for resettlement actions, which will be spread over a considerable period of time (estimate provided in standalone RAP). It is therefore not possible to predict with accuracy the beginning of construction activities without considering the implementation schedule for the Resettlement Action Plan (RAP).

## 3.5 PROJECT REQUIREMENTS

The Project will require various locally available construction materials for construction of the transmission line. Such locally sourced materials required for construction work include aggregates, gravel or crushed stone, sand and water. These will be sourced in areas within the footprint of the Project site.

Detailed Project requirements are not available at this stage of the Project design and will be detailed in construction plans by the Contractor, once a contractor has been selected. However, in line with ESS 1, sourcing of construction materials will be subject to environmental and social due diligence processes to ensure that such materials are sources from compliant facilities. The due diligence process will be under the Contractor's responsibility, with oversight from the PIU.

### *3.5.1 AGGREGATES, GRAVEL, AND SAND*

Aggregates, gravel, and sand will mostly be required for installation of pylon foundations. Required volumes are not known at this stage and are to be confirmed by the selected Contractor; however, these are are estimated at 35,000 tonnes of aggregate, 15,000 tonnes of sand, and 20,000 tonnes of gravel. They will be sourced locally as much as possible, and if not, these will be transported by trucks to the Project site. Once the test results indicate their suitability for work, agreements can be made with the quarry or landowners for production to meet the Project requirements.

### *3.5.2 WATER*

Water will also be required for Project construction work. The source of water for the construction work will be from the local suitable streams that cross the Project area or water boreholes. Required volumes of water will be confirmed ahead of construction by the Contractor, but it is currently estimated that approximately 400,000 liters of water may be required. The Contractor will need to obtain required water use permits.

### *3.5.3 PERSONNEL*

Although the number of workers to be employed is not yet established, it is expected that at the peak of the construction phase, as many as 600 workers will be employed. Of the 600 employed during construction, approximately 120 shall work for the Project for the duration of the construction period via contracts with the prime Contractor and their subcontractors. It is estimated that approximately 20% of employees will be skilled and 80% will be unskilled. It is also expected that approximately 85% of employees will be local and 15% will be regional or international.

The types of positions that may be created during the construction include civil work and installation service supervision (local or external personnel), expert level pre-commissioning work (external personnel), design work (external personnel), administration (local and external personnel), and shipment, logistics, and local transportation (local and external personnel). Additionally, informal jobs may be created by the Project through the supply of food and consumables to contractor camp sites.

After construction, the Project will be managed by the existing workforce in ZESCO. Direct job creation during operation and maintenance is estimated to remain low because associated activities will be completed by the established organizational structure in place.

### 3.5.4 CAMP SITES

The Contractor shall provide, maintain and operate, under a competent Manager, such camps and facilities necessary for maintaining an efficient and safe working environment for housing, feeding and accommodation of all employees. The location, construction, operation and maintenance of such camps and facilities shall be subject to the approval of the Supervising Engineer. The Project will require two types of camp sites; substation and transmission line camps. The substation camps are normally nearest to the substations and the line site camps are far away from towns and substations (normally over 50 km).

Regardless of the approval of the Supervising Engineer, the Contractor shall comply with all local laws and regulations that affect the buildings, maintenance or operation of the camps, and shall be responsible for any or all damages or claims resulting from inadequate or improper location of facilities or operations. The camps shall be designed accordingly.

### 3.5.5 LOCAL SUPPLIES AND SERVICES (FOOD, MEDICAL ATTENTION, AND FUEL)

The most likely way to get food for workers is from nearby villages. Although it is anticipated that approximately 648 tonnes of food will be required (e.g., carbohydrates, fat, and proteins), the exact mechanisms for this provision still need to be determined in order to not impair local food resources.

Health treatments will be from District Hospitals on an as needed basis (i.e., monthly malaria treatment for 6 months of the year, for a two-year period, and treatment for STI`s).

It is expected that approximately 2 million liters of diesel fuel will be required, which will be sourced in bulk.

### 3.5.6 ELECTRICITY

Power during construction will be supplied from generators. During operation, electricity will be taken on the ZESCO network.

## 3.6 PROJECT ACTIVITIES

### 3.6.1 PRE-CONSTRUCTION PHASE

The pre-construction phase will start once all studies are completed and the Project is ready to be implemented. The main activities being conducted at different stages include:

- Labour recruitment, including hiring of local and foreign workers.
- Land acquisition and resettlement of affected persons and assets, which will include displacement of economic activities.
- Site preparation: site preparation activities, including establishment of equipment storage yards and worker camps, vegetation clearing, removal of topsoil, excavation, earthworks and construction of access roads.The exact size and location of the storage yards and worker camps remain to be specified. The extent and configuration of vegetation clearing will require only strips of land to be cleared due to it being for line construction and certain access roads.

### 3.6.2 CONSTRUCTION PHASE

The construction phase will mainly involve the following activities:

- Transportation and traffic: road transportation of materials, equipment and workers to and from the site, including fueling and maintenance of vehicles and machinery.
- Construction activities: construction of the power transmission line and substations, including temporary facilities used during the work phase, such as borrow pits, as well as the erection of towers and stringing of conductors.
- Waste and hazardous materials management: management and storage of waste, hazardous substances and other materials to be removed, including hydrocarbons.
- Purchase of materials, goods and services: purchases required for the construction of the power transmission line and substations.
- Presence of workers: presence of the construction workforce, including hiring foreign and local skilled/unskilled workers, as well as the installation and operation of construction work camps.

### 3.6.3 OPERATION PHASE

The following activities are expected during the operation phase:

- Presence and operation of line, substations and access roads: presence and operation of facilities.
- Transportation and traffic: road transportation of materials and equipment, including vehicle fueling and maintenance.
- Maintenance and repairs: inspection, maintenance and repair of conductors, towers and structures in substations, as well as ROW maintenance.
- Waste and hazardous materials management: handling operations and storage of hazardous waste used during the operation, including oil used in transformers at substations.
- Purchase of materials, goods and services: purchases required for the operation of the substations and the transmission line.
- Presence of workers: hiring local and foreign workers, as appropriate, and presence of employees operating substations and during maintenance along the line.

### 3.6.4 DECOMMISSIONING PHASE

The Project, like other transmission lines, involves the construction of permanent electricity infrastructure, and therefore, it is not envisaged that the transmission line will be decommissioned soon. However, after the Project's operational design lifespan, a reassessment of the status of the transmission line shall be carried out. The decommissioning phase refers to all activities related to the proposed transmission line when it is no longer in use.

The following activities could be expected during the decommissioning phase:

- Decommissioning activities: dismantling of equipment, including lines, transmission towers, substations and other associated components; removal of temporary structures, landscaping, clearing of the ROW and access roads, filling in pylon locations, removal of construction materials and waste, levelling, sloping and revegetation.
- Transportation and traffic: traffic related to vehicle transport of materials, goods and workers associated with the decommissioning work, removal or handover of service roads and construction access roads.

- Waste and hazardous materials management: safe disposal of waste generated by dismantling of equipment.
- Purchase of materials, goods and services: purchases required for operation of the worker camps.
- Presence of workers: presence of the construction workforce, including hiring of foreign and local skilled/unskilled workers, as well as the installation and operation of construction work camps.

The proposed Project has a design lifespan of 50 years, after which the performance of the Project scales to diminishing. A detailed decommissioning plan should be prepared at the end of the Project life for approval by ZEMA before implementation. This plan shall contain at a minimum:

- Procedures for decommissioning,
- outcomes of consultations,
- Preliminary identification of potential impacts, and
- preliminary identification of mitigation measures.

The incorporation of remediation plans into the overall Project planning is essential because it allows proponents to understand the need to restore the environment to its original state or near its original state when decommissioning and remediation plans are being conceptualized.

# 4 PROJECT ALTERNATIVES ANALYSIS

The following sections provide a description of each of the proposed corridors, outline a methodology for the comparison of corridor options, and outline the results of an analysis of alternatives allowing for the identification of a technically feasible corridor option that results in the fewest environmental and social impacts.

## 4.1 THE "DO NOTHING" OPTION

The "do-nothing" option refers to a scenario where the Project is not implemented.

The main objective of the ZTIP project, as stated in the introduction of this ESIA, is to increase the firm capacity of the interconnection with Tanzania and enhance the transmission and distribution network capacity in the northern regions of Zambia, enabling access expansion. It will enable the full integration of SAPP and EAPP and create the largest geographic energy market in the world, from Cape to Cairo.

The ZTIP will lead towards market expansion for participating countries, improvement in their energy security, facilitate the diversification of energy sources, enable the sharing of generation reserves, and optimize the cost of electricity supply through trade, both regionally and for participating countries such as Zambia, specifically.

The above objective and its benefits will not be achieved under the "do nothing" option, which is the main risk of the "do nothing option".

Furthermore, the Project area currently faces several environmental and social issues, including:

- Degradation of natural vegetation cover, particularly near roads, villages, and watercourses where agricultural activities encroach on natural vegetation;
- Heavy reliance on charcoal and unsustainable agricultural practices which result in loss of forest cover, and increased soil erosion and sedimentation of watercourses;
- Local communities do not benefit from revenues from electricity trade, increased stability of the national electrical network, or potential economic growth associated with improved and increased access to electricity;
- Access to safe drinking water (e.g., protected wells, boreholes, or taps) is low in the Northern Province (26%), and better, but still problematic, in the Central Province (53.3%).

Under a "do-nothing" option, these national and local challenges would remain, and likely worsen over time.

Without access to electricity, use of wood and charcoal for cooking and heating is unlikely to reduce. Agricultural practices are also unlikely to change. As such, loss of forest cover and increased soil erosion and sedimentation of watercourses is likely to continue.

Socioeconomic benefits and economic gains anticipated from the Project would not be realised. Direct and indirect employment opportunities (including informal opportunities) for communities expected because of the construction and maintenance of the Project would not be realized. Improved household food security, resulting from decreased unemployment from the up to 600 employment opportunities during construction (at peak) (see Section 3.5.3 of the ESIA) and associated economic growth from direct and indirect employment opportunities, would not be felt. Similarly, local community and national development resulting from taxes and royalties associated with the Project would not occur.

In addition, the development and growth of the Northeastern part of the country, as well as the nation at large, would not experience the additional thrust in development of the electricity transport in the area.

Conversely, the negative impacts associated with the Project described in Chapter 6, such as permanent loss of natural habitats, increased habitat fragmentation, impacts on land use, the need for resettlement, and impacts on archaeological sites, specifically Mwela Rock Art site, would not occur.

## 4.2 DESCRIPTION OF THE CORRIDOR ALTERNATIVES

Corridor alternatives considered for interconnecting the Tanzanian and Zambian national electricity transmission systems were jointly developed by AECOM (as Feasibility Consultants) and WSP. These corridor alternatives were developed at various stages of the feasibility and E&S studies that have been conducted for the Project. All corridor alternatives are 2 km wide and vary in length. The corridor alternatives have been optimized where possible to reduce impacts and in consideration of technical elements (i.e., reducing the number of angle towers along the centreline). Environmental and social constraints within the Project area are numerous (see Chapter 5), due in part to the extent of the Project footprint, in which protected areas, wetlands, and human activity are common.

Corridor alternatives have been grouped according to three line-segments, that is the Tanzanian border to Kasama, Kasama to Mpika, and Mpika to Pensulo. The corridor alternatives developed are described hereafter from north to south with indicative kilometer posts (KPs) provided for key features. Due to the length of the corridor alternatives, each corridor will be described in sections that share similar general characteristics allowing for a more structured description of corridor alternatives. The description of alternatives is based largely on interpretation of satellite imagery and gathered primary and secondary data. The parameters used to compare corridor alternatives are outlined in Section 4-1. Maps 4-1 to 4-3 depict the corridor alternatives under study for each segment.

### *4.2.1 TANZANIAN BORDER TO KASAMA*

After having assessed various line route and design options in between the Tanzanian border and Kasama, it was decided to merge the ZTIP with Kasama-Nakonde single circuit 330kV line which is now the preferred option to house the ZTIP. Indeed, instead of having a single circuit 330kV ZTIP in parallel to the Kasama-Nakonde single circuit 330kV, it was decided to combine both lines on same pylons and to have a double circuit 330kV for this section. The following sections described corridor alternatives assessed for the Kasama-Nakonde single circuit 330kV line, which now hosts the ZTIP.

#### 4.2.1.1 CORRIDOR 1

Corridor 1 links the Tanzanian border and Kasama via a northern central route (see Map 4-1). The corridor accounts for 226.6 km in length. This corridor follows the Tazara railway and the D3 primary road for most of its length, crossing alternately relatively hilly topography and the northern extremity of the Chambeshi River floodplain. .

#### CORRIDOR 1, SECTION 1

Section 1 covers KP 0 to KP 14. From the border, the corridor reaches the prospective location of the Nakonde substation near the D1 Road and then veers west towards Kasama. That section is characterized by its relative proximity to Nakonde and the slightly higher population density that ensues. Denser agricultural zones are scattered along that section. Two village perimeters are also found along that stretch. However, none of those more densely built areas affected by the corridor's central axis. In terms of infrastructure, section 1 crosses the Tazara railway at KP 6 and reaches Departmental Road D1 at KP 13. Altitude at the Tanzania – Zambia border is at approximately 1,600 m, decreasing to 1,500 m at KP 14.

### CORRIDOR 1, SECTION 2

Section 2 covers the remainder of Corridor 1 (KP 14 to 226). Elevation oscillates between 1,500 m at the Nakonde substation and 1,250 m in the lowest areas crossing the Chambeshi floodplain. Isolated hills peaking at approximately 1,400 m are found along the way. In terms of existing infrastructure, this section of Corridor 1 follows the Tazara railway to Kasama, with some crossings along the way. Departmental Road D3 is also relatively parallel to the corridor along a significant stretch. Road D3 is partially unpaved. The linear infrastructure and Corridor 1 cross the northern extremity of the Chambeshi River floodplain, which is the main natural feature in the area. Section 2 is predominantly a rural complex zone. In terms of sensitive sites, the Zwangendaba burial site is in the area but does not appear to be impacted by the corridor. Human occupation is relatively sparse (i.e., sporadic), with village perimeters dispersed along the Tazara railway and the D3 Road, intensifying upon reaching Kasama. Three forest reserves are also present in the corridor, including Chitimukulu Forest Reserve (KP 184), Mungwi Forest Reserve (KP 194), and the Kasama National Forest Reserve (KP 209). Although largely disturbed, the riverine habitats within the Mungwi Forest Reserve play an important role in protecting the water catchment in that area and maintaining important ecological functions. The forest within the Kasama National Forest Reserve and the Chitimukulu Local Forest are relatively disturbed by human activity. The Mwela Rock Art site located within the Kasama National Forest Reserve is also crossed by Corridor 1. The corridor touches urban perimeters at KP 22.5, KP 31, KP 60.5, KP 86, KP 113, KP 117, KP 218, and KP 224. However, none of those perimeters are impacted by the central axis, except the entrance of Kasama which appears to be dominated by human dwellings surrounded by small agricultural plots, with little industrial/commercial land use.

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#### 4.2.1.2 CORRIDOR 2

Corridor 2 links the Tanzanian border and the Kasama substation via a southern route, mainly located along existing primary and secondary roads (see Map 4-1). The corridor alternative is 198 km in length. This corridor follows the D18 Road for most of its length, crossing alternately relatively flat to hilly topography and the Chambeshi River floodplain.

### CORRIDOR 2, SECTION 1

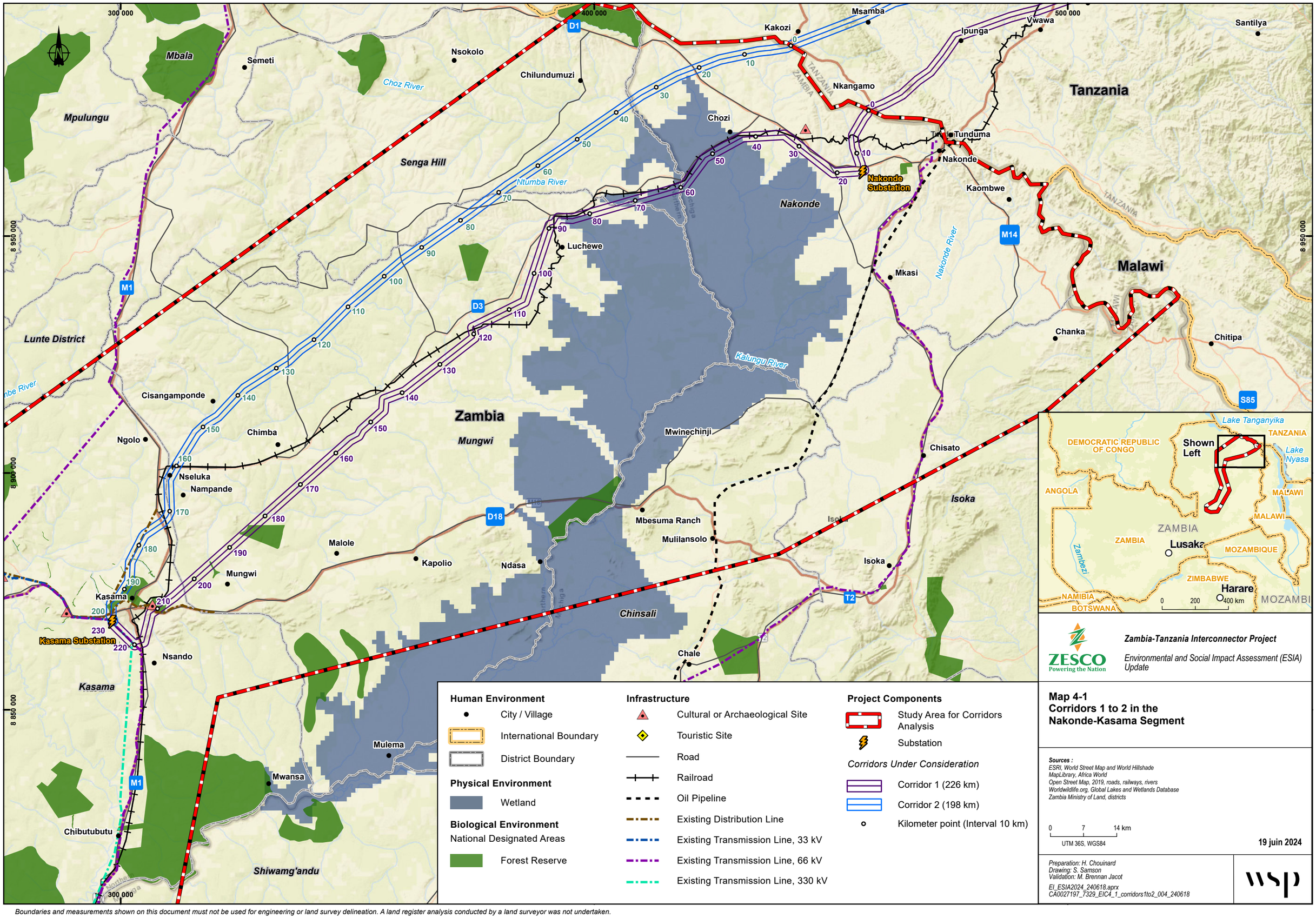
Section 1 extends from KP 0 to KP 69. From the Zambian border to the East of Nakonde, Corridor 1 reaches the southern side of the D1 Road. It heads out towards the southwest in a straight line up to the level of Kayambi. In doing so, the proposed corridor passes just south of the Luchinde Local Forest (No 449) and enters the Bemba (Makasa) Reserve at the level of Kayambi.

### CORRIDOR 2, SECTION 2

Section 2 extends from PK 69 to PK 169. It first veers to the southwest at the level of Kayambi and follows the northern side D3 Road as well as the Tazara railway until reaching the town of Nseluka. This corridor crosses the Bemba (Masaka) Reserve for approximately half the length of this section passing south of the Makasa Local Forest (No 229). As it exits the Bemba Reserve, the corridor follows the limits of the drainage basin of the Chamlubu (flowing on the north side) and of the Kalungu (flowing on the south side) Rivers. The section ends just after crossing part of the urban area of Nseluka and the M1 Highway heading north from Kasama.

### CORRIDOR 2, SECTION 3

Section 3 extends from PK 169 to PK 206. It begins just after the M1 Highway at the level of the town of Nseluka. It heads straight south in parallel to the west side of the M1 Highway for approximately 10 km. It then turns to the southwest passing through the Olam coffee farm and by the community of Mukanko, crossing the Milima River and following the northwestern limit of the Kasama Local Forest (No. 47). The alignment then turns sharply to the southeast, crosses the M3 Road and reaches the Kasama substation.




**Human Environment**
- City / Village
- International Boundary
- District Boundary

**Physical Environment**
- Wetland

**Biological Environment**
National Designated Areas
- Forest Reserve

**Infrastructure**
- Cultural or Archaeological Site
- Touristic Site
- Road
- Railroad
- Oil Pipeline
- Existing Distribution Line
- Existing Transmission Line, 33 kV
- Existing Transmission Line, 66 kV
- Existing Transmission Line, 330 kV

**Project Components**
- Study Area for Corridors Analysis
- Substation

*Corridors Under Consideration*
- Corridor 1 (226 km)
- Corridor 2 (198 km)
- Kilometer point (Interval 10 km)

ZESCO Powering the Nation

***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

## Map 4-1
## Corridors 1 to 2 in the Nakonde-Kasama Segment

***Sources :***
*ESRI, World Street Map and World Hillshade*
*MapLibrary, Africa World*
*Open Street Map, 2019, roads, railways, rivers*
*Worldwildlife.org, Global Lakes and Wetlands Database*
*Zambia Ministry of Land, districts*

0 7 14 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC4_1_corridors1to2_004_240618*

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.*

## 4.2.2 KASAMA TO MPIKA

### 4.2.2.1 CORRIDOR 3

Corridor 3 links Kasama and Mpika for a total length of 196.9 km (see Map 4-2). This corridor follows the western side of M1 Road and of the Tazara railway from Kasama to Mpika. A 330kV line is also present to the west of the corridor linking Pensulo to Kasama.

#### CORRIDOR 3, SECTION 1

Section 1 covers KP 0 to KP 13.6, from the substation to the peri urban limits of Kasama. It crosses a peri urban/rural complex area, with dense land occupation, mostly agricultural. Two forest reserves (24 and 25) are present near the northeastern limit of the corridor at KP 4 and KP 5.

#### CORRIDOR 3, SECTION 2

Section 2 includes KP 13.6 to KP 176.6 and it is characterized by the presence of bush, forested areas, and multiple crossings of the Chambeshi River. Human presence is low and is generally located close to the M1 Road. The only exceptions are a relatively dense agricultural area in the Kachasa area and in the Chandesi community area where population density is moderate (KP 85). At the level of Chandesi, the corridor also bypasses the Von-Lettow-Vorbeck Memorial site and a sensitive flooding area of the Chambeshi River.

At KP 43.7, the corridor crosses the western extremity of the Nkole Mfumu Forest Reserve. It also passes near the eastern limits of two other forest reserves, Lutadebwe (KP 65) and Chief Mpepo (KP 116 to KP 130). Other infrastructure from those mentioned above include secondary roads and trails and some lower voltage electrical lines and substations.

#### CORRIDOR 3, SECTION 3

Section 3 covers KP 176.6 to KP 200.6 and corresponds to the western and southern peri urban areas of Mpika. Human presence remains low to moderate with land occupancy characterized by a mixture of agriculture, forested areas, low-density dwellings along roads, and a few pockets of up to 50 residential dwellings. The corridor bypasses the Tazama oil storage facility on its southern side (KP 195.5) and crosses the Tazara railway at KP 195. Two 66kV lines (Pensulo-Mpika and Mpika-Kabwe) and a pipeline are present to the east of the centreline's ending point.

### 4.2.2.2 CORRIDOR 3A

Corridor 3A also links Kasama and Mpika for a total length of 194.6 km (see Map 4-2). The first 5.5 km follow the same alignment as Corridor 3. Where Corridor 3 veers south to stay on the western side of the M1 Road, Corridor 3A continues towards the southeast until crossing the M1 Road at KP 15.5. From this point to Mpika it generally stays on the eastern side of the M1. It also follows the Tazara railway for its entire length between Kasama and Mpika remaining on its eastern side.

#### CORRIDOR 3A, SECTION 1

Section 1 extends from KP 0 to KP 12.7 covering the peri urban area of Kasama. The area is characterized by moderate to high agricultural density with some dispersed dwellings located primarily around secondary roads and trails. Two forest reserves (24 and 25) are present near the northeastern limit of the corridor at KP 4 and KP 5.

#### CORRIDOR 3A, SECTION 2

Section 2 extends from KP 12.7 to KP 188. It is characterized by the presence of bush, forested areas, and multiple crossings of the Chambeshi River. Human presence is low and generally located close to M1 Road. The only exceptions are a relatively dense agricultural area, between the crossing point of the M1 and Tazara railway, south of Kasama and the community of Ishitu (KP 16 to KP 52), and in the Chandesi community area (KP 86) where population density is moderate with pockets of up to 50 residential dwellings. In this same general area, the corridor also crosses the Von-Lettow-Vorbeck Memorial site and a sensitive flooding area of the Chambeshi River.

Between KP 45 and KP 55, the corridor crosses the western extremity of the Nkole Mfumu Forest Reserve twice. Other infrastructure apart from those mentioned above include secondary roads and trails and some lower voltage electrical lines and substations. The centreline of the corridor crosses the M1 Road four times, at the beginning of the section (KP 15.5), twice more between the communities of Mpepo and Mushipashi (KP 107 to KP 27) and once more before arriving in the Mpika suburbs at KP 187.

#### CORRIDOR 3A, SECTION 3

Section 3 covers KP 188 to KP 198 and corresponds to the western and southern peri urban areas of Mpika. Human presence remains low to moderate (single dwellings along roads and pockets of up to 50 residential dwellings) and land occupancy is characterized by a mixture of agriculture, forested areas, and low-density dwellings. The Tazama oil storage facility falls within the corridor but its centreline is to the south of the facility (KP 193.3). It crosses the Tazara railway at KP 193. Two 66-kV lines (Pensulo-Mpika and Mpika-Kabwe) and a pipeline are present to the east of the end of the centreline.

### 4.2.2.3 CORRIDOR 3B

Corridor 3B links Kasama and Mpika for a total length of 199.3 km (see Map 4-2). A new 330kV line is located west of the corridor linking Pensulo to Kasama. This corridor is very similar to Corridor 3. It follows the western side of M1 Road and of the Tazara railway from Kasama to Mpika.

#### CORRIDOR 3B, SECTION 1

Section 1 covers KP 0 to KP 12, from the substation to the peri urban limits of Kasama. It crosses a peri urban/rural complex area, with dense land occupation, mostly agricultural. Corridor 3B runs parallel to the Pensulo to Kasama 330kV transmission line from KP 0 to KP 12. Within this section Corridor 3B intersects the eastern end of a small local forest at approximately KP 6.

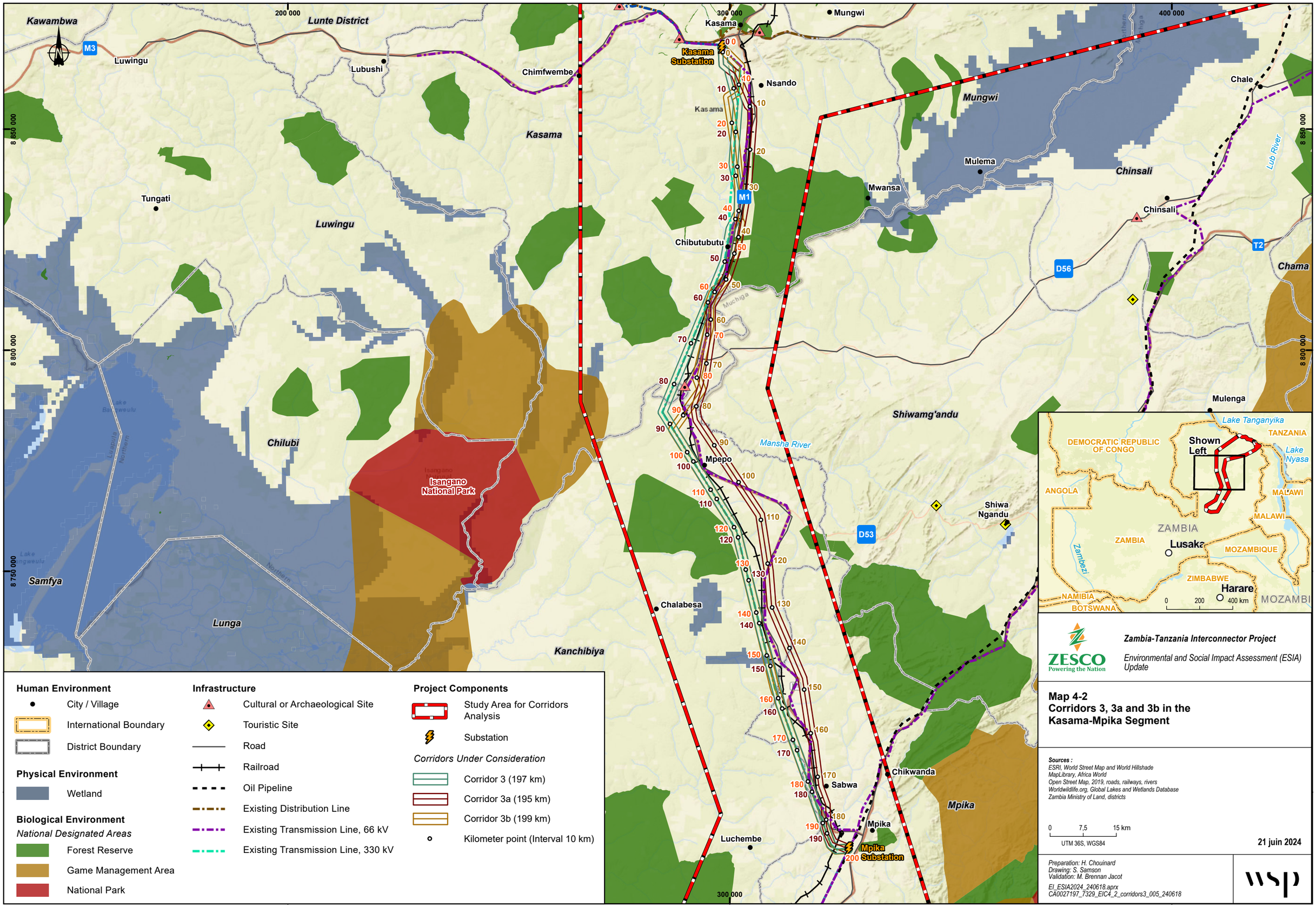
#### CORRIDOR 3B, SECTION 2

Section 2 extends from KP 12 to approximately KP 179 and is characterized by the presence of bush, forested areas, and multiple crossings of the Chambeshi River and its tributaries. Human presence is low and generally located close to the M1 Road, when present. The only exceptions are a relatively dense agricultural area in the Kachasa area and in Chandesi where population density is moderate (KP 90) with pockets of up to 50 residential dwellings. The Von-Lettow-Vorbeck Memorial site and a sensitive flooding area of the Chambeshi River are avoided between KP 80 and KP 90.

The corridor crosses the western extremity of the Nkole Mfumu Forest Reserve at approximately KP 45 and again between KP 51 and KP 55. From KP 97 to KP 179 Corridor 3B parallels the recently constructed Pensulo – Kasama 33-kV transmission line. Other infrastructure beyond those mentioned above include secondary roads and trails and some lower voltage electrical lines and substations.

#### CORRIDOR 3B, SECTION 3

Section 3 covers KP 179 to KP199.3 and corresponds to the western and southern peri urban areas of Mpika. Human presence remains low to moderate (single dwellings along roads and pockets of up to 50 residential dwellings) and land occupancy is characterized by a mixture of agriculture, forested areas, and low-density dwellings. The corridor bypasses the Tazama oil storage facility on its southern side (KP 195.5) and crosses the Tazara railway at KP 195. Two 66kV lines (Pensulo-Mpika and Mpika-Kabwe) and a pipeline are present to the east of the centreline's ending point. Corridor 3B runs parallel to the recently constructed Pensulo – Kasama 330kV transmission line.




**Human Environment**
- City / Village
- International Boundary
- District Boundary

**Physical Environment**
- Wetland

**Biological Environment**
*National Designated Areas*
- Forest Reserve
- Game Management Area
- National Park

**Infrastructure**
- Cultural or Archaeological Site
- Touristic Site
- Road
- Railroad
- Oil Pipeline
- Existing Distribution Line
- Existing Transmission Line, 66 kV
- Existing Transmission Line, 330 kV

**Project Components**
- Study Area for Corridors Analysis
- Substation

*Corridors Under Consideration*
- Corridor 3 (197 km)
- Corridor 3a (195 km)
- Corridor 3b (199 km)
- Kilometer point (Interval 10 km)

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## Map 4-2
## Corridors 3, 3a and 3b in the Kasama-Mpika Segment

***Sources :***
*ESRI, World Street Map and World Hillshade*
*MapLibrary, Africa World*
*Open Street Map, 2019, roads, railways, rivers*
*Worldwildlife.org, Global Lakes and Wetlands Database*
*Zambia Ministry of Land, districts*

0 7,5 15 km
UTM 36S, WGS84

**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

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*CA0027197_7329_EIC4_2_corridors3_005_240618*

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.*

## 4.2.3 MPIKA TO PENSULO

### 4.2.3.1 CORRIDOR 4

Corridor 4 links Mpika and Pensulo for a total length of 184 km (see Map 4-3). It essentially follows the T2 Road down to Pensulo.

#### CORRIDOR 4, SECTION 1

Section 1 covers KP 0 to 101 of Corridor 4. Along that stretch, the corridor keeps to the west of highway T2 and mostly follows existing infrastructure, namely the Tazama pipeline from KP 0 to KP 28, an existing 66kV line from KP 0 to KP 102, and the new 330kV line built by the Chinese cooperation along the entire length of this section. Population density along this section is quite sparse, with a low density rural complex land occupancy pattern. This section impacts the boundaries of two small villages and three small dense agricultural areas. The Nachikufu Caves National Heritage Site is located approximately 2.5 km to the east of the corridor's central axis at KP 52 (outside the corridor). However, the corridor's centreline crosses a short segment of the tip of the Lavushi Manda National Park, around KP 62.

#### CORRIDOR 4, SECTION 2

Section 2 covers KP 101 to KP 184 of Corridor 4 where the corridor reaches Pensulo substation. This section is characterized by an intensification of land occupation. Although land occupation can still be characterized as a rural complex, larger amounts of dense agricultural perimeters are found along section 2, especially between KP 106 and KP 140, approximately.

Section 2 also follows the 330-kV line recently constructed by the Chinese cooperation to the east along this stretch, where it then crosses it to its western side at approximately KP 146. The line route then enters slightly less inhabited land between that point and KP 186, while it circles the Kanona Forest Reserve to the north, before rejoining with the Pensulo substation.

**Human Environment**

- City / Village
- International Boundary
- District Boundary

**Physical Environment**

- Wetland

**Biological Environment**

National Designated Areas

- Forest Reserve
- Game Management Area
- National Park

**Infrastructure**

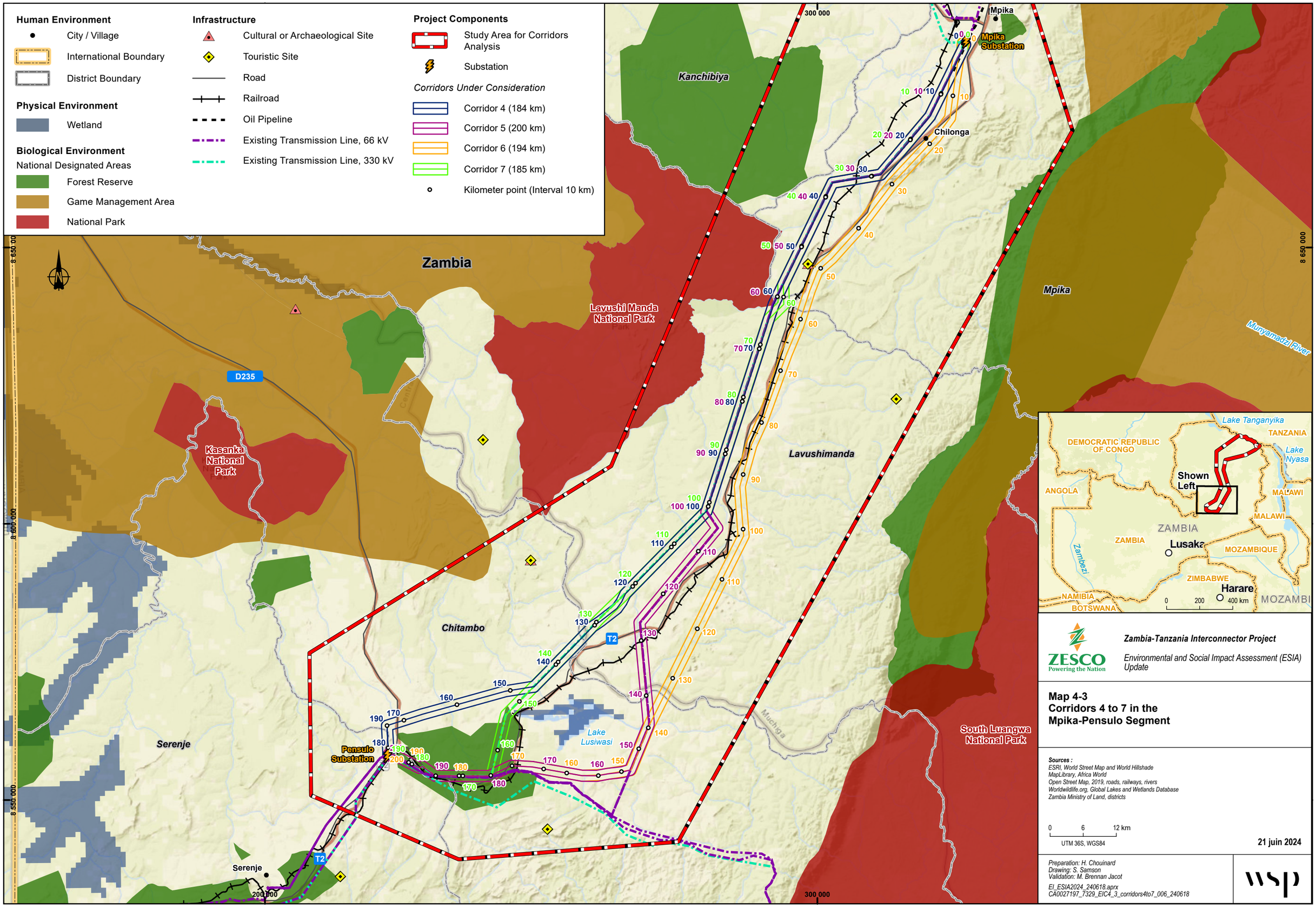
- Cultural or Archaeological Site
- Touristic Site
- Road
- Railroad
- Oil Pipeline
- Existing Transmission Line, 66 kV
- Existing Transmission Line, 330 kV

**Project Components**

- Study Area for Corridors Analysis
- Substation

*Corridors Under Consideration*

- Corridor 4 (184 km)
- Corridor 5 (200 km)
- Corridor 6 (194 km)
- Corridor 7 (185 km)
- Kilometer point (Interval 10 km)

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*Environmental and Social Impact Assessment (ESIA) Update*

**Map 4-3**
**Corridors 4 to 7 in the Mpika-Pensulo Segment**

***Sources :***
*ESRI, World Street Map and World Hillshade*
*MapLibrary, Africa World*
*Open Street Map, 2019, roads, railways, rivers*
*Worldwildlife.org, Global Lakes and Wetlands Database*
*Zambia Ministry of Land, districts*

0 6 12 km
UTM 36S, WGS84

**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC4_3_corridors4to7_006_240618*

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*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.*

### 4.2.3.2 CORRIDOR 5

Corridor 5 links Mpika and Pensulo for a total length of 200 km (see Map 4-3). Approximately 160 km of this corridor is shared with Corridor 5, which essentially follows T2 Road.

#### CORRIDOR 5, SECTION 1

Section 1 covers KP 0 to KP 101of Corridor 5 and follows the same course as Corridor 4, along this stretch (see above).

#### CORRIDOR 5, SECTION 2

Section 2 covers KP 101 to KP 200 of Corridor 5. This section circles Lake Lusiwasi before veering west to parallel D225 Road and many existing high and medium voltage transmission lines. It crosses the Tazara railway, Tazama pipeline and T2 Road at KP 175, before entering the Kanona Forest Reserve, which contains some patches of mature woodland and where it parallels other existing transmission lines. Section 2 also approaches an industrial site at KP 174 and crosses the new 330kV transmission line built by the Chinese cooperation at KP 181. As this stretch approaches Pensulo, the land occupation can be described as a rural complex, with the Kanona Forest Reserve appearing heavily degraded. The corridor crosses the T2 Road and Tazara railway again at KP 194 and KP 199.5, just before making a 90 degree turn to the southwest, to enter the Pensulo substation.

### 4.2.3.3 CORRIDOR 6

Corridor 6 links Mpika and Pensulo for a total length of 194 km (see Map 4-3). This corridor follows T2 Road until KP 100 and then diverts toward a more southeastern route.

#### CORRIDOR 6, SECTION 1

Section 1 covers KP 0 to KP 88 of Corridor 6. Along this stretch the corridor remains on the eastern side of highway T2. The Tazara railway is the only major infrastructure found in this section between KP 50 and KP 88. Population density is quite sparse, with a low density rural complex soil occupation pattern. Few sensitive sites are affected, including some small village perimeters and two small dense agricultural perimeters. The Nachikufu Caves National Heritage Site is located approximately 2.5 km to the west of the corridor's central axis at PK 51 (outside the corridor). It should be noted that by passing on the eastern side of the T2 road, this corridor avoids direct impact on the Lavushi Manda National Park.

#### CORRIDOR 6, SECTION 2

Section 2 covers KP 88 to KP 155 of Corridor 6. This section is characterized by the intensification of anthropogenic land use. Although land use can still be characterized as a rural complex, larger amounts of dense agricultural perimeters are found along section 2. The corridor then veers westwards at KP 149, circling lake Lusiwasi and joining with routing of Corridor 5 at KP 155.

#### CORRIDOR 6, SECTION 3

Section 3 covers KP 155 to KP 194. Along that stretch routing is shared with Corridor 5's section 2.

### 4.2.3.4 CORRIDOR 7

Corridor 7 links Mpika and Pensulo for a total length of 185 km (see Map 4-3). It follows a similar alignment to Corridor 4 with a few exceptions which are discussed in further detail below.

### CORRRIDOR 7, SECTION 1

Section 1 covers KP 0 to 101 of Corridor 7. Within this section, the corridor remains on the western side of Highway T2 and mostly follows existing infrastructure, namely an existing 66kV line and recently built 330kV Chinese corporation line, except for a slight deviation at KP 57, where the line veers east to avoid the eastern tip of the Lavushi Manda National Park. The corridor then returns to parallel the existing 66kV and 330kV lines at KP 65. Population density along this section is quite sparse, with a low density rural complex land occupancy pattern. This section impacts the boundaries of two small villages and three small dense agricultural areas. The Nachikufu Caves National Heritage site is located approximately 2.5 km to the east of the corridor's central axis at KP 52 (outside the corridor).

### CORRIDOR 7, SECTION 2

Section 2 covers KP 101 to KP 184 of Corridor 7 where the corridor reaches Pensulo substation. This whole section is paired with the existing 330kV line recently built by the Chinese corporation. It is characterized by an intensification of anthropogenic land use. Although land occupation can still be characterized as a rural complex, larger amounts of dense agricultural perimeters are found along section 2, between KP 106 and KP 139.5. Section 2 enters Kanona Forest Reserve, to the west off Lake Lusiwasi at approximately KP 152, until KP 183, following the existing 330kV line all across this Forest Reserve, which contains some patches of mature woodland.

Section 2 also follows the 330kV line recently constructed by the Chinese cooperation to the east from KP 0 to approximately KP 165 where it crosses the same line and follows it to the west until it reaches Pensulo substation.

## 4.3 COMPARATIVE CORRIDOR ANALYSIS

The current report compares the various corridor alternatives to identify the most suitable Project line route.

The methodology adopted to select the most suitable corridor alternative is based on an analytical approach that compares environmental and social constraints, and technical elements that influence the buildability and cost of the Project. Metrics used for the analysis of alternatives were calculated using publicly available sources of data or through interpretation of high-resolution satellite imagery. Criteria used in the analysis are described in Table 4-1.

**Table 4-1 Description and Justification for Criteria used in the Comparative Corridor Analysis**

| Criteria | Description | Justification |
|---|---|---|
| **Technical Elements** | | |
| Distance not paralleling existing or planned linear infrastructure. | This criterion represents the combined length of the route that does not directly parallel an existing or planned linear infrastructure. | Paralleling existing linear infrastructure avoids new fragmentation of habitats. It also reduces maintenance costs. Pairing with existing lines reduces the additional ROW required compared to areas where existing linear infrastructure is not present, and in turn generally reduces associated environmental and social impacts. |
| Presence of important infrastructure. | The number of occurrences of important infrastructure in the right-of-way, such as air strips, mines, or important industrial facilities that would present construction constraints. | The presence of major infrastructure associated with incompatible activities is an important technical and social constraint to consider. As these types of infrastructure are not compatible, relocation would be required which would result in considerable costs and likely further environmental and social impacts. |
| Inaccessibility | This criterion considers accessibility of the proposed route and is a measure of the length of the route that is greater than 2.5 km away from existing roads or pathways. | Proximity to existing roads or pathways reduces construction and maintenance costs as well as the amount of new disturbance. |
| Erosion risk | This criterion represents a factor of erosion risk along the route. This factor is calculated by a weighted ratio of erosion hazard categories. These values were extracted from a map published by the Soil and Water Conservation and Land Utilization Co-Ordination Unit. | These geotechnical hazards can considerably impact the stability of, and costs for structures. |
| Corridor length | Length in km of each route section. | The length of the line determines the footprint of the Project, which is directly related to environmental impacts. Longer lines also usually result in higher costs. |
| Number of angle towers. | Calculated according to the deviation of a rectilinear line along the route. | Angle towers are more expensive and require a larger footprint outside of the ROW for line stringing. Angle towers require greater technical consideration during the design stage and more complex infrastructure maintenance during the operation phase. |
| Low resistance infrastructure crossing. | Infrastructure crossed that is easily manageable. This criterion includes linear infrastructure like pipelines, major roads, railways, and transmission lines. | Other infrastructure could be damaged during construction and maintenance activities associated with the current Project. If damage occurs, there would be associated repair costs and impacts to services provided by the infrastructure. Technical disposition would also be required prior to construction of the line. |
| **Natural or Physical Environment** | | |
| National Parks. | This criterion represents the length (km) of the portion of the centreline that falls within a national park boundary. | National Parks in Zambia are established for the conservation and protection of wildlife and objects of aesthetic, prehistoric, historical, and scientific interest in National Parks. Under the Zambia Wildlife Act 2015, the Minister may make provision for the control, regulation or prohibition of land development or mining within a National Park, Game Management Area or Community Partnership Park and the imposition of terms and conditions under which land development or mining may be undertaken in such areas. |

| Criteria | Description | Justification |
|---|---|---|
| Important Bird Areas. | This criterion is classified as low, medium, and high interference levels. High interference involves direct impact within the boundaries of the IBA. Medium interference occurs when the centreline falls within 2 km of the IBA boundary, and low interference occurs when the centreline falls within 5 km of the IBA boundary. | IBAs are globally important for the conservation of bird species. The presence of transmission line infrastructure may result in habitat loss, habitat fragmentation, and risk of bird collisions or electrocution. |
| Other National Protected Areas. | This criterion represents the length (km) of the centreline that falls within a national protected area other than National Parks, such as forest reserves and game management areas. | The management and protection of all national and local forest reserves in Zambia is covered by the Forest Act 4 of 2015. These two types of forest reserves relate to the conservation and sustainable use of forests and trees, and the implementation of international instruments. |
| High Integrity Forests. | This criterion represents the length (km) of the centreline that falls within high integrity forests. High integrity forests represent wooded areas with very little human disturbance and mature and abundant vegetation. These areas were identified through interpretation of high-resolution satellite imagery at a scale of<br>1:10 000. | Wooded areas are a source of resources for people, help regulate water quality and erosion and provide habitat for wildlife. |
| Wetlands/low bearing capacity soils. | This criterion represents the length (km) of the centreline that passes through wetlands. Wetlands are features that contain water permanently or occasionally, with specific vegetation. Wetlands were identified through interpretation of high-resolution satellite imagery at a scale of 1:10 000. | Wetlands are areas with considerable biodiversity and are often used for agricultural purposes. In addition, they are generally geotechnically unstable areas with low bearing capacity. |
| Watercourse crossings. | Number of watercourse crossings including larges rivers and streams. | Watercourses are an important source of water for the local population and wildlife. Crossing watercourses may require removal of riparian vegetation resulting in habitat disturbance and increased risk of erosion and sedimentation. |
| **Human Environment** | | |
| Potential Project affected people (PAPs). | Potential PAPs is calculated using a ratio combining ROW width, district population density, and length of the line in each district. | The number of PAPs directly correlates with a project's social impacts and is often an important consideration in Project cost and social acceptability. |
| Urban/village perimeters. | This criterion corresponds to the length of the centreline crossing built areas. Built areas correspond to zones with presence of buildings, concessions, or well-defined private land. These areas were interpreted from high resolution satellite imagery at a scale of 1:10 000. | Passage in the built environment involves relocation or compensation for the loss of buildings located in the Project ROW. This can have social and financial impacts for relocated people and can increase Project costs. |
| Archaeological and cultural heritage sites. | Number of sacred sites, subject to customary practices or heritage sites, identified on the National List of Cultural and Natural Heritage or the World Heritage List. | Where possible, these sites are to be avoided to limit relocation needs and disturbance to valued sites. Their disruption can lead to changes in community lifestyle and high costs for temporary or permanent relocation. |
| Dense traditional agricultural zones. | Areas with important agricultural activity. Agriculture is practiced in a traditional way extensively within the study area. Parcels are usually small and clustered around areas near streams or wetlands. These areas were identified from high resolution satellite imagery at a scale of 1:10 000. | Placing the transmission line through areas with dense traditional agriculture will require relocation or compensation for the loss of plantations or crops located in the Project ROW. This can have social and financial impacts for relocated people and increase Project cost. |

Siting criteria and environmental and social constraints considered in corridor alternatives selection were classified as very high resistance, high resistance, medium resistance, or low resistance, according to the following definitions:

- **Very high resistance criteria** should be strongly considered in option selection. These include direct impacts on national protected areas like National Parks, Important Bird Areas, or archaeological or heritage sites. Major technical constraints like following existing linear disturbance to reduce environmental and social impacts are also considered very high resistance.
- **High resistance criteria** require avoidance, where possible or efforts to reduce impacts. These include impacts such as Forest Reserves or resettlement requirements.
- **Medium resistance criteria** require consideration in the Project design but are more easily managed and, if impacted, can be addressed via the ESMP or RAP.
- **Low resistance criteria** can offer some resistance or impose minor design constraints (ex. pipeline crossings which must be at a 60º angle minimum) but are otherwise manageable.

Corridor alternatives within a segment were compared and the alternative with the least impacts for a specific criterion was deemed the "winner" for that criterion. A weighting was then applied to the "winner" of each criterion based on the degree of resistance. These weighted criteria were summed for each corridor alternative to allow for overall comparison of corridor alternatives within a given segment. The corridor option with the highest score was recommended for selection. The weightings applied to criteria are as follows:

- **Very high resistance criteria** were applied a weighting of 4;
- **High resistance criteria** were applied a weighting of 3;
- **Medium resistance criteria** were applied a weighting of 2;
- **Low resistance criteria** were applied a weighting of 1.

Unless otherwise indicated, metrics have been calculated based on intersection with the centreline of the corridor.

### 4.3.1 TANZANIAN BORDER – KASAMA SEGMENT

Table 4-2 provides a comparison of corridors 1 and 2, based on the retained selection criteria.

**Table 4-2 Corridor Alternatives Analysis, Border – Kasama Section**

| Criteria | Resistance | Corridor 1 | Corridor 2 |
|---|---|---|---|
| **Technical Elements** | | | |
| Distance not paralleling existing or planned transmission lines (km) | Very high[4] | 14.3 | 208.5 |
| Important infrastructure (no.) | High[3] | 0 | 1 |
| Inaccessibility (km) | Medium[2] | 23.6 | 75.5 |
| Erosion risk factor | Medium[2] | 1.2 | 1.1 |
| Length (km) | Low[1] | 226.1 | 198 |
| Number of angle towers (no.) | Low[1] | 37 | 8 |
| Low resistance infrastructure crossing (no.) | Low[1] | 6 | 8 |
| ***Sum of weighting values for technical elements*** | | 10 | 4 |

| Criteria | Resistance | Corridor 1 | Corridor 2 |
|---|---|---|---|
| **Environmental Elements** | | | |
| National Parks (km) | Very high[4] | 0 | 0 |
| Important Bird Areas | Very high[4] | Low | High |
| Other National Protected Areas (km) | High[3] | 6.0 | 0 |
| High Integrity Forests (km) | Medium[2] | 0 | 14 |
| Wetlands/low bearing capacity soils (km) | Medium[2] | 17.6 | 42 |
| Watercourse crossings (no.) | Low[1] | 21 | 13 |
| ***Sum of weighting values for environmental elements*** | | 8 | 4 |
| **Social Elements** | | | |
| Archaeological and cultural heritage sites (no). | Very high[4] | 1 | 0 |
| Potential PAP (no.) | High[3] | 256 | 226 |
| Urban/village perimeters (km) | High[3] | 0.9 | 15.4 |
| Dense traditional agricultural zones (km) | Medium[2] | 0 | 15 |
| ***Sum weighting values for social elements*** | | 5 | 7 |
| ***Total weighting values per corridor*** | | 23 | 15 |

#### 4.3.1.1 DISCUSSION

The Corridor 1 is a corridor alternative that is considered to be a straight line option to connect Tanzanian border and Kasama. Even if it is shorter in length compared to the Corridor 1, the Corridor 2 has not considered environmental and social constraints along its length which is manifested by its scoring for the corridor alternatives analysis mainly for environmental and social criteria. The Corridor 2 notably enters in wetland areas, high integrity forests, urban perimeter (close to Kasama) and dense traditional agricultural zones. The corridor 2 also does not connect to the Nakonde substation and goes directly to Mbeya.

The greatest advantage of the Corridor 1 is that it uses an existing wayleave that was planned for the Kasama-Nakonde line under ICBC funding that has since been cancelled. The wayleave targeted for this Kasama-Nakonde single circuit 330kV line is indeed the preferred option to house the 330kV double-circuit from Kasama to Nakonde for the ZTIP. It reduces considerably associated environmental and social impacts. Additionally, Corridor 1 has a better accessibility, has less interaction with Important Bird Areas and results in less impacts with forested areas. As for social criteria, Corridor 1 avoids dense traditional agricultural zones, has the fewest impacts on urban or village perimeters, but results in slightly more potential estimated PAPs.

#### 4.3.1.2 RECOMMENDATION

Corridor 1 is recommended for linking Mbeya to Kasama based on receiving the highest ranking in the option comparison analysis and the discussion provided above.

### *4.3.2 KASAMA-MPIKA SEGMENT*

Table 4-3 below provides a comparison of corridors 3, 3A, and 3B based on the criteria described above.

**Table 4-3 Corridor Alternatives Analysis, Kasama-Mpika Section**

| Criteria | Resistance | Corridor 3 | Corridor 3A | Corridor 3B |
|---|---|---|---|---|
| **Technical Elements** | | | | |
| Distance not paralleling existing or planned transmission lines (km) | Very high[4] | 33.3 | 191.4 | 54.8 |
| Important infrastructure (no.) | High[3] | 0 | 0 | 0 |
| Inaccessibility (km) | Medium[2] | 5.3 | 3.0 | 6.8 |
| Erosion risk factor | Medium[2] | 1.11 | 1.10 | 1.63 |
| Length (km) | Low[1] | 196.9 | 194.6 | 199.3 |
| Number of angle towers (no.) | Low[1] | 28 | 32 | 26 |
| Low resistance infrastructure crossing (no.) | Low[1] | 5 | 16 | 5 |
| ***Sum of weighting values for technical elements*** | | 4 | 5 | 2 |
| **Environmental Elements** | | | | |
| National Parks (km) | Very high[4] | 0 | 0 | 0 |
| Important Bird Areas | Very high[4] | Low | Low | Low |
| Other National Protected Areas (km) | High[3] | 1.0 | 4.5 | 4.7 |
| High Integrity Forests (km) | Medium[2] | 15.6 | 7.9 | 11.7 |
| Wetlands/low bearing capacity soils (km) | Medium[2] | 17.0 | 13.6 | 10.3 |
| Watercourse crossings (no.) | Low[1] | 10 | 11 | 8 |
| ***Sum of weighting values for environmental elements*** | | 3 | 2 | 3 |
| **Social Elements** | | | | |
| Archaeological and cultural heritage sites (no). | Very high[4] | 0 | 0 | 0 |
| Potential PAP (no.) | High[3] | 168 | 161 | 172 |
| Urban/village perimeters (km) | High[3] | 0.8 | 1.0 | 0.7 |
| Dense traditional agricultural zones (km) | Medium[2] | 2.3 | 1. 5 | 0.4 |
| ***Sum weighting values for social elements*** | | 0 | 3 | 4 |
| ***Total weighting values per corridor*** | | 7 | 10 | 10 |

**Note:** Only the corridor that results in the least impacts for a given criteria receives a weighting value (highlighted cell).
[1]Low resistance constraints have a weighting of 1.
[2]Medium resistance constraints have a weighting of 2.
[3]High resistance constraints have a weighting of 3.
[4]Very high resistance constraints have a weighting of 4.

#### 4.3.2.1 DISCUSSION

Corridor 3A is the shortest corridor alternative within the Kasama to Mpika segment at 194.6 km, compared to 196.9 km for Corridor 3, and 199.3 km for Corridor 3B. However, Corridor 3 is the alternative with the shortest distance that does not parallel an existing or planned linear disturbance (33.3 km), followed by Corridor 3B (54.8 km) and Corridor 3A (191.4 km). As such, Corridors 3 and 3B will result in the least amount of new habitat fragmentation and have the added benefit of requiring less new ROW (35 m) in areas where it parallels the recently constructed Pensulo-Kasama 330-kV transmission line, compared to areas where existing or planned transmission lines do not run directly parallel (50 m). Additionally, Corridor 3B contains the fewest number of angle towers (25), reducing costs and resulting in less area required for temporary construction activities (i.e., line stringing).

Corridor 3A has the lowest erosion risk factor (1.10), when compared to Corridor 3 (1.11) and Corridor 3B (1.63). An accessibility assessment also determined that the most accessible corridor based on existing access was Corridor 3A, followed by Corridors 3 and 3B.

None of the corridor alternatives within this segment result in direct impacts on National Parks. All corridor alternatives within this segment result in impacts in Nkole Mfumu Forest Reserve, with Corridor 3 crossing the least distance with 1.0 km, followed by Corridor 3A which crosses 4.5 km, and Corridor 3B which crosses 4.7 km. Similarly, all options result in similar anticipated impacts on Important Bird Areas (low). Corridor 3A results in the least impact on high integrity forests (7.9 km), whereas corridors 3B and 3 intersect 11.66 km and 15.59 km, respectively. Corridor 3B is the alternative that results in the least impact on wetlands and low bearing capacity soils (10.3 km compared to 13.6 km for Corridor 3A and 17.0 km for Corridor 3).

Rivers and streams pose technical challenges during line construction (obstacles to be crossed) and may be polluted during construction works or suffer from excess erosion after the wayleave is cleared. Corridor 3B has the least number of river crossings (8), followed by Corridor 3 (10), and Corridor 3A (11).

Corridor 3B results in the least impact on urban or village perimeters. This corridor crosses the built environment for 0.7 km, followed by Corridor 3 (0.8 km) and Corridor 3A (1.0 km). Corridor 3B has a slightly greater potential for PAPs within a 100 m indicative wayleave than the other two corridor alternatives. Corridor 3B results in the least impact on dense traditional agricultural zones (0.4 km), followed by Corridor 3A (1.5 km) and Corridor 3 (2.3 km). There are no direct impacts on known archaeological or cultural heritage sites.

#### 4.3.2.2 RECOMMENDATION

Since the total weightings for Corridors 3A and 3B are quite comparable, individual metrics were further considered when recommending a corridor for selection. Corridor 3B parallels the recently constructed Pensulo-Kasama 330-kV transmission line for a greater distance than Corridor 3A, thereby reducing the amount of new habitat fragmentation when compared to Corridor 3A. As mentioned previously, where the corridor parallels the recently constructed Pensulo-Kasama 330-kV transmission line, the Project will share portions of the ROW thereby reducing the required ROW width from 50 m to 35 m in these areas. Therefore, based on the abovementioned discussion of the selection criteria and weightings provided Corridor 3B is recommended for selection.

### 4.3.3 MPIKA - PENSULO SEGMENT

Table 4-4 below provides a comparison of corridors 4, 5, 6, and 7 based on the criteria described above.

**Table 4-4 Corridor Alternatives Analysis, Mpika-Pensulo Section**

| Criteria | Resistance | Corridor 4 | Corridor 5 | Corridor 6 | Corridor 7 |
|---|---|---|---|---|---|
| **Technical Elements** | | | | | |
| Distance not paralleling existing or planned transmission lines (km) | Very high[4] | 46.4 | 25.7 | 162.,3 | 8.2 |
| Important infrastructure (no.) | High[3] | 0 | 0 | 0 | 0 |
| Inaccessibility (km) | Medium[2] | 5.4 | 3.1 | 8.2 | 0 |
| Erosion risk factor | Medium[2] | 2.00 | 2.12 | 2.39 | 2.10 |
| Length (km) | Low[1] | 184.0 | 200.0 | 194.2 | 184.8 |
| Number of angle towers (no.) | Low[1] | 33 | 45 | 30 | 43 |
| Low resistance infrastructure crossing (no.) | Low[1] | 7 | 14 | 15 | 8 |
| ***Sum of weighting values for technical elements*** | | 4 | 0 | 1 | 6 |
| **Environmental Elements** | | | | | |
| National Parks (km) | Very high[4] | 0.7 | 0.7 | 0 | 0 |
| Important Bird Areas | Very high[4] | High | High | Low | Medium |
| Other National Protected Areas (km) | High[3] | 0 | 22.8 | 22.8 | 30.7 |
| High Integrity Forests (km) | Medium[2] | 13.5 | 11.1 | 14.4 | 11.7 |
| Wetlands/low bearing capacity soils (km) | Medium[2] | 10.5 | 11.5 | 11.5 | 10.3 |
| Watercourse crossings (no.) | Low[1] | 14 | 13 | 9 | 10 |

| Criteria | Resistance | Corridor 4 | Corridor 5 | Corridor 6 | Corridor 7 |
|---|---|---|---|---|---|
| ***Sum of weighting values for environmental elements*** | | 3 | 2 | 9 | 6 |
| **Social Elements** | | | | | |
| Archaeological and cultural heritage sites (no.) | Very high[4] | 0 | 0 | 0 | 0 |
| Potential PAP (no.) | High[3] | 189 | 204 | 198 | 183 |
| Urban/village perimeters (km) | High[3] | 0.3 | 0.3 | 0.1 | 0.3 |
| Dense traditional agricultural zones (km) | Medium[2] | 1.6 | 2.3 | 4.9 | 2.1 |
| ***Sum weighting values for social elements*** | | 2 | 0 | 3 | 3 |
| ***Total weighting values per corridor*** | | 9 | 2 | 13 | 15 |

**Note:** Only the corridor that results in the least impacts for a given criteria receives a weighting value (highlighted cell).
[1]Low resistance constraints have a weighting of 1.
[2]Medium resistance constraints have a weighting of 2.
[3]High resistance constraints have a weighting of 3.
[4]Very high resistance constraints have a weighting of 4.

#### 4.3.3.1 DISCUSSION

Corridor 4 is the shortest corridor alternative within the Mpika to Pensula segment by 800 m (184.0 km), followed by Corridor 7 (184.8 km), Corridor 6 (194.2 km), and Corridor 5 (200.0 km). However, Corridor 7 is the alternative with the shortest distance that does not parallel an existing or planned linear infrastructure (8.2 km), followed by Corridor 5 (25.7 km), Corridor 4 (46.4 km), and Corridor 5 (162.3 km). Therefore, Corridor 7 will result in the least amount of new habitat fragmentation and have the added benefit of requiring less new ROW (35 m) in areas where it parallels the recently constructed Pensulo-Kasama 330kV transmission line (all except for 8.2 km of the corridor length where it was adjusted to avoid direct impacts on Lavushi Manda National Park), compared to areas where existing or planned transmission lines do not run directly parallel (50 m). Additionally, Corridor 7 contains the fewest number of angle towers (21), reducing costs and resulting in less area required for temporary construction activities (i.e., line stringing). Corridor 4 has the lowest erosion risk factor (2.00), followed closely by Corridor 7 (2.10), and Corridor 5 (2.12). Corridor 6 has a slightly higher erosion risk factor (2.39). An accessibility assessment also determined that the most accessible corridor based on existing access was Corridor 7, as there were no sections of the line that were beyond 2.5 km from existing access roads.

Corridor 6 or Corridor 7 do not result in direct impacts on National Parks, whereas Corridor 4 and Corridor 5 each cross 0.7 km of National Park. Corridor 4 is the only corridor that does not directly impact forest reserves. Of the remaining options, Corridors 5, 5, and 7 cross 22.7 km, 22.79 km, and 30.71 km in Kanona Forest Reserve, respectively. Corridor 6 results in the least impact on Important Bird Areas (low), followed by Corridor 7 (medium), and Corridor 4 and Corridor 5 (both high). Corridor 5 results in the least impact on high integrity forests (11.1 km), whereas Corridors 7, 4, and 6 intersect 11.7 km, 13.5 km, and 14.4 km, respectively. Corridor 7 is the alternative that results in the least impact on wetlands and low bearing capacity soils (10.3 km compared to 10.5 km for Corridor 4, and 11.5 km for both corridors 5 and 6).

Rivers and streams pose technical challenges during line construction (obstacles to be crossed) and may be polluted during construction works or suffer from excess erosion after the wayleave is cleared. Corridor 6 has the least number of river crossings (9), followed by Corridor 7 (10), Corridor 5 (13), and Corridor 4 (14).

Corridor 4 results in the least impact on dense traditional agricultural zones (1.6 km), followed by Corridor 7 (2.1 km), Corridor 5 (2.3 km), and Corridor 6 (4.9 km).

Corridor 7 has the least potential PAPs within a 100 m indicative wayleave (183), followed closely by Corridor 4 (189, Corridor 6 (198), and Corridor 5 (204) than the other two corridor alternatives. Additionally, His Royal Highness Chief Mpumba in Lavushi Manda District advised that a corridor closer to the existing 330kV line is more reasonable if socially compared. Corridor 6 also passes through a farm block created by the Government Republic of Zambia and encroaches on Lavushi Manda District Council planned Town Development Land. There are no direct impacts on known archaeological or cultural heritage sites.

#### 4.3.3.2 RECOMMENDATION

Corridor 7 is recommended for linking Mpika to Pensulo based on receiving the highest ranking in the option comparison analysis and the discussion of results provided above.

## 4.4 PROJECT CONFIGURATION

At the multiple stages of the environmental and social studies, various Project configurations were discussed and analyzed by the Consultant, in collaboration with Feasibility Consultants and the Client. Following this process, the Feasibility Consultant recommended the following Project design configuration, which has been adopted by the Client:

- Border – Nakonde segment: two circuits of 330kV alternating current, mounted on one row of double-circuit pylons;
- Nakonde – Kasama segment: two circuits of 330kV alternating current, mounted on one row of single-circuit pylons;
- Kasama – Mpika segment: one circuit of 330kV alternating current, mounted on one row of single-circuit pylons;
- Mpika – Pensulo segment: one circuit of 330kV alternating current, mounted on one row of single-circuit pylons.

All analyses in the present report's following chapters are based on the corridor selection and Project design recommendations provided above. As part of alternatives analysis, initial assessment suggests that the chosen alignment is unlikely to result in extensive economic loss because the area is mostly agricultural and located in areas of low population density. However, a detailed socioeconomic census is ongoing as part of the RAP. All economic losses identified will be documented and addressed accordingly within the RAP.

## 4.5 LINE ROUTE OPTIMIZATION FOR THE LINE SECTION WITHIN THE KASAMA FOREST RESERVE

The selected Corridor 1 for the line section in between the Tanzanian border and Kasama substation has multiple advantages compared to its other alternative, Corridor 2 (see section 4.2.1). However, detailed analysis during the ESIA update have led to the identification of important environmental and social issues associated with the crossing of the Kasama forest reserve, which also overlaps the Mwela Rock Art site.

### *4.5.1 PRESENCE OF A CRITICAL HABITAT*

The flora species *Euphorbia perplexa var. Kasamana* triggers critical habitat Criterion 2 – Endemic/Restricted Range Species. The species is known only from Zambia, north of Kasama (Phiri, 2015). This small shrub characterised by spines of 10 mm long was observed in the Kasama Forest Reserve on the rocky outcrops of the Mwela Rock Art Site during the walkover surveys in September 2019. Although its precise extent of occurrence is unknown, it is assumed that the species must have a restricted range (less than 50,000 km2) that is found partly in the Ecologically Appropriate Area of Analysis (EAAA). Hence, it can be assumed that the EAAA contains more than 0.5% of the species population and triggers critical habitat. The critical habitat is considered to be Rock outcrop in the Kasama area. Even if the species' presence outside the Kasama Forest Reserve is not confirmed yet, it is expected to be found in the rock outcrop around Kasama as this habitat may meet its ecological requirements.

As per World Bank's ESS6 requirements, there are multiple conditions for a project to be implemented within a critical habitat. The first one is however to be able to demonstrate that there is no other viable alternative within the region for development of the project in habitats of lesser biodiversity value.

### 4.5.2 CULTURAL HERITAGE COMPONENTS

The Heritage Impact Assessment conducted by the National Heritage Conservation Commission (NHCC) has assessed potential impacts from the ZTIP within the Mwela Rock Art site (NHCC, 2020). Various physical cultural resources and rock arts have been identified in the surrounding of the ZTIP. No resource has been identified within the ZTIP wayleave, however, this causes concerns for potential impacts coming from construction works and vehicles in the surrounding of the wayleave. Figure 4-1 shows the location of identified Rock Art and Paintings associated with the Mwela National Monument. Mwela Rock paintings are found eastwards rock outcrops of Mwankole, Sumina, Mulundu, Fwambo, Changa Mwibwe, and westwards, 10 km from the town of Lwimbo rock outcrops.

The ZTIP is currently crossing the site protected under the NHCC Act, Cap 173 of the laws of Zambia and was declared collectively as a National Monument under Government notice no. 255 of 1964, bearing the name of Mwela. The site is considered of international importance, because of its rich features and the fact that it was submitted to UNESCO for classification as a world heritage site.

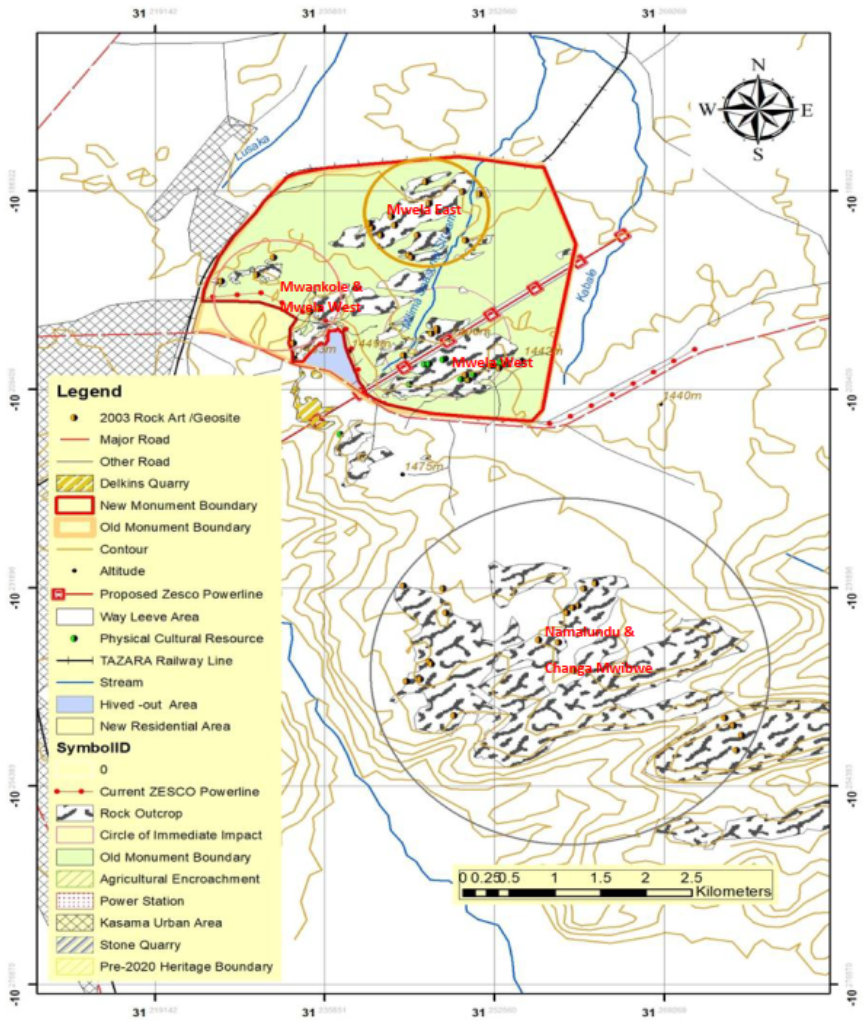



**Figure 4-1 Mwela National Monument Rock Outcrop Areas with Rock Paintings**

Source : NHCC, 2020

### 4.5.3 RECOMMENDATIONS FOR OPTIMIZATION

The concerns associated with the project implementation within the Kasama Forest Reserve and the Mwela National Monument site are linked with highly valued features (critical habitat and cultural heritage) both associated with the rock outcrops. In order to avoid as much as possible impacts on these features, it is recommended to optimize the line alignment in and around the Kasama Forest Reserve and the Mwela National Monument site to avoid any crossing of rock outcrops. This will involve a deviation of the current line route. In order to validate the location of the deviation and not move potential impacts on critical habitat or cultural heritage in other locations, it is recommended to:

- Assess feasible technical options to avoid the crossing of rock outcrops within the Kasama Forest Reserve/ Mwela National Monument site and also outside the site (See rock outcrops location at Figure 4-2). The optimization of the line route, including is deviation, to avoid any crossing should be privileged. However, other options should also be considered including line span, tower locations, work methods and access roads locations.
- Conduct targeted surveys for species triggering critical habitat along the proposed deviation options to validate the presence/absence of these species within and around the associated wayleave.
- Conduct site assessment with NHCC of the proposed deviation options to validate the presence/absence of physical cultural resources within and around the associated wayleave.

**Figure 4-2 Rock outcrops to be avoided and protected**

# 5 BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

The general objective of this baseline study is to document the existing elements of the environment to inform the impact assessment exercise and allow proper monitoring. Field surveys have been completed and in-depth analyses of the Project area in the physical, biophysical and social environments have been conducted.

The activities undertaken to characterize baseline conditions include:

- Review of available data and literature, including studies completed for other Projects that may be relevant;
- Interpretation of aerial photography to understand land use, habitat conditions, and to identify points of interest for future site investigations;
- Site investigations to better understand existing environmental conditions and possible Project interactions. The site investigations focused on terrestrial and aquatic habitat quality, soil condition and quality, current land use, perceived socioeconomic conditions, and water use demand;
- Interviews and focused discussions with local stakeholders and community leaders.

This chapter presents the environmental and social baseline information collected using the above-mentioned data collection techniques.

## 5.1 IDENTIFICATION OF THE STUDY AREAS

Three study areas, which vary in terms of extent, have been identified in order to study the relevant components better and serve the objectives of the ESIA. The study areas considered for the baseline study are the following:

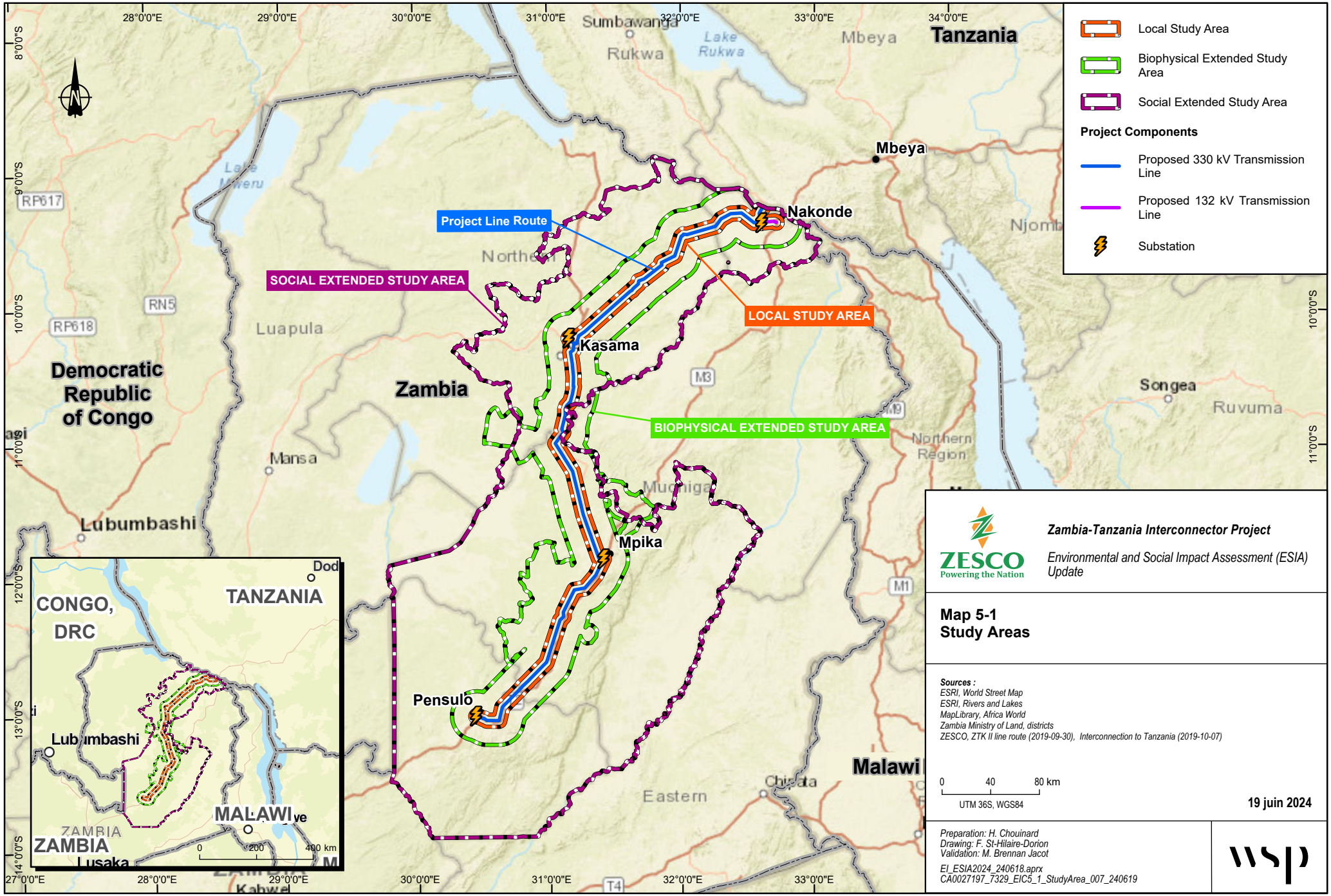
- A Local Study Area (LSA) consisting of a 5 km buffer area on either side of the line route and around substations. The LSA has an area of 6152.07 km$^2$ and is considered to be the area where the Project's immediate environmental and social effects are mainly felt. The LSA integrates the Project's direct footprint.
- A Biophysical Extended Study Area (BESA) consisting of a 20 km buffer area on either side of the line route and around substations, as well as all protected areas that are completely or partially contained within this buffer area. The BESA is used to portray the biophysical environment. It is different from the SESA as it relies on ecosystems and habitat connectivity rather than administrative limits to assess biological and physical impacts. The BESA has an area of 28676.18 km$^2$.
- A Social Extended Study Area (SESA) consisting of the territory of all districts affected by Project infrastructure. The SESA is used to portray the socio-economic context, which will be compared to data gathered at the local level during RAP activities. Districts included in the SESA are listed in Table 5-1. The SESA has an area of 93265.94 km$^2$.

**Table 5-1 Districts included in the SESA**

| Provinces | Districts |
|---|---|
| Central | Serenje, Chitambo |
| Muchinga | Lavushimanda, Mpika, Kanchibiya, Nakonde |
| Northern | Kasama, Mungwi, Senga Hill, Mbala |

All three study areas are shown on Map 5-1.

Though the LSA comprises a 5 km buffer area around the Project footprint, the ROW and substation footprints are more thoroughly characterized as these are where impacts will be the most important, including in terms of habitat modification and resettlement.

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***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-1**
**Study Areas**

***Sources :***
*ESRI, World Street Map*
*ESRI, Rivers and Lakes*
*MapLibrary, Africa World*
*Zambia Ministry of Land, districts*
*ZESCO, ZTK II line route (2019-09-30), Interconnection to Tanzania (2019-10-07)*

0 40 80 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: F. St-Hilaire-Dorion*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_1_StudyArea_007_240619*

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.*

# 5.2 PHYSICAL ENVIRONMENT

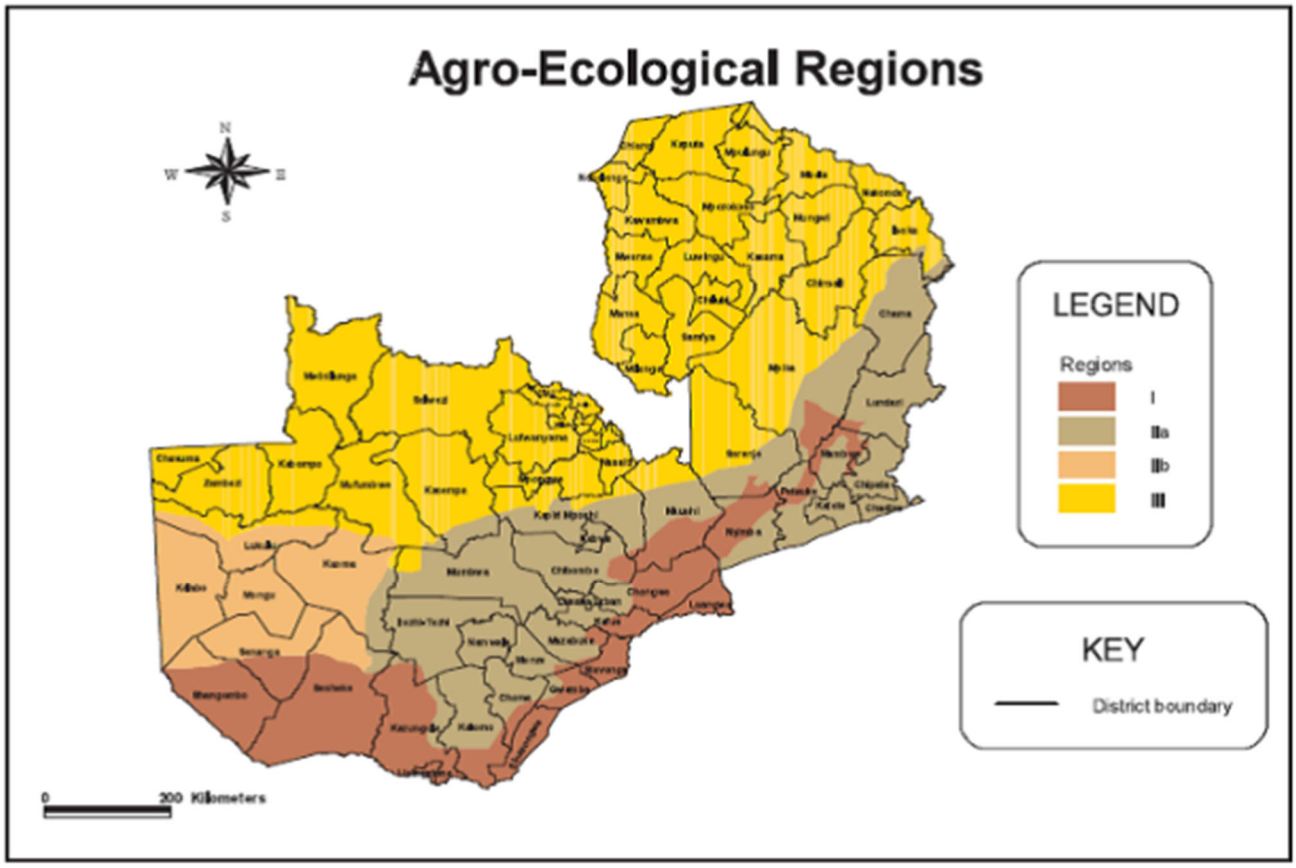
## 5.2.1 CLIMATE

Zambia's tropical climate is modified by altitude and latitude, resulting in a subtropical climate rather than a tropical one for most of the year. Temperatures vary from a mean maximum range of 28-35°C to a minimum range of 12-14°C. Due to latitude and altitude differences, the northern part of Zambia has slightly cooler temperatures and receives more rainfall than the southern part. Rainfall in Zambia generally increases as one moves northward within the country.

According to the Meteorological Department, Zambia is divided into three agro-ecological (climatic) regions, with rainfall being the key determining factor (see Figure 5-1).

- On average, Region I receives an annual rainfall below 800 mm and is comprised of low-lying areas covering the Luangwa and Zambezi rift valleys;
- Region II receives between 800 mm and 1000 mm rainfall and covers Lusaka, Central, Southern, Eastern and Western Provinces;
- Region III receives over 1000 mm of annual rainfall on average. This region mostly covers the northern parts of the country, including Northern, Muchinga[1], North-western, Luapula and Copperbelt provinces.

[1] The bigger part of Muchinga Province. Part of Muchinga Province is in the escarpments and the valley in the Eastern part of the province.




Soil Survey Unit, Mount Makulu Central Research Station.

**Figure 5-1 Agro-Ecological Regions Source**

The line route is mostly located in Region III, with a short section in Region II near Pensulo.

Climate and seasons are relatively uniform across Zambia's northern and central parts. Even though these regions are characterized by moderate to high levels of rainfall, distribution is uneven, with most of the precipitations occurring between November and April (rainy season). Virtually no precipitation occurs during the months of June, July, and August (dry season).

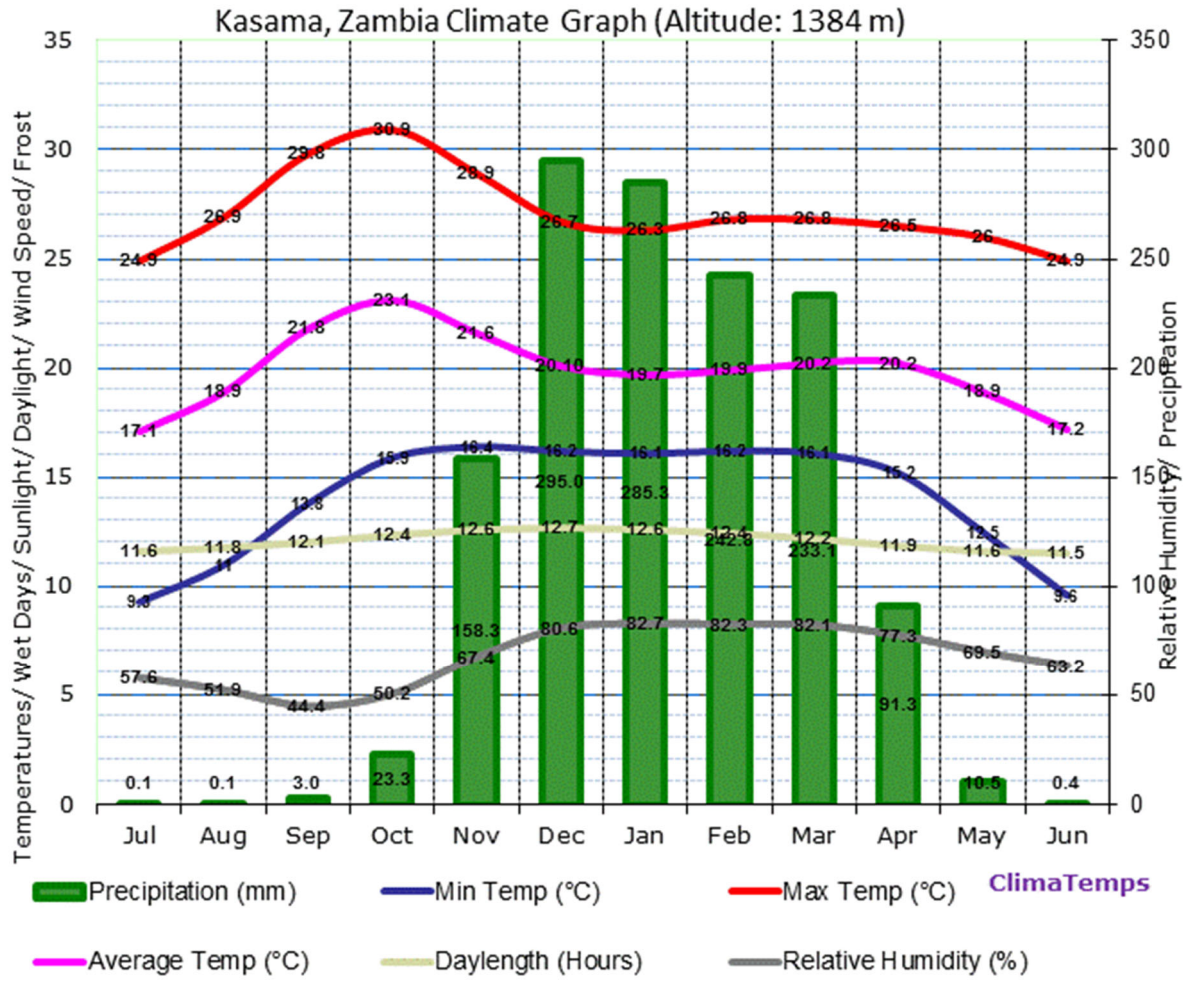
September, October, and November are the hottest months, with average highs ranging between approximately 26ºC and 32ºC. During the rest of the year, average highs range between 23ºC and 26ºC. Average lows range yearly between 9ºC and 17ºC.

More detailed climate data have been gathered, where available, for major towns located along or near the Project line route. Figure 5-2 to Figure 5-5 display detailed climate graphs for Kasama, Mpika, Mbala and Serenje, while Table 5-2 displays Nakonde rainfall figures from 1995 to 2003.

**Table 5-2 Nakonde Yearly Rainfall Figures for 1994 to 2003**

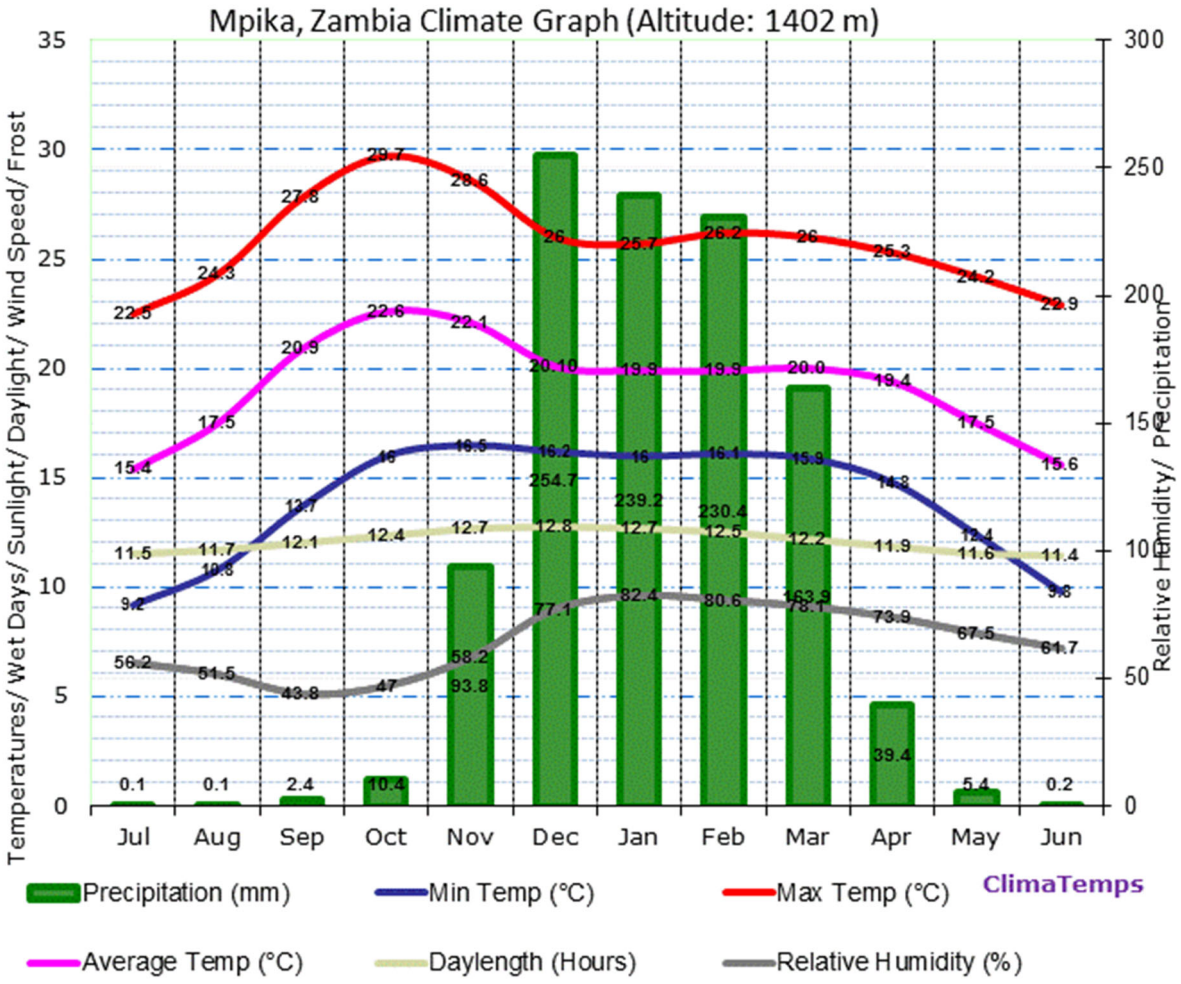
| Year | Rain Days | Rainfall (mm) |
|---|---|---|
| 1994/95 Rain Season | 97 | 1,010 |
| 1995/96 Rain Season | 104 | 754.5 |
| 1996/97 Rain Season | 89 | 84,405 |
| 1997/98 Rain Season | 89 | 1,105.7 |
| 1998/99 Rain Season | 87 | 803.5 |
| 1999/00 Rain Season | 93 | 901 |
| 2000/01 Rain Season | 123 | 1,410 |
| 2001/02 Rain Season | 98 | 1,015 |

Source: Nakonde MACO – April 2005



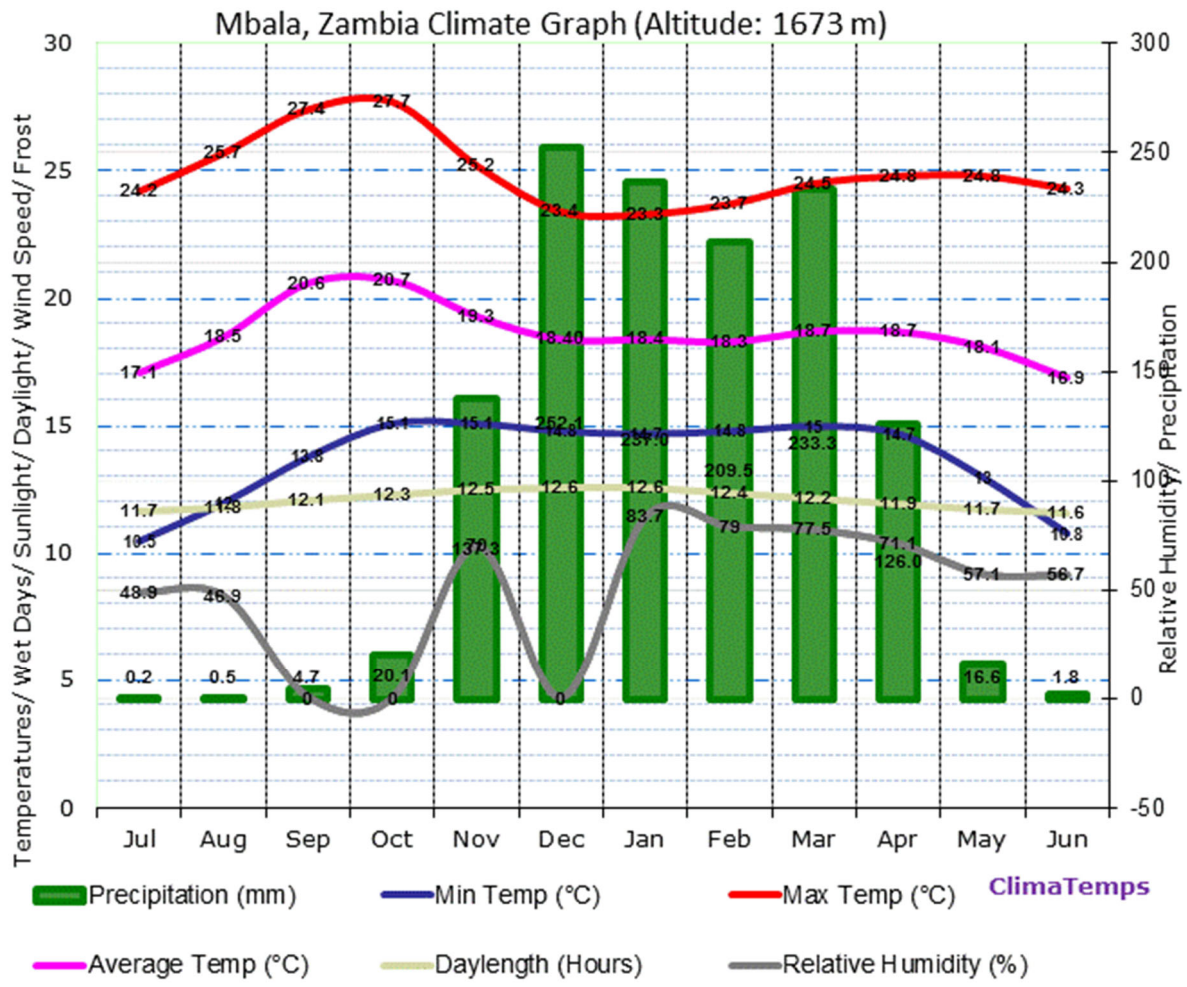

Source: Climatemps, 2019.

**Figure 5-2 Kasama Climate Graph**




Source: Climatemps, 2019.

**Figure 5-3 Mpika Climate Graph**




Source: Climatemps, 2019.

**Figure 5-4 Mbala Climate Graph**

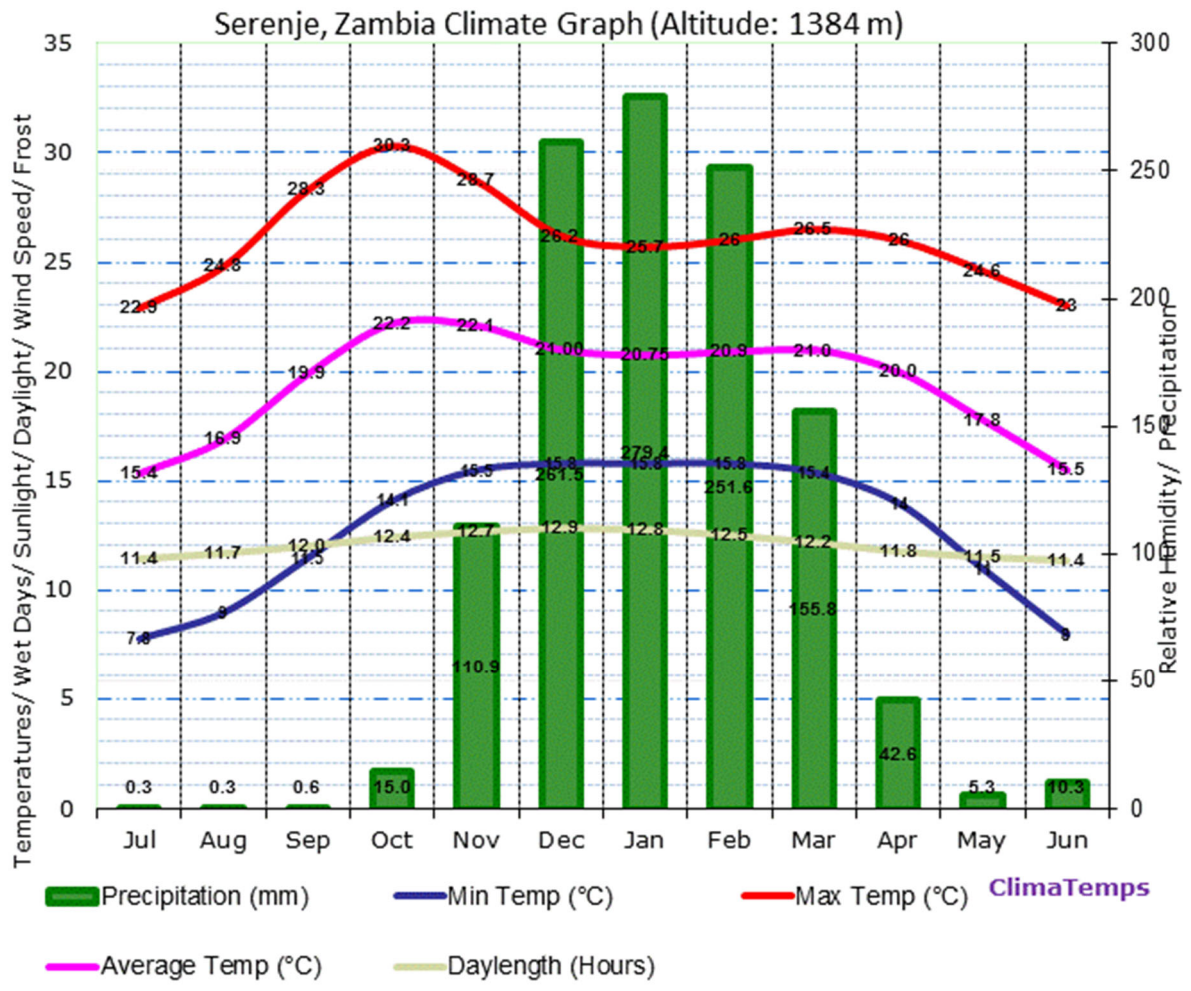



**Figure 5-5 Serenje Climate Graph**

## 5.2.2 CLIMATE CHANGE VULNERABILITY

Zambia has historically faced drought, extreme temperatures, and both seasonal and flash flooding (World Bank Group, 2024). Climate change is anticipated to increase both the severity and frequency of these climate hazards, resulting in impacts on human health and well-being, the environment, and the economy, including infrastructure damage and losses due to operational disruptions. Ensuring that climate change is considered in infrastructure design can help mitigate the consequences of future climate change hazards during Project construction and operations. This section aims to communicate key climate change hazards and infrastructure vulnerabilities to be considered for Project design.

In order to understand how climate change may impact the Project, a selection of temperature and precipitation indicators were chosen to understand climate change trends in Zambia. Project infrastructure is anticipated to be most at risk from extreme events, and so climate indictors were selected related to extreme temperature and precipitation events. Climate change Projections were obtained from the Work Bank Group Climate Change Knowledge Portal (2024). Additional climate Projections for other indicators are available on this Portal and it is recommended that the Project design team reference this Portal if additional climate data is required to inform design.

Global climate change data is based on a series of shared socioeconomic pathways (SSPs). Each SSP is based on a future development scenario, which includes considerations related to population growth, the use of fossil fuels, and levels of international cooperation. Climate change Projections shown within this section were selected to represent a worst-case scenario: SSP5-8.5. This scenario describes a global future with high fossil fuel use and associated greenhouse gas emissions. Using SSP5-8.5 in risk assessments is a conservative approach to allow for planning for extreme climate events.

#### 5.2.2.1 CHANGES IN TEMPERATURE

Temperatures in Zambia are Projected to increase in all seasons throughout all regions of the country. Figure 5-6 shows the change in mean temperature over time. As can be seen in this figure, average temperatures are Projected to increase each decade, with a 6°C increase in average temperature Projected by 2100.

By 2100, maximum temperatures are Projected to exceed 40°C, with temperatures exceeding 45°C in some areas of the country (based on 90$^{th}$ percentile Projections) (World Bank, 2021). Figure 5-7 shows the evolution of maximum temperature Projections regionally throughout Zambia over time. Each image in the below figure represents a two-decade time period and covers from 2020 until 2099.

Project components anticipated to be vulnerable to extreme heat are the transmission lines and substations, both of which have reduced capacity in high temperatures. Demand on the electrical grid may increase in extreme heat if people are running air conditioning systems, which further stresses the infrastructure during extreme heat events. Extreme heat also poses a health and safety risk of heat illness to construction and operations workers.

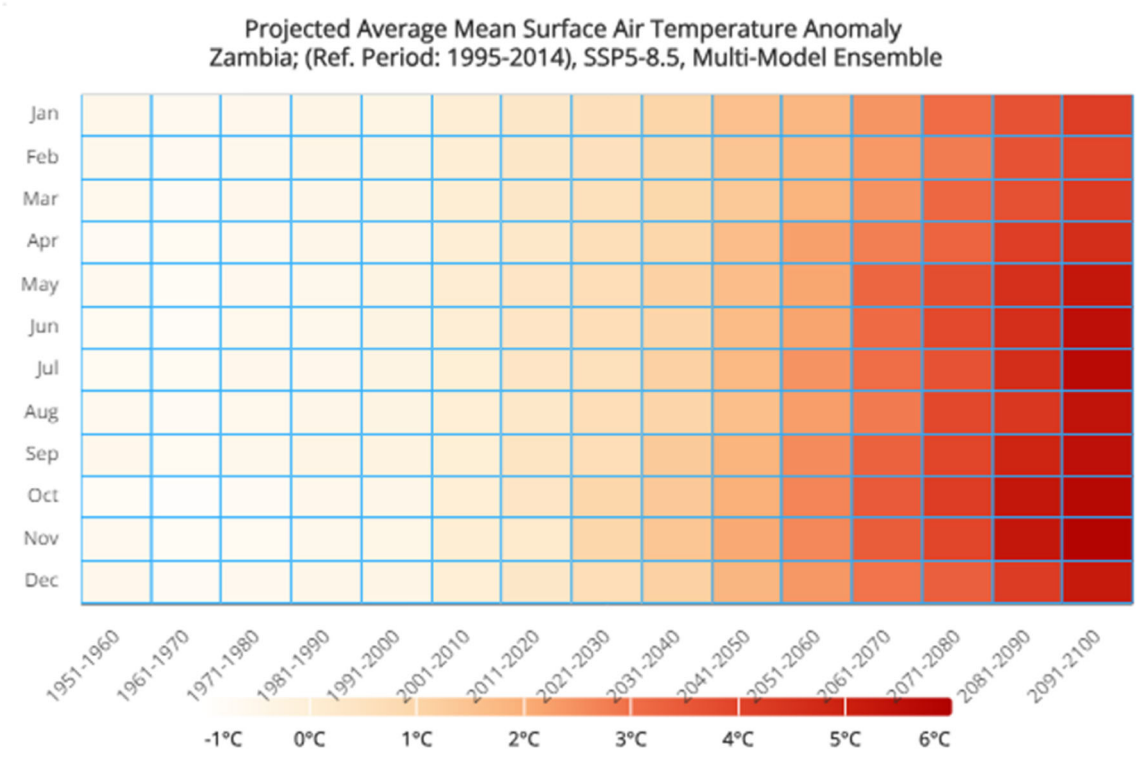



**Figure 5-6 Average Mean Surface Air-Temperature Change, Source: World Bank Group Climate Change Knowledge Portal**

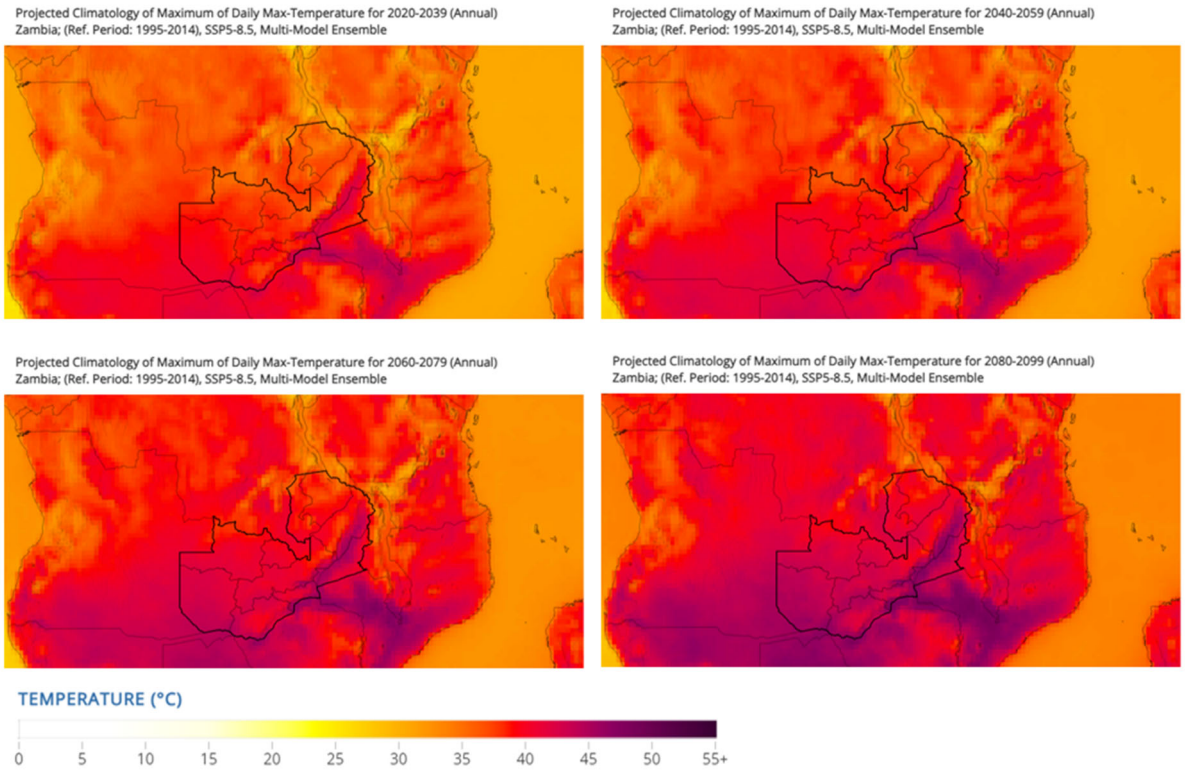


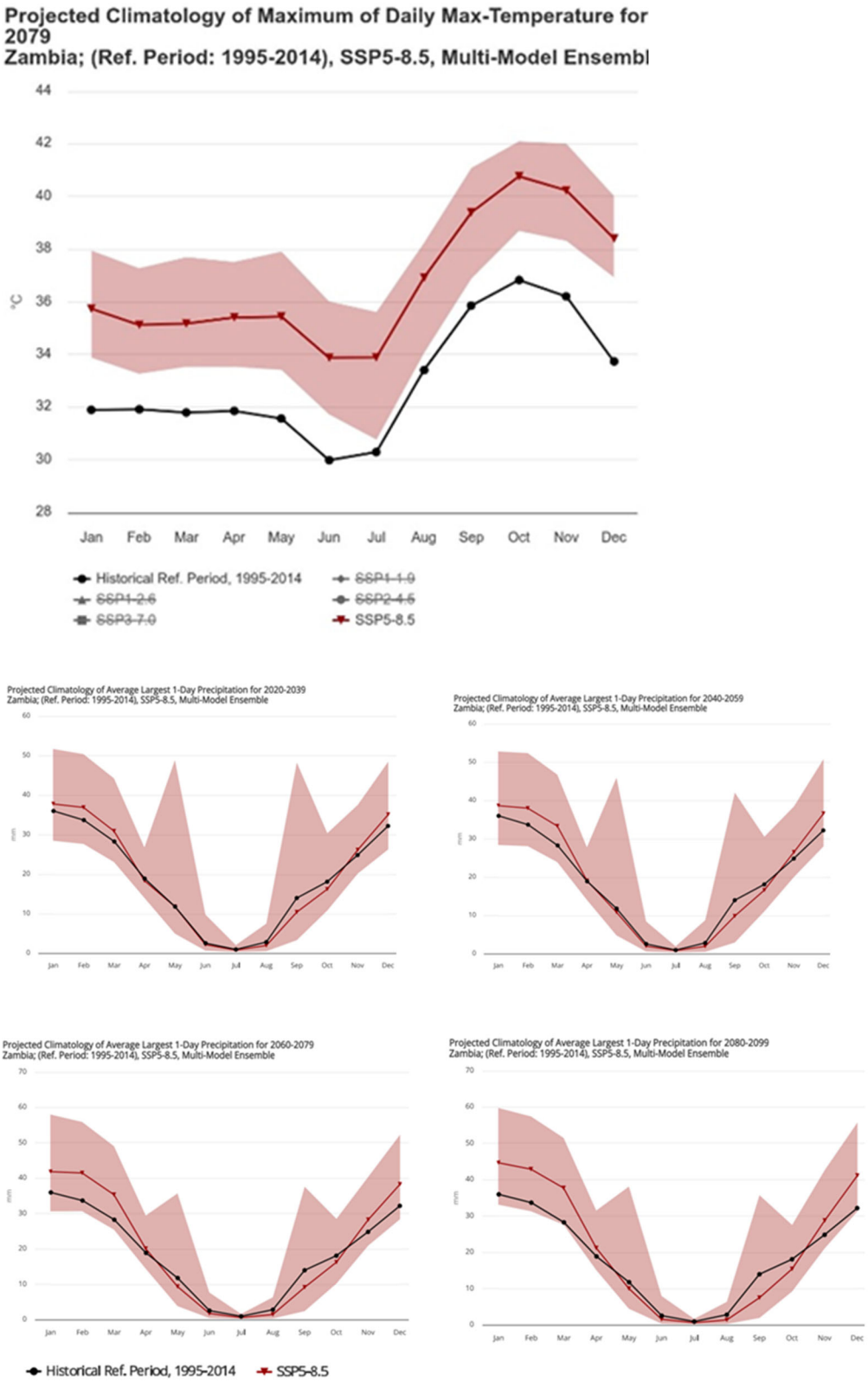

**Figure 5-7** **Maximum Daily-Max Temperature, 50th Percentile Results, Four Time Horizons Between 2020-2099 Source: World Bank Group Climate Change Knowledge Portal**

### 5.2.2.2 CHANGES IN PRECIPITATION

Although average precipitation is Projected to remain fairly stable compared to historical values in the future, there is fairly significant variation between the upper and lower Projections for monthly rainfall throughout September to May and this variation within Projected values increases over time. Throughout May to September, rainfall is Projected to remain low and is comparable to historical values, with slightly increased rainfall Projected from January to April and slightly less rainfall Projected from September to December.

Similarly, trends related to extreme rainfall events generally indicate more intense rainfall events throughout December through March, with extreme rainfall equal to or less than historic amounts between April and November. The following figure illustrates Projections for the largest one-day precipitation events for four different time horizons between 2020 and 2099. As can be seen in these figures, the 90th percentile Projections indicate that one-day rainfall could exceed 50 mm in the short term and up to 60 mm by 2100.

Zambia has historically experienced flooding and flood events are anticipated to worsen with climate change. Extreme rainfall has the potential to flood substations, causing damage and disruptions to operations. Access and maintenance routes may also be impacted by flooding leading to challenges with operations. Finally, if pylons are located in flood plains or areas that have historically experienced flooding, foundations may need to be reinforced to withstand flood conditions.




Source: World Bank Group Climate Change Knowledge Portal

**Figure 5-8 Largest 1-Day Precipitation Events, Comparing Climate Change Projections to Historical Baseline for Four Time Horizons Between 2020-2099**

#### 5.2.2.3 DROUGHT AND WILDFIRE

Drought conditions, combined with high temperatures, may lead to increased wildfire risk throughout Zambia. Wildfires have the potential to cause direct damage to substations. Wildfires may also impact transmission lines due to smoke tripping the circuit or heat from wildfires damaging transmission lines.

Prolonged drought may impact soil stability which could have an impact on pylon and substation foundations.

#### 5.2.2.4 EXTREME WEATHER EVENTS

Wind and lightning can potentially damage Project infrastructure and interrupt operations. Climate change is anticipated to lead to an increase in extreme weather events. However, there is a lower data confidence level in wind and lightning Projections than in other climate indicators. Lightning and wind speed are projected to increase (Finney et *al.*, 2020). Although wind speed changes are projected to be fairly minimal (Liabanda and Paeth, 2023), there could still be extreme wind associated with storm events. Climate change is projected to decrease the frequency of cyclones in East and Southern Africa. However, cyclones that do occur are projected to have higher wind speeds (Trisos et *al.*, 2022). Although cyclones are primarily anticipated to impact coastal nations, areas of Zambia have historically been impacted by cyclones, and so this risk is anticipated to continue into the future, especially with higher-intensity storms.

### *5.2.3 GEOLOGY AND SEISMICITY*

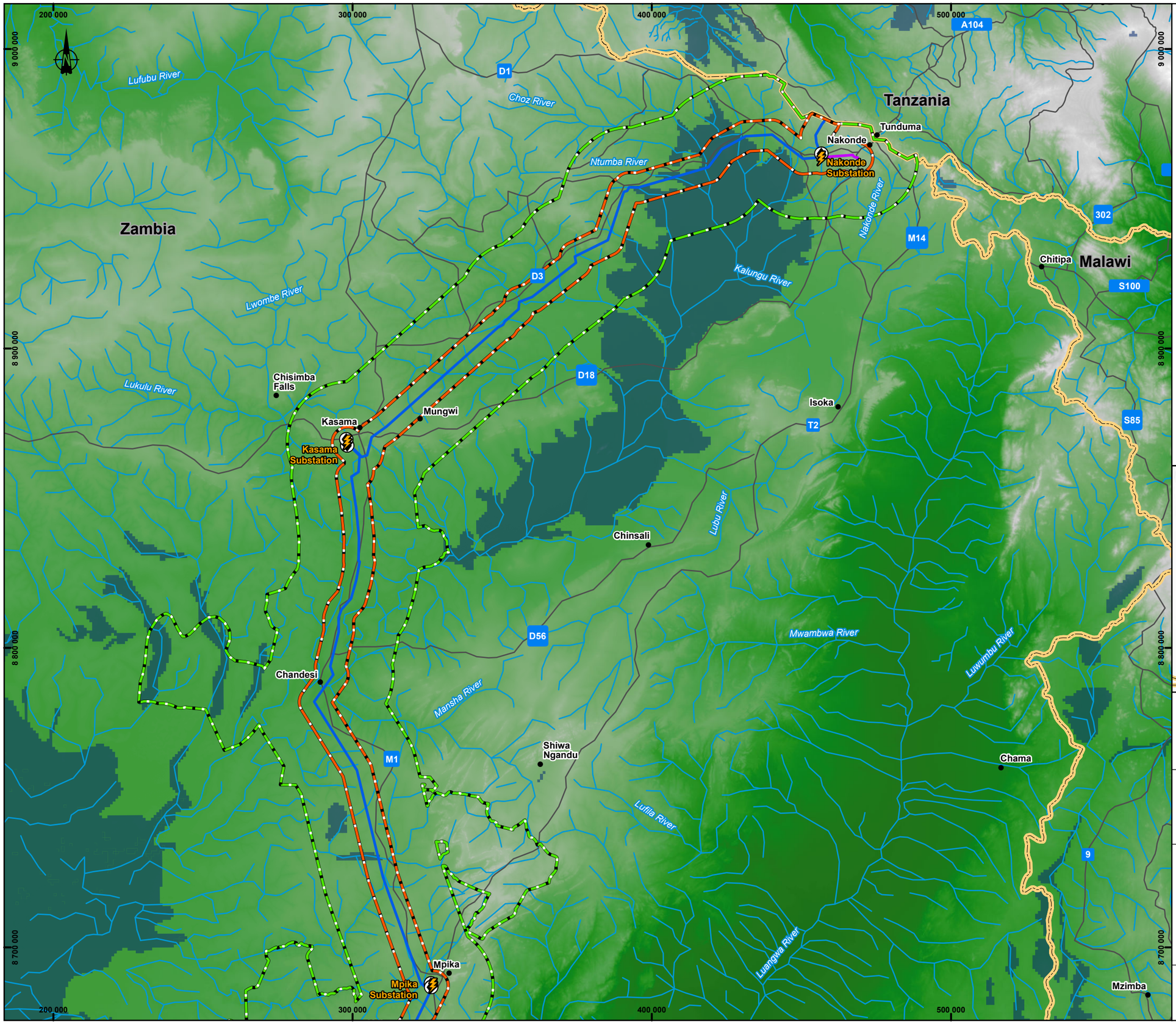
Relevant components of the physical environment are illustrated in Map 5-2 and Map 5-3.

The oldest succession of rocks in the country, the Basement Supergroup, consists mostly of granitic gneisses and migmatites, which are evident throughout eastern, central, and southern Zambia, in places in-folded with meta-carbonate, metaquartzite, and metapelite units. In central and eastern Zambia, the sequence of metapelites and metaquartzites is commonly in-folded and even imbricated with the basement rocks, the metapelites and metaquartzites sequences being later folded to form the core of the Irumide Belt extending north-eastwards from Kabwe to Mpika and forming a major component of the Zambezi Belt south and east of Lusaka.

In northern Zambia, which is in the proposed Project option location, the Proterozoic basement is largely made up of rocks of the Bangweulu Block, which was deformed during the Paleoproterozoic (Eburnian). Within the Bangweulu Block of northern Zambia, the sedimentary sequence is very different, comprising a lower 5,000 m-thick succession of continental sediments (rudites, arenites, quartzites and argillites) - the Mporokoso Group, overlain by quartzites, hematitic sandstones, mudstones and minor conglomerates of the Kasama Formation which ranges in thickness from c.100m over the Bangweulu Block to 3,500m southwards into the Irumide Belt.

The northeast striking Mesoproterozoic Irumide Belt and the Neoproterozoic rocks of the Katangan Supergroup, which form the Lufilian Arc, are exposed in the northern and north-western parts of the country (Drysdall et al. 1972; Andersen and Unrug 1984). Karoo beds are found in the Luangwa Rift Valley and the Zambezi Rift Valley. The Katanga Supergroup overlies the Basement and Muva sequences following an angular unconformity. Rocks of the Karoo Supergroup (late Carboniferous to Jurassic) occupy the rift troughs of the valleys such as Luangwa, Luano-Lukusashi and Kafue.

The Central Region of Tanzania is ranked as a seismically active region. The surrounding areas of the Western Rift Valley are assumed to be governed by the same tectonic setting. The locations of the substations Mbeya, Tunduma and Mpika are close to the Western Rift valley therefore they are considered high seismic zones. The maximum earthquake magnitude range is between 5.0 and 6.4, with dominant magnitudes ranging between 4.0 and 4.8 (AECOM, 2017).




**Physical Environment**

- Lake
- River
- Wetland

*Elevations*

High: 2 900 m

Low: 1 m

**Human Environment**

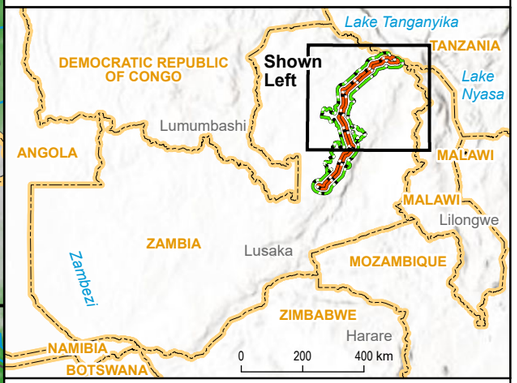
- International Boundary
- City / Village

**Infrastructure**

- Road

**Project Components**

- Local Study Area
- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Proposed 132 kV Transmission Line
- Substation
- Noise Sampling Station

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***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

## Map 5-2
## Physical Environment, Nakonde - Mpika segment

***Sources :***

*ESRI, World Street Map and World Hillshade*
*MapLibrary, Africa World*
*Open Street Map, 2019, roads, railways, rivers*
*Worldwildlife.org, Global Lakes and Wetlands Database*
*Zambia Ministry of Land, districts*

0 12,5 25 km

UTM 36S, WGS84

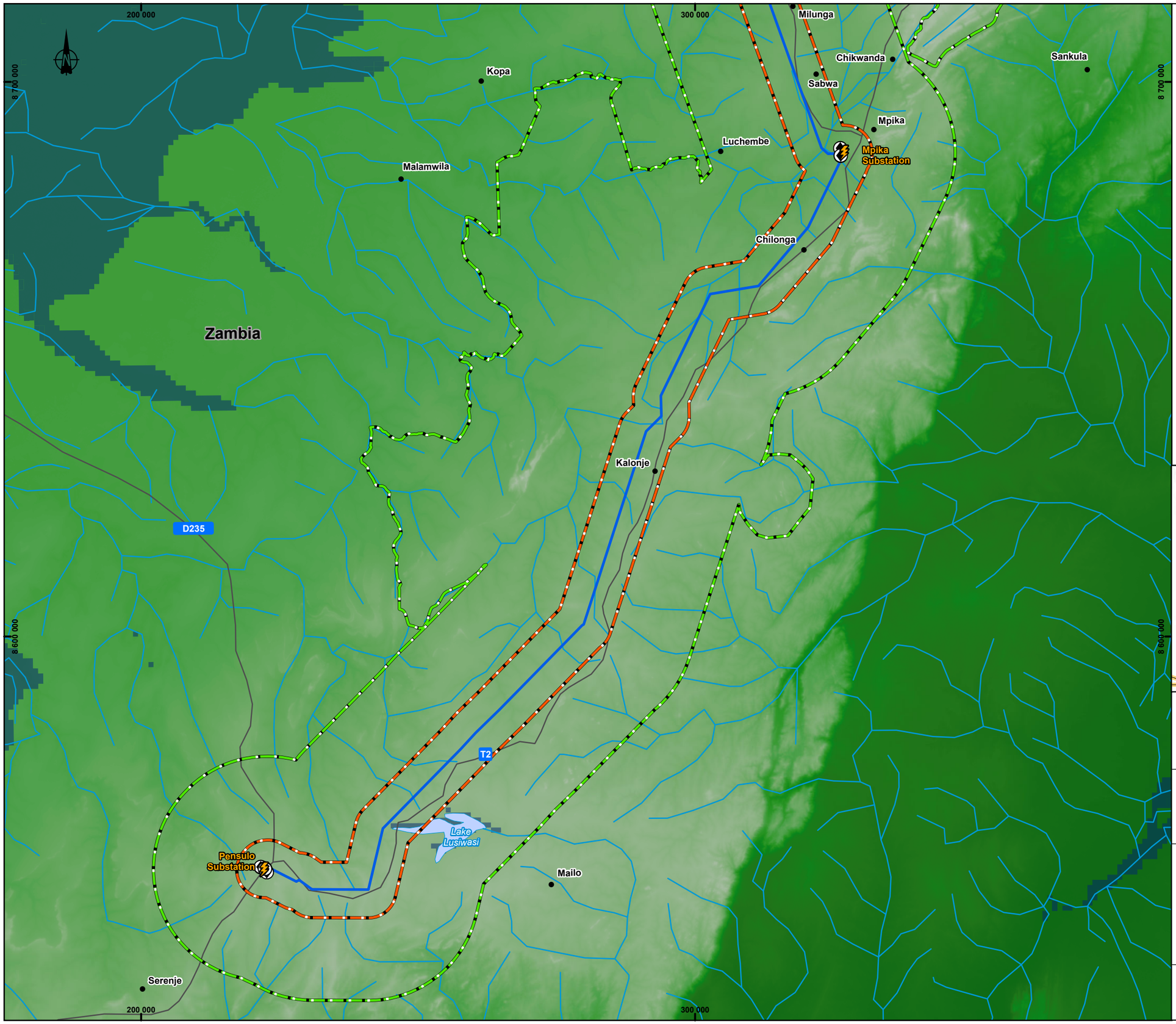
**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_2_PhysiEnviro_North_008_240618*

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.*




**Physical Environment**

- Lake
- Wetland
- River

*Elevations*

High: 2 900 m

Low: 1 m

**Human Environment**

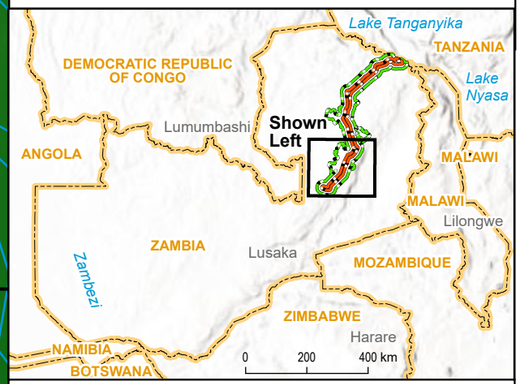
- City / Village

**Infrastructure**

- Road

**Project Components**

- Local Study Area
- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Substation
- Noise Sampling Station

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***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

## Map 5-3
## Physical Environment, Mpika - Pensulo segment

***Sources :***
*ESRI, World Street Map and World Hillshade*
*MapLibrary, Africa World*
*Open Street Map, 2019, roads, railways, rivers*
*Worldwildlife.org, Global Lakes and Wetlands Database*
*Zambia Ministry of Land, districts*

0 6,75 13,5 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

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*CA0027197_7329_EIC5_3_PhysiEnviro_South_009_240618*

wsp

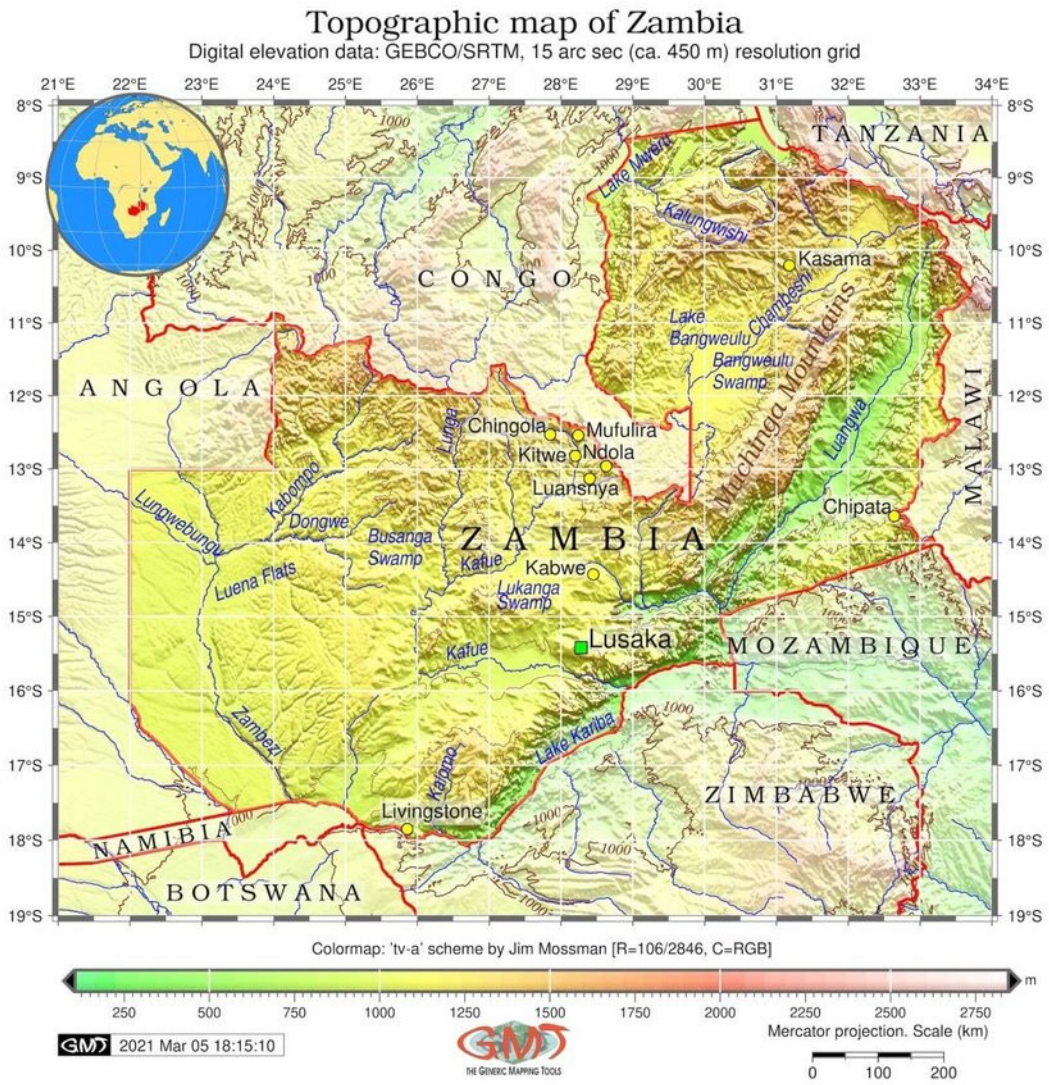
*Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.*

### 5.2.4 TOPOGRAPHY

Zambia lies on the Central African Plateau with elevations between 1,000 and 1,600 m above sea level (masl) (Figure 5-9). Relevant components of the physical environment are illustrated on Maps 5-2 and 5-3. Most of the Project area lies between 1,100 m and 1,650 m. The highest parts of the Project area occur as a belt stretching from the northern end of Nakonde Town to the northern part of Kasama, parallel with Tazara and along the Mpika-lsoka Ridge. The Mpika-lsoka Ridge land region is a high belt of terrain following the Congo Zambezi watershed along the eastern side of the Project area. It roughly coincides with the eastern branch of the Irumide folded zone and is characterized by gentle to moderate slopes. Erosion slowly exhumes the folding, and the landscape is consequently distinguished by long ridges, plunging anticlines, and synclines.

The land region attains its maximum width north of Mpika, where quartzite formations are repeated (Marten, 1968). The ancient landscape of folded basement rocks – granite, gneiss and schist – was split into blocks by tectonic movements. Some of the blocks subsided, others rose, forming plateaus such as Namatinji Ridge (1460-1682 masl) and Chapalapata (1400 m-1682 masl). The Congo Basin in the north covers about 25% of Zambia, and an area of internal drainage occurs in northern Zambia, where the largest stream is the Chambeshi. Erosion and sedimentation modified the faulted surface.

The plateau landscape is dissected by two main river systems; namely the Zambezi and its tributaries, Kafue and Luangwa; and, the Chambeshi-Luapula system, which is part of the Congo River Basin.




Source: ResearchGate, 2024.

**Figure 5-9 Topographical Map**

## 5.2.5 SOILS

Soils in Zambia have been formed from a great diversity of parent materials. However, the characteristics and distribution of the soils are largely influenced by climate, particularly rainfall. The northern part of Zambia is mainly characterized by high rainfall of 1,000 to 1,500 mm, and the soils are mostly Haplic Acrisols, which are highly leached and acidic. The central part of the country is mainly characterized by medium rainfall of 800 to 1,000 mm and the soils are mainly Haplic Lixisols, Haplic Luvisols and Haplic Acrisols. Although parent materials are similar, soils in the central part of the country show moderate weathering and leaching as compared to soils in the northern region. In line with the FAO/UNESCO (1974) Soil classification system, 13 major soil units are found in the study area. Map 5-4 displays these soil types.

The major soil units are shown in Table 5-3, together with associated soil units and important inclusions.

| Soil Type | Type of Relief | FAO / UNESCO Classification | | |
|---|---|---|---|---|
| | | *Major Soil Unit(s)* | *Associated Soil Unit(s)* | *Important Inclusions* |
| 2 | high relief area | lithosol, ferric acrisol, ferric luvisol | - | - |
| 3 | high relief area | lithosol | - | - |
| 4 | high relief area | lithosol, orthic ferralsol | - | dystric / eutric gleysol |
| 5 | high relief area | lithosol, orthic ferralsol | ferric acrisol | - |
| 6 | low relief areas (eastern plateau) | acric ferralsol | humic ferralsol | - |
| 7 | low relief areas (eastern plateau) | humic ferralsol | xanthic / orthic ferralsol, humic cambisol | dystric / humic gleysol |
| 8 | low relief areas (eastern plateau) | orthic / xanthic ferralsol, ferric acrisol | - | dystric gleysol |
| 9 | low relief areas (eastern plateau) | ferric acrisol, ferric luvisol | orthic / xanthic ferralsol | dystric / eutric gleysol |
| 10 | low relief areas (eastern plateau) | rhodic / orthic ferralsol | ferric acrisol, dystric nitosol | dystric gleysol |
| 12 | low relief areas (eastern plateau) | chromic luvisol, orthic acrisol, eutric nitosol | orthic / ferric luvisol, haplic / luvic phaeozem, humic nitosol | eutric / vertic cambisol, chromic / pellic vertisol, dystric / eutric gleysol, calcaric phaeozem |
| 15 | low relief areas (eastern plateau) | orthic / xanthic ferralsol | rhodic ferralsol, ferric acrisol | dystric gleysol |
| 26 | depression | xanthic ferralsol | ferralic cambisol, humis ferralsol, dystric gleysol | - |
| 29 | depression | dystric gleysol, humic gleysol, dystric fluvisol | eutric gleysol, gleyic cambisol | dystric histosol, humic cambisol |

Tanzania
Zambia
Democratic Republic of Congo
Malawi
Lake Malawi
Lake Bangweulu
Lake Lusiwasi
Mpulungu
Mbala
Mbeya
Tunduma
Nakonde
Nakonde Substation
Chisimba Falls
Kasama
Kasama Substation
Mungwi
Isoka
Chinsali
Chandesi
Shiwa Ngandu
Chama
Mpika
Mpika Substation
Chilonga
Pensulo Substation
M2
B8
D1
A104
B345
302
M14
D3
S100
D18
T2
S85
D56
M1
308
24
1
9
107
5
D94
D79
D451
D235
M12

**Physical Environment**
- Lake

**Human Environment**
- City / Village
- International Boundary

**Infrastructure**
- Road

**Project Components**
- Local Study Area
- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Proposed 132 kV Transmission Line
- Substation

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*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-4**
**Soil Types**

***Sources :***
*ESRI, Shaded Relief*
*F.A.O. / UNESCO Classification, Zambia_FAO UNESCO_Soil Map.jpg*
*MapLibrary, Africa World*
*Zambia Ministry of Land, Districts*

0 20 40 km
UTM 36S, WGS84

**20 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_4_soilTypes_010_240620*

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.*

**Table 5-3 Description of the Soils – FAO/UNESCO Classification**

| Map Unit | Major Soil Units | Description / Reference | Associated Soil Units | Important Inclusions |
|---|---|---|---|---|
| 2 | Lithosol, ferric acrisol, ferric luvisol | This soil type is only found in small portions of the study area. | - | - |
| 3 | Lithosol | Shallow soils derived from acid rocks, occurring on hill ranges. Only small pouches across the southern part of the Project area are covered by these types of soils. | - | - |
| 4 | Lithosol, orthic ferralsol | Association of shallow soils occurring on hills and moderately leached reddish to brownish clayey to loamy soils derived from acid to basic rocks (Miombo). These soils are mainly in areas around the Mpika Isoka ridge. The proposed line route does not cross this major soil unit. | - | Distric/eutric gleysol |
| 5 | Lithosol, orthic ferralsol | Association of shallow soils occurring on hills and shallow to deep strongly leached reddish to brownish clayey to loamy soils derived from acid rocks (Miombo). These soils are crossed by the proposed line route to the East and South of Kasama, as well as for a few kilometres after Chilonga. | Ferric acrisol | - |
| 6 | Acric ferralsol | Strongly leached clayey soils with very low retention capacity derived from acid rocks (Miombo). The proposed line route crosses this soil type for a few kilometers midway between Nakonde and Kasam in the Makasa area. | Humic ferralsol | - |
| 7 | Humic ferralsol | Strongly leached dark brownish loamy to clayey soils derived from acid rocks (Miombo). Such soils are found between Kasama and Chambeshi. | Xanthic / orthic ferralsol, humic cambisol | Dystric/humic gleysols |
| 8 | Orthic / xanthic ferralsol, ferric acrisol | Association of strongly and moderately leached reddish to brownish clayey to loamy soils derived from acid rocks (Miombo). The portion of the line route located between Chambeshi River and Mpika features these types of soils. | - | Distric gleysol |
| 9 | Ferric acrisol, ferric luvisol | Moderately leached reddish to brownish clayey to loamy soils derived from acid rocks (Mimbo). They are the main soils encountered between Chilonga and Pensulo. | Orthic / xanthic ferralsol | Distric/eutric gleysol |
| 10 | Rhodic / orthic ferralsol | Moderately leached reddish to brownish clayey to loamy soils derived from acid rocks (Miombo). Found mainly around the Nakonde and Mpika areas. | Ferric acrisol, dystric nitosol | Dystric gleysol |
| 15 | Orthic / zanthic ferralsol | Strongly leached reddish to brownish clayey to loamy soils derived from acid rocks (Miombo). The line route runs predominantly in these types of soils between Kalamba and Kasama, apart from small sections where it crosses areas covered by #5&6. More than 50% of the northern part of the Project area is covered by these soils. | Rhodic ferralsol, ferric acrisol | Distric gleysol |
| 26 | Xanthic ferralsol | Association of strongly leached brownish to yellowish mainly loamy well, drained, and poorly drained floodplain soils. Found around Lubu River, and to the West of Chambeshi | Ferralic cambisol, humic ferralsol, dystric gleysol | - |
| 29 | Dystric gleysol, humic gleysol, dystric fluvisol | Floodplain soils (termitary associated and grasslands). These soils are found along the floodplains of the Chambeshi River and its tributaries such as the Chozi River on the northern part of Nakonde. The line route crosses these soils for close to 60 km. | Eutric gleysol, gleyic cambisol | Dystric histosol, humic cambisol |

Soils in the extended study area are generally highly weathered, strongly leached and acidic with pH below 4.5, low in organic matter content. Along the Chambeshi flood plains, the soils are poor and highly drained. Similar soils are found in shallow depressions on the upland called Dambos.

Although the chemical fertility of the upland soils is generally poor, the physical properties are good. The soils are deep, well drained and prone to erosion hazards especially after disturbance of the vegetation by human activities. Overviews of main soil types, their characteristics, crop suitability and geographical distribution are given below (JAICAF, 2008).

### ACRISOLS AND FERRALSOLS

The major part of Zambia (as well as the study area) is covered with acrisols and ferralsols. These soils are highly weathered and strongly leached and are thus infertile soils, characterized by weakly structured, loamy topsoils, clayey sub soils. Ferralsols are easy to form stable structures due to the clay properties. The major difference between the two soils is that Ferralsols generally tend to have a uniform texture throughout the profile while acrisols display a marked clay increase with depth. Topsoil textures of acrisols show loamy sand or sandy loam while ferralsols show clayey textures (er).

### WETLAND SOILS

Low wetland includes floodplains, swamps, marshes, and so-called dambos. The wetland soils differ greatly in their chemical properties as well as textural characteristics; this being a function of the rock type from which the alluvium is presumed to have formed. The most important group comprises Gleysols which are very poorly to poorly drained soils. These soils occur along the Chambeshi plains. The agricultural potential is low due to poor drainage. They are suited to vegetable cultivation, especially just after the rain season. [2]

### AGRO-ECOLOGICAL REGIONS

The agro-ecology of Zambia is roughly divided into three regions according to the rainfall and soil characters (Figure 5-1).

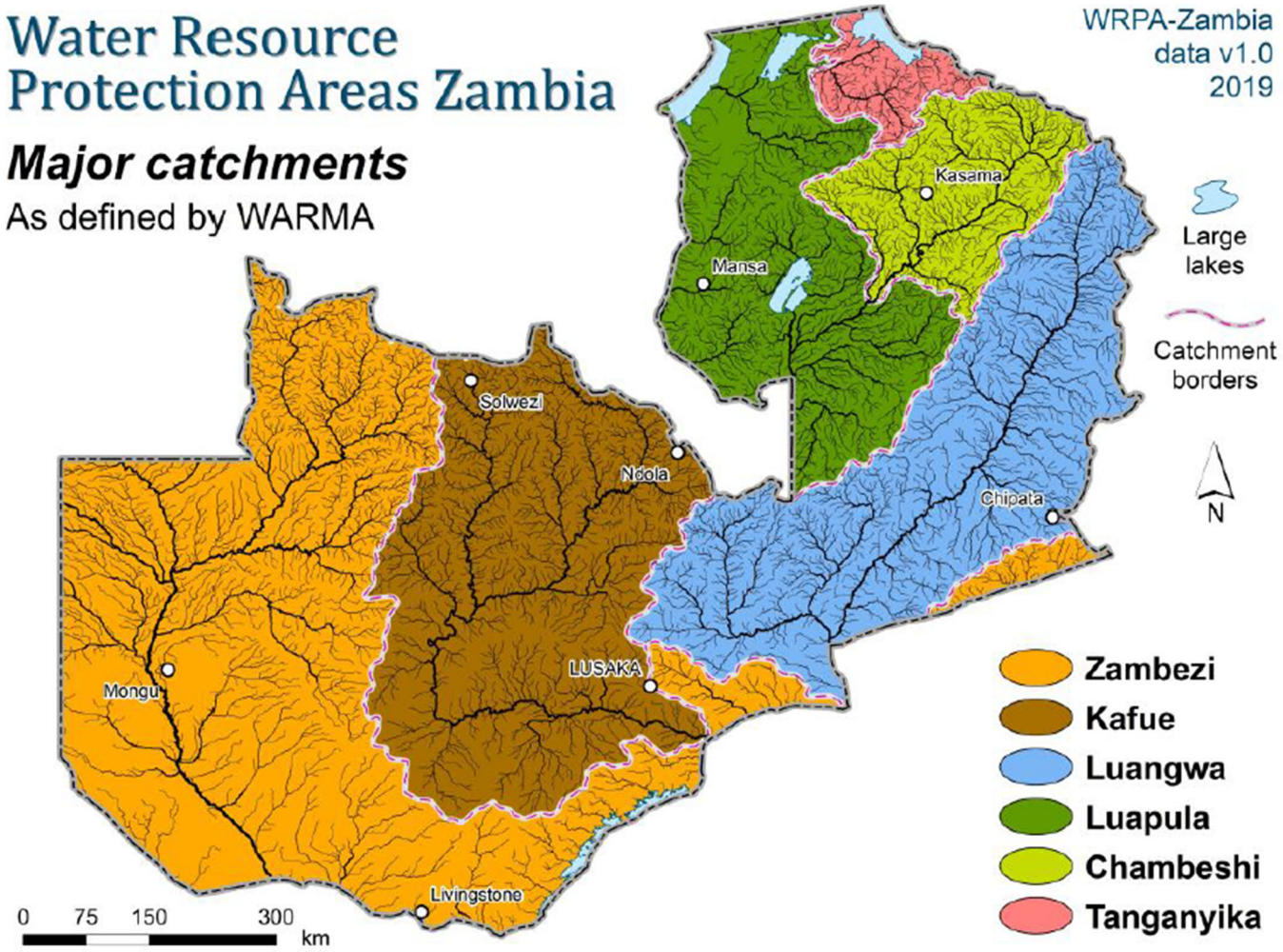
The line route is mostly located in Region 3, with some of it brushing in Region 2. Region 2 is located at the centre of the country and covers Western Province, Central Province and Eastern Province and a part of Northern Province. The region is a medium-rainfall area receiving 800 – 1000 mm rainfall annually. It accounts for 42% of the whole national acreage. The crop planting period is for 100-140 days. Region 2 is further divided into 2a and 2b sub-regions. The 2a subregion covers the four provinces of Lusaka, Central, Southern and Eastern and is characterized as a fertile plateau. Such crops as maize, groundnuts, sorghum, cassava, beans, millet, and cotton are planted. The area is also suitable for flower and vegetable production, such as paprika.

Region 3 is one of the highest rainfall areas, with an average annual rainfall of 1,000-1,500 mm. The period suitable for crop production is 120-150 days. The region accounts for 46% of the whole national acreage, and covers Northern Province, Luapula Province, Copperbelt Province, the most part of Northwest Province, and a part of Central Province. Except in the Copperbelt Province, the soil in the Region is in an advanced stage of leaching and acidification, yet it can be used as farmland when applying lime. It is suitable for the production of millet, cassava, sorghum, beans and groundnut. Coffee, sugarcane, rice, and pineapple were also planted. Some streams flow throughout the year without interruption and can be utilized for small-scale irrigation. Development of freshwater fish and aquaculture are also expected.

## 5.2.6 WATER RESOURCES

Zambia has two main river systems: the Zambezi and its tributaries - Kafue and Luangwa, which flow to the Indian Ocean, and the Chambeshi - Luapula River system, which is part of the Congo River Basin. The northern part of the Project line route is in the Chambeshi – Luapula Watershed, with the Chambeshi and its tributaries being the main river in this area (see Figure 5-10 and Photo 5-1). After Mpika, however, the Project line route advances approximately on the split line between the two watersheds. Kafue and Luangwa Rivers are the main tributaries of the Zambezi River Basin.

[2] Agriculture and Forestry in Zambia, Present Situation and Issues for Development - JAICAF, 2008.




Source: Lehner, 2020

**Figure 5-10 Major catchments in Zambia**

**Photo 5-1 Chambeshi River in the Dry Season**

The Zambezi River Basin is the fourth-largest river basin in Africa, with an area of 1,390,000 km$^2$. The Zambezi River rises in black marshy dambos in Northwestern Zambia, about 1,585 m above sea level. The 2,574 km river then flows through eastern Angola, along the eastern border of Namibia and the northern border of Botswana, then along the border between Zambia and Zimbabwe to Mozambique, where it crosses that country to empty into the Indian Ocean.

Two of the main tributaries of the Zambezi River are the Kafue and the Luangwa. The Kafue River rises in the north of Zambia, at the border with the Democratic Republic of Congo. After flowing for a long distance of about 960 km, it joins the Zambezi River with a discharge of about 10 km$^3$/year. The Kafue River has a mean flow rate of 320 m$^3$/s through its lower half, with high seasonal variations. The Luagwa River originates in the northeast of Zambia. At the border with Mozambique, it flows into the Zambezi River with an annual discharge of over 22 km$^3$.

The Chambeshi begins as a stream in the mountains near Lake Tanganyika in Zambia at an altitude of 1760 m. It flows 480 km to the Bangweulu swamps, which form part of Lake Bangweulu and then comes out of the swamps in the Luapula River towards Lake Mweru on the Zambia and Democratic Republic of Congo border. The Chambeshi River flows in flood plains east of Kasama towards the Bangweulu Swamps, between 2 km and 25 km wide or more in some sections. The Great Bangweulu Basin, the Lake, and a massive Wetland area lie in a shallow depression. The basin is fed by 17 principal rivers from a catchment area of 190,000 km$^2$ but is drained by only one river, the Luapula River.

Data on the flows and depth of the Chambeshi River and its tributaries is not currently available. It is clear, though, that the river system has more water in the rainy season than the dry season, with some tributaries and streams/wetlands completely drying out in the dry season (from May to November). The Chambeshi River flows approximately from northeast to west in the Northern part of Zambia and creates several wetlands along the way, some spanning several kilometres on either side of the main river channel. These wetlands do not have specific names but are called by the names of the rivers and streams.

The watercourses of the two river systems are mainly used for economic activities such as fishing, small-scale irrigation as well as a source for water supply for local people in villages as well as in towns. With respect to the Zambezi River, waters are also used for hydroelectric power, such as Kafue Gorge Power Station, which is the largest electricity-generating power station in Zambia. Reliable data on the efficient use of water resources in the Project area is not available. Photos 5-2 and 5-3 provide some illustrations of the Chambeshi river system.

**Photo 5-2 Extensive Wetlands in Mbesuma Area in the Rain Season**

**Photo 5-3 Wetland/Grasslands in the Dry Season**

### 5.2.7 AIR QUALITY

In accordance with the World Health Organization's guidelines, the air quality in Zambia is considered moderately unsafe (European Commission and UNEP GRID-Geneva, 2024). The EU/UNEP-GRID-Geneva site mentions that the most recent data indicates the country's annual mean concentration of PM2.5 is more than double the recommended maximum of 10 µg/m$^3$.

As for PM10, the most recent data (European Commission and UNEP GRID-Geneva, 2024) show that 260.5 kilotonnes are emitted annually, and the main sources are from economic activities (transport, mining, etc.), households (agriculture, cooking, etc.) and government-related activities. Finally, the same source mentions that mercury emissions are below 8000 kg per year (2018 numbers), with an approximate yearly emission rate of 2,250 kg. The mercury comes mostly from artisanal and small-scale mining, non-ferrous metals production, cement production, waste management, biomass burning, and some stationary combustion of coal.

Overall, most air pollution problems in Zambia are associated with large mining facilities, which are, for the majority, located in the western half of the country, away from the proposed Project. Although particulate matter exceedance can be expected in the larger urban areas and areas where cut-and-burn agriculture is conducted, the general air quality in the areas crossed by the Project is considered acceptable to good.

### 5.2.8 AMBIENT NOISE

The Project crosses essentially natural and agricultural areas by passing some small communities and entering the city of Kasama. It also follows sections of national roads and railway tracks. In terms of ambient noise, the main sources will originate from natural components associated with wind and animal sounds. Noise generated by human activities will essentially be present near larger communities and along the national road and will be mainly linked to transportation (vehicles and truck movements).

Noise sampling was completed in May 2024 at substation locations along the line route using RION Noise Meter. Noise sampling was conducted over 2-hour periods with recordings every 30 seconds. A total of seven measurements were done, detailed in Table 5-4. Sampling stations were located near the Projected entrance and exit bays of the ZTIP, close to the nearest sensitive receptor.

**Table 5-4 Noise Sampling Stations**

| Substation | Station ID | GPS Coordinates | | Date | Time | Weather conditions |
|---|---|---|---|---|---|---|
| | | Latitude | Longitude | | | |
| Pensulo | P-A | -13,0304738 | 30,4404301 | May 29, 2024 | 7:10 to 9:10 am | Windy |
| | P-B | -13,0304738 | 30,4404301 | May 27, 2024 | 4:40 to 6:40 pm | Calm |
| Mpika | M-A | -11,8709036 | 31,4090822 | May 26, 2024 | 6:40 to 8:40 am | Windy |
| | M-B | -11,8709036 | 31,4090822 | May 25, 2024 | 4:35 to 6:35 pm | Windy |
| Kasama | K-A | -10,2318567 | 31,1583925 | May 23, 2024 | 7:00 to 9:00 am | Calm |
| | K-B | -10,2270134 | 31,1574622 | May 22, 2024 | 4:28 to 6:45 pm | Calm |
| Nakonde | N-A | -9,373692 | 32,604619 | May 21, 2024 | 6:13 to 8:13 pm | Calm |

The noise sampling results are shown in Table 5-5 and include the average over the sampling period ($L_{eq}$) as well as the highest and lowest noise levels measured (Lmax and Lmin, respectively). Those are raw measurements that were not adjusted. The complete set of data collected during noise sampling is presented in Appendix 5-1.

**Table 5-5 Noise Sampling Results, May 2024**

| Station ID | Noise level recorded in dB(A) | | |
|---|---|---|---|
| | $L_{eq}$ (2hrs) | $L_{max}$ | $L_{min}$ |
| P-A | 77.9 | 88.1 | 58.5 |
| P-B | 72.1 | 88.9 | 54.6 |
| M-A | 75.1 | 89.6 | 50.7 |
| M-B | 68.8 | 87.6 | 50.0 |
| K-A | 71.0 | 84.2 | 49.1 |
| K-B | 62.2 | 83.0 | 38.0 |
| N-A | 64.9 | 72.6 | 50.0 |

As mentioned in Chapter 2, Zambia does not yet have noise standards. In this context, IFC's EHS Guidelines will be applied. Those state that noise levels near residential, institutional, and educational receptors should be limited to 55 dBA during daytime (7:00 am to 10:00 pm) and 45 dBA during nighttime (10:00 pm to 7:00 am). However, those standards are average noise levels for the duration of the given period (i.e., the 15-hour period for daytime and a 9-hour period for nighttime).

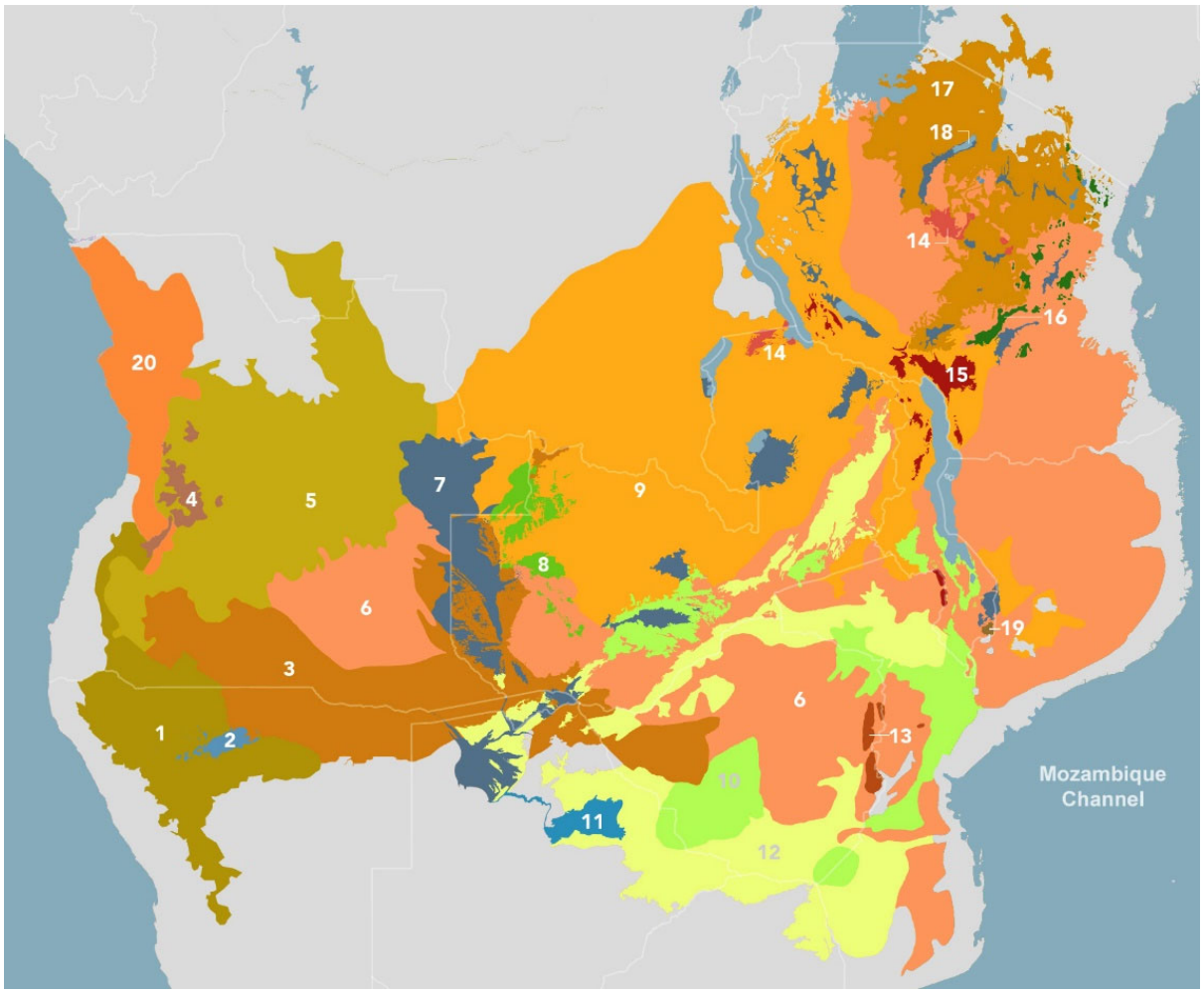
The measured noise levels are quite high, which could result from noise sources that were observed near sampling stations, including people passing by and talking, motorbike and car traffic, birds, and wind.

## 5.3 BIOLOGICAL ENVIRONMENT

### 5.3.1 REGIONAL BIODIVERSITY CONTEXT

The study area is part of the Greater African Subequatorial Savannas & Mixed Woodlands Bioregion. is the largest in the Afrotropics realm, covering the entire width of the continent from the drylands and grasslands of southern Africa north to the beginning of the Equatorial forest zone, extending to the southern shore of Lake Victoria.

The bioregion consists mostly of savannas and woodlands but also includes pockets of dry forest and flooded grasslands. It is made up of twenty ecoregions, as illustrated in Figure 5-11 (One Earth, 2024a).



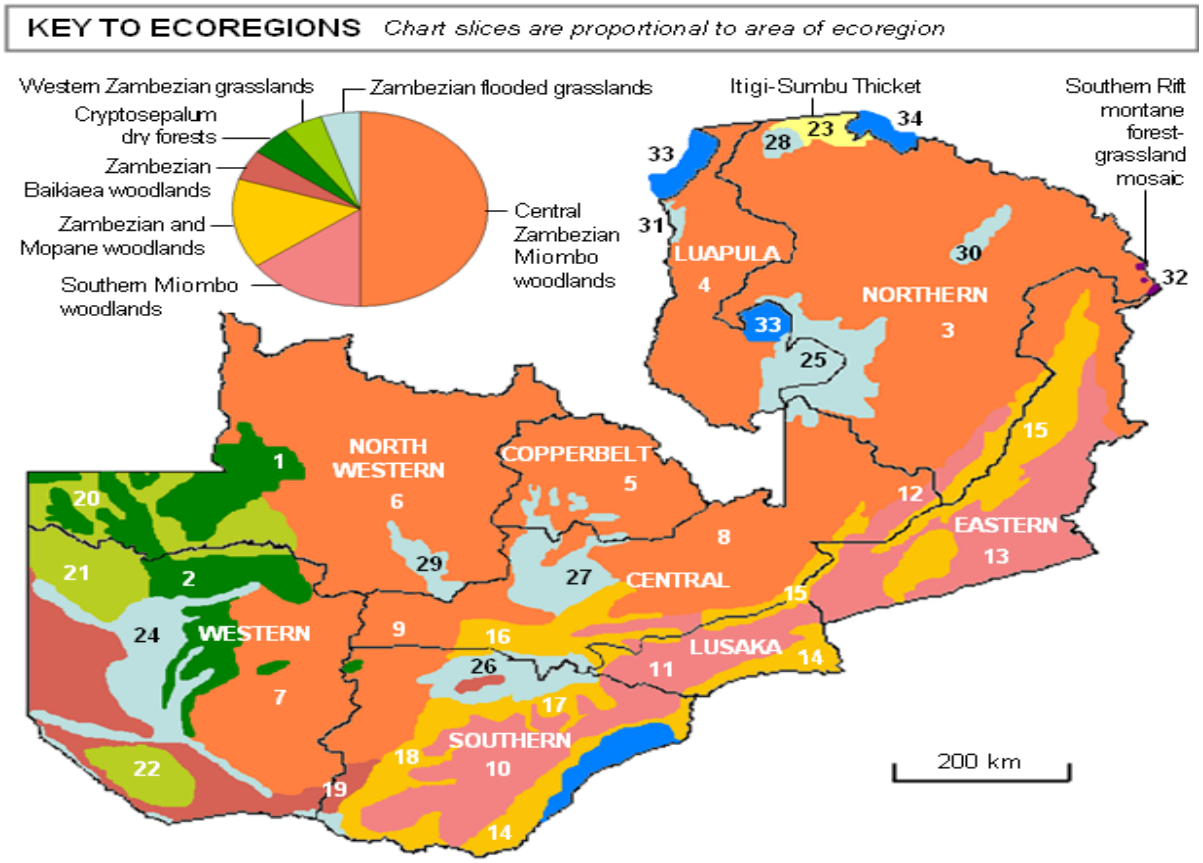

Angolan Mopane Woodlands [1], Etosha Pan Halophytics [2], Zambezian Baikiaea Woodlands [3], Angolan Montane Forest-Grassland [4], Angolan Wet Miombo Woodlands [5], Dry Miombo Woodlands [6], Zambezian Flooded Grasslands [7], Zambezian Evergreen Dry Forests [8], Central Zambezian Wet Miombo Woodlands [9], Zambezian-Limpopo Mixed Woodlands [10], Makgadikgadi Halophytics [11], Zambezian Mopane Woodlands [12], Nyanga-Chimanimani Montane Forest-Grassland [13], Itigi-Sumbu Thicket [14], Southern Rift Montane Forest-Grassland [15], Eastern Arc Forests [16], Southern Acacia-Commiphora Bushlands and Thickets [17], East African Halophytics [18], Mulanje Montane Forest-Grassland [19], Angolan Scarp Savanna and Woodlands [20]
Source: One earth, 2024a

**Figure 5-11 The Greater African Subequatorial Savannas & Mixed Woodlands Bioregion**

A majority of woodland in the bioregion consists of miombo woodland. Miombo is a vernacular word for *Brachystegia*, a genus of trees comprising many species. It is a woodland ecosystem that is dominated by tree species in the genera *Brachystegia*, *Julbernadia* and *Isoberlinia* (Photo 5-4). An estimated 8,500 plant species grow in the central Miombo woodlands, about half of which are endemic. Miombo woodlands are home to many large mammals including antelopes, giraffes, rhinos, lions and the largest population of elephants in Africa (WWF, 2024). Most of the BESA is set in the Central Zambezian Wet Miombo Woodlands. The ecoregion covers about 70 percent of central and northern Zambia (Figure 5-12).

Source: Field Investigations

**Photo 5-4 Typical Miombo Woodlands Vegetation Association**




Source: Malambo and Syampungani, 2008.

**Figure 5-12 The Major Ecoregions of Zambia**

The Central Zambezian Miombo woodland is the most extensive Zambian ecoregion, covering about 70% of the country (Malambo and Syampungani, 2008). The ecoregion has a high degree of floral richness when compared to the other miombo ecoregions in Zambia. This ecoregion may support over 3000 plant species, including several hundred endemic species (One Earth, 2024a). There are typically more evergreen trees than in most miombo woodlands. The classic miombo trees *Brachystegia*, *Julbernardia*, and *Isoberlinia* dominate the woodlands with canopy dominant tree species such as *Brachystegia floribunda, B. glaberrima, B. taxifolia, Julbernardia globiflora, J. Paniculata,* and *Isoberlina angolensis* (One Earth, 2024b).

There is a low density of large mammals, attributed to the harsh dry season, long droughts, and poor soils, which results in vegetation of low nutrient content – ideal conditions for elephant and African buffalo. Other species make more use of non-miombo habitats, including sable antelope, roan antelope, Lichtenstein's hartebeest, and southern reedbuck (One earth, 2024a). Rates of mammal endemism are low, with three strict endemics: Rosevear's striped grass mouse and two white-toothed shrews, Ansell's shrew and Upemba shrew. Threatened species include lions, cheetahs, and African wild dogs. The only strict avifauna endemics are Ruwet's masked weaver and black-faced waxbill. (One Earth, 2024a).

Finally, the Project area also overlies some areas of the Zambezian flooded grassland ecoregion. Embedded predominantly within miombo and mopane woodlands, the ecoregion occurs as isolated patches, mainly in the Kafue Flats and the Bangwuelu/Luapala/Chambezi system in Zambia, The vegetation is characterized mostly by a mosaic of edaphic grassland and semi-aquatic vegetation. This ecoregion has few endemic species, but the overall species richness is high, especially for birds. While several of the wetlands have been occupied for centuries, more recent large-scale changes are becoming evident in many areas as human activities and land-use intensify, including converting pastoral areas to farmland. One Earth, 2024c)

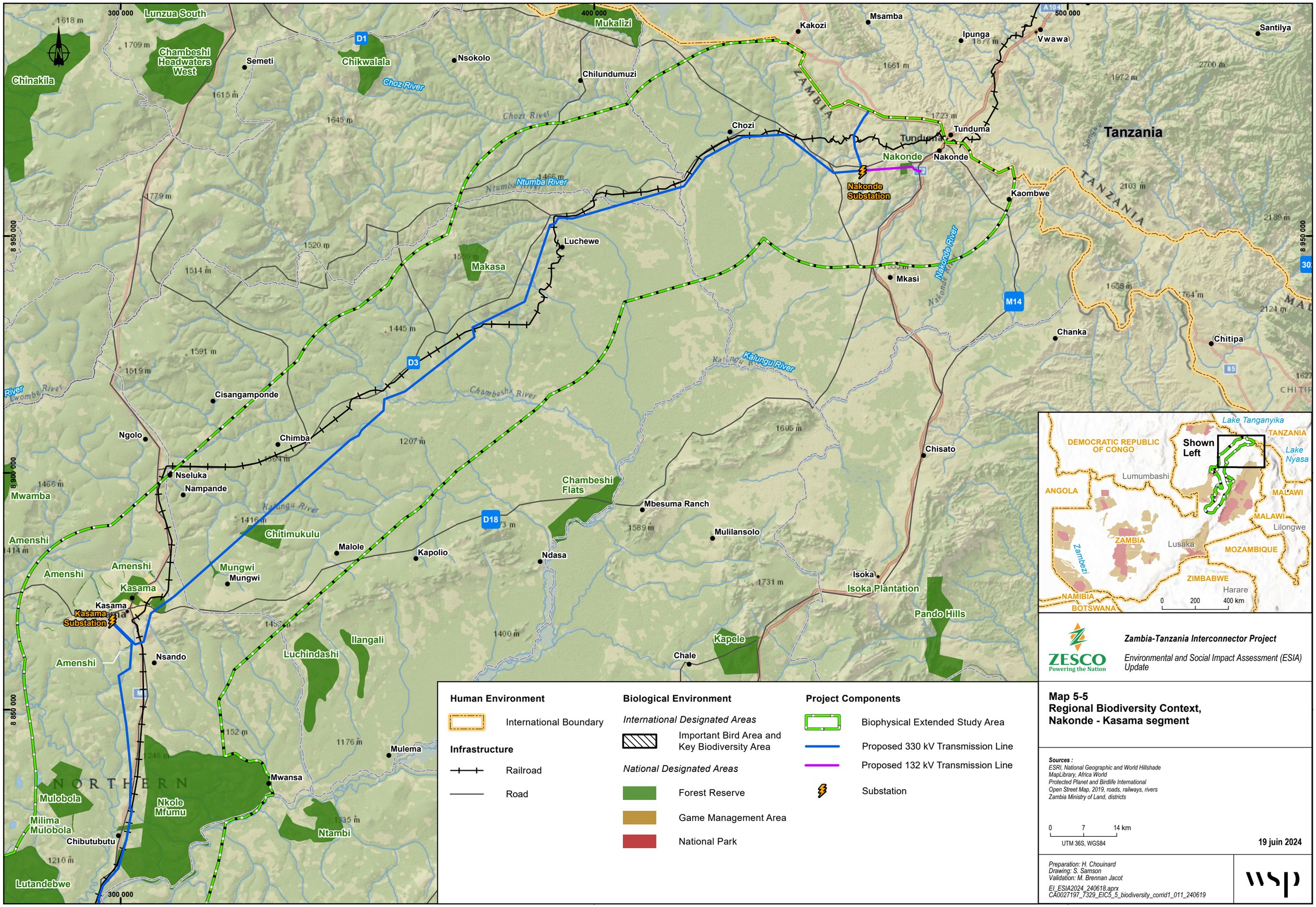
Although much of the miombo woodland ecoregions are sparsely populated, there are only a few areas that have not been affected by anthropogenic activities in some way. Deforestation is one of the most widespread threats. Woodlands are being cleared for fuelwood, charcoal, and building materials, as well as for agricultural land. Slash and burn agriculture is widespread. In particular, chitimene, a traditional form of ash-fertilizing agriculture, is commonly practised throughout northern Zambia. Growing staple, as well as cash crops, are present in several areas, which have been converted into maize, cassava, sorghum, millet, and tobacco crops (One Earth, 2024b).

The high incidence of fires in the area poses further threats to the ecoregion. Although fire is an integral part of Miombo ecology, human-set fires are believed to have increased the frequency of fire far above the natural level. Most of the deliberate burning and uncontrolled fires occur at the end of the dry season, just before the onset of the summer rains. The fires burn with greater intensity as quantities of dry fuel accumulate.

Repeated fires during the late season have a negative impact on forest regeneration, seed germination, and seedling survival growth, which can be severely disturbed (One Earth, 2024b).

Finally, poaching and illegal hunting for bushmeat have a significant impact on the wildlife throughout the ecoregion. Elephant and rhino poaching has been extremely severe throughout the ecoregion. Most areas outside parks and reserves have relatively little wildlife left (One Earth, 2024b).

Inside the study area itself, the natural vegetation cover has been largely modified by human presence. Habitat degradation intensifies near roads, villages and watercourses, where agricultural activities encroach on the natural vegetation. However, some sparse natural vegetation patches are still present. These patches are mainly conserved as they have been classified nationally as managed or protected areas (national parks, game management areas, forest reserves, etc.) or as areas of international ecological importance (Ramsar sites or Important Bird Areas). The study area hosts several of these protected areas, which are described in the next section and identified on Maps 5-5, 5-6, and 5-7.

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*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-5**
**Regional Biodiversity Context, Nakonde - Kasama segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

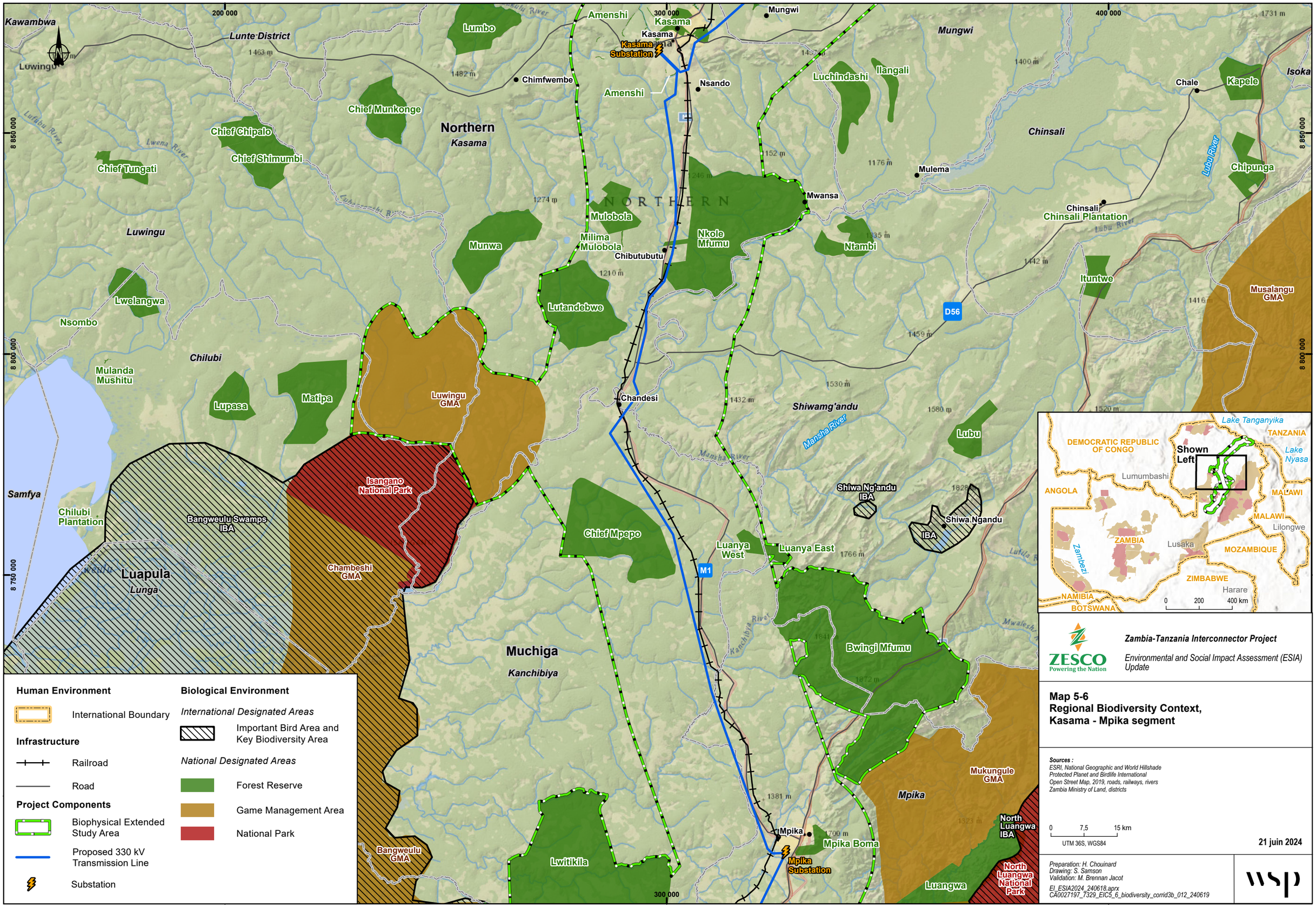
**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA00027197_7329_EIC5_5_biodiversity_corrid1_011_240619*

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.*




**Human Environment**

- International Boundary

**Infrastructure**

- Railroad
- Road

**Project Components**

- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Substation

**Biological Environment**

*International Designated Areas*

- Important Bird Area and Key Biodiversity Area

*National Designated Areas*

- Forest Reserve
- Game Management Area
- National Park

*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

# Map 5-6
# Regional Biodiversity Context, Kasama - Mpika segment

***Sources :***
*ESRI, National Geographic and World Hillshade*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

0 7,5 15 km
UTM 36S, WGS84

**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_6_biodiversity_corrid3b_012_240619*

*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.*

**Human Environment**

International Boundary

**Infrastructure**

Railroad

Road

**Biological Environment**

*International Designated Areas*

Important Bird Area and Key Biodiversity Area

*National Designated Areas*

Forest Reserve

Game Management Area

National Park

**Project Components**

Biophysical Extended Study Area

Proposed 330 kV Transmission Line

Substation

Kanchibiya
Luchembe
Mpika
Mpika Boma
Mpika Substation
Mukungule GMA
North Luangwa National Park
North Luangwa IBA
Lwitikila
Chilonga
Samfya
Bangweulu GMA
Bangweulu Swamps IBA
Kafinda GMA
Mulembo
Lavushi Manda National Park
Lavushi Manda IBA
Kalonje
Luangwa
Munyamadzi GMA
Mutinondo Wilderness IBA
D235
Kasanka National Park
Kasanka IBA
Lavushimanda
Zambia
Musola
Chitambo
Lukulu River
Musola River
T2
Lake Lusiwasi
Serenje
Musangashi
Pensulo Substation
Kanona
Mailo
South Luangwa National Park
South Luangwa IBA
Munte
Luombwa
Serenje
8 650 000
8 600 000
8 550 000
300 000
200 000

Lake Tanganyika
TANZANIA
DEMOCRATIC REPUBLIC OF CONGO
Lake Nyasa
Lumumbashi
Shown Left
ANGOLA
MALAWI
MALAWI
Lilongwe
ZAMBIA
Lusaka
Zambezi
MOZAMBIQUE
ZIMBABWE
Harare
NAMIBIA
BOTSWANA
0 200 400 km

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***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-7**
**Regional Biodiversity Context, Mpika - Pensulo segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

0 6 12 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_7_biodiversity_corrid8_013_240618*

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*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.*

### 5.3.1.1 PROTECTED AREAS AND INTERNATIONNALLY RECOGNIZED AREAS

Many protected areas are found within the BESA. They are listed in Table 5-6 with the distance from the proposed transmission line route. One national park (also and Important Bird Area), one game management area and one private wilderness area (also an Important bird area) are located inside the local study area and are further described below.

As shown in Table 5-6 below, a total of 15 forest reserves are found within the BESA, with seven of them being crossed by the proposed transmission line route. These seven forest reserves are described in more detail below.

**Table 5-6 National Protected Areas and Internationally Recognized Areas in the BESA**

| Name | Type | Distance from the Proposed Transmission Line Route (km) |
|---|---|---|
| Lavushi Manda | National Park / Important Bird Area | 1.1 |
| Luwingu | Game Management Area | 15.0 |
| Mutinondo Wilderness Area | Important Bird Area | 18.7 |
| Lwitikila | Forest Reserve | 4.4 |
| Mpika Boma | Forest Reserve | 2.5 |
| Bwingi Mfumu | Forest Reserve | 17.4 |
| Chief Mpepo | Forest Reserve | 1.1 |
| Luanya | Forest Reserve | 14.0 |
| Lutandebwe | Forest Reserve | 4.3 |
| Mulobola | Forest Reserve | 7.7 |
| Makasa | Forest Reserve | 8.3 |
| Kanona | Forest Reserve | 0.0 (crossed by the line along 30.7 km) |
| Amenshi | Forest Reserve | 0.0 (crossed by the line along 0.3 km) |
| Kasama | Forest Reserve | 0.0 (crossed by the line along 2.9 km) |
| Nkole Mfumu | Forest Reserve | 0.0 (crossed by the line along 4.4 km) |
| Chitimukulu | Forest Reserve | 0.0 (crossed by the line along 3.2 km) |
| Mungwi | Forest Reserve | 0.0 (crossed by the line along 0.4 km) |
| Nakonde | Forest Reserve | 0.0 (crossed by the line along 1.4 km) |

#### LAVUSHI MANDA NATIONAL PARK

Lavushi Manda National Park was created in 1972 to protect 1,500 km$^2$ of Central Zambezian Miombo woodlands. It is bordered by the Bangweulu Game Management Area (GMA) along much of the western boundary, and the Lwitikila National Forest (NF) along most of the northern boundary. It lies between the Muchinga Escarpment and the alluvial flats of the Bangweulu Wetlands (ZAWA and Kasanka Trust Ltd, 2014). A 40 km long dramatic rocky massif runs through the centre and holds large patches of pristine hill miombo woodlands, dambo wet grasslands, plains, and gallery forests along the headwaters of the Lukulu and Lulima rivers. The major reasons for establishing the park were to protect a large watershed area of regional importance, as well as to provide a preserved corridor between South Luangwa National Park, North Luangwa National Park and Bangweulu swamps. The park is also an IBA and is of major importance for African and paleartic migrants. It also serves as an upland wildlife refuge for ungulates of the Bangweulu during the wet season (World Bank, 2009). A total of 50 large mammal species have been recorded in the Lavushi Manda National Park (LMNP).

Even though the wildlife population has been depleted due to poaching, LMNP still hosts most of the large mammals that historically occurred in the area. Notable are lion, leopard, African elephant, hippopotamus and African buffalo, but also the large roan and sable antelopes, although only in very low densities (ZAWA and Kasanka Trust Ltd, 2014). Other wildlife species can still be found in the park include kinda baboon, vervet monkey, warthog, bush pig, reedbuck, bushbuck, common duiker, klipspringer, hartebeest, black lechwe, waterbuck, porcupine, side-striped jackal and caracal (World Bank, 2009).

Although Kasanka Trust is not involved in the management of Lavushi Manda National Park anymore, it is currently leading a Project to create Community Forests Areas along the Lavushi Manda National Park in the Mpumba chiefdom along the park's southeastern boundary to stimulate the securing of biodiversity and return of wildlife while improving community livelihoods.

The proposed powerline for the ZTIP passes some 1.5 km away from the Eastern tip of the National Park. Two existing lines already pass within the park's boundaries in this area (see Photo 5-5). Field observations and stakeholder consultations confirmed that the eastern area of the park has largely been converted to agriculture. However, in 2018, communities within the park's boundaries were relocated and the area is now recovering.

**Photo 5-5 Powerline and Disturbed Woodland Along the Eastern Tip of the Lavushi Manda National Park**

## LUWINGU GAME MANAGEMENT AREAS

GMAs in Zambia were established as buffer-zones for national parks and have been used primarily for hunting (mainly by foreign nationals) and hunting for meat by local and national residents. Unlike in the national parks, human settlement is permitted in GMAs and there are large and expanding human populations in many of them, which is accompanied by widespread habitat loss (Lindsey et al., 2014).

Luwingu GMA is located within the Bangweulu swamp ecosystem. It covers an area of 1 090 km$^2$ (NRCF, 2008) and is located North of Isangano National Park. Despite their size and potential, the wildlife resources in many GMAs are in a state of steep decline and are not sufficiently productive in ecological, economic or social terms (Lindsey et al., 2009). Wildlife communities in the GMAs are considered depleted, but they still host some large mammal populations with small numbers of black lechwe and sitatunga.

## FOREST RESERVES

The management and protection of all national and local forests in Zambia is covered by the Forest Act 4 of 2015. According to their provisions, two main categories of forest reserves are found in the country: local and national forests. Zambia has a total of 481 Protected Forest Areas of which 181 are National Forests and 300 are Local Forests (Jachmann, 2000). In National Forests, logging and collection of forest products are regulated by the Forestry Department, whereas Local Forest Reserves are meant to serve the needs of the local people in the surrounding area. These two types of forest reserves relate to the conservation and sustainable use of forests and trees, and the implementation of international instruments. For these reasons, both local and national forests fall under category VI of the IUCN conservation area.

Regardless of the type of forest reserve, no permanent settlements are allowed. However, enforcement of forest protection is lacking in many forest reserves. Nearly all forests in Zambia are currently managed without management plans. The country lacks up-to-date forest inventory data. The only management tool for Forest Reserves under the Forestry Department has been licensing. A licence simply states the minimum amount of timber to be removed annually. The effectiveness of this system has been limited by a number of problems, including but not limited to inadequate capacity of the Forestry Department (FAO, 2002).

Generally, most forest reserves crossed by the transmission line suffered from encroachment through human settlements and agricultural activities, which resulted in habitat degradation. The land take acreage in each forest reserve and habitat types/landuse affected are presented in the Table below. Chapter 6 discusses the Project's impacts on the forest reserves and the significance of habitat conversion or degradation.

**Table 5-7 Habitat types in the ROW in the different forest reserves affected**

| Habitat type/ Landuse | Kasama Forest Reserve | Amenshi Forest Reserve | Chitimukulu Forest Reserve | Mungwi Forest Reserve | Nkole Mfumu Forest Reserve | Kanona Forest Reserve | Nakonde Forest Reserve |
|---|---|---|---|---|---|---|---|
| Agriculture | 0.06 | 1.08 | 2.29 | | 1.13 | 20.91 | - |
| Build-environment | 0.01 | - | - | - | - | 0.26 | - |
| Fallow land | - | - | 7.12 | - | 0.64 | 10.53 | - |
| Grassland - Open area | 0.11 | - | | - | - | 5.46 | - |
| Rock Outcrop | 4.78 | - | - | - | - | - | - |
| Riverine forest | - | - | | 0.74 | | 1.81 | - |
| Wetland | 0.24 | - | - | 1.41 | - | 6.41 | - |
| Plantation | - | - | - | - | - | - | 4.18 |
| Degraded Woodland | - | - | - | - | - | - | 0.34 |
| Woodland-Mature | - | - | - | - | 4.72 | 20.46 | |
| Woodland-Secondary | 9.08 | - | 6.75 | - | 15.64 | 41.64 | - |
| Total | 14.28 | 1.08 | 16.16 | 2.15 | 22,13 | 107.48 | 4.52 |
| Total natural habitat | 9.08 | 0 | 6.75 | 0.74 | 20.36 | 63.91 | 0 |

## KANONA FOREST RESERVE

Kanona National Forest No. P172 covers a total of 28,500 ha. It shares boundaries with three Chiefs (Chief Muchinka, Chiefteness Serenje and Chief Kabamba) and falls within two districts (Serenje and Chitambo). This forest reserve covers a large watershed that houses a number of river sources that drain into the Luangwa River and Luapula River. According to the Serenje District Forestry Department, the management plan for the Kanona Forest Reserve is out of date and many communities are illegally settled within the reserve. The Forestry Department is currently working on reforesting degraded areas where plantations currently exist.

The town of Kanona is found within the Kanona Forest Reserve, along the T2 Road, which crosses the area. Encroachments on the reserve are common, including several human settlements and agricultural land (see Photo 5-6). The forest reserve is also crossed by many other transmission lines, under which the woodland has been cleared and only herbaceous vegetation is maintained (see Photo 5-7). The proposed line follows an existing 330 kv line built in 2016 with a 50 m row (Figure 5-13).

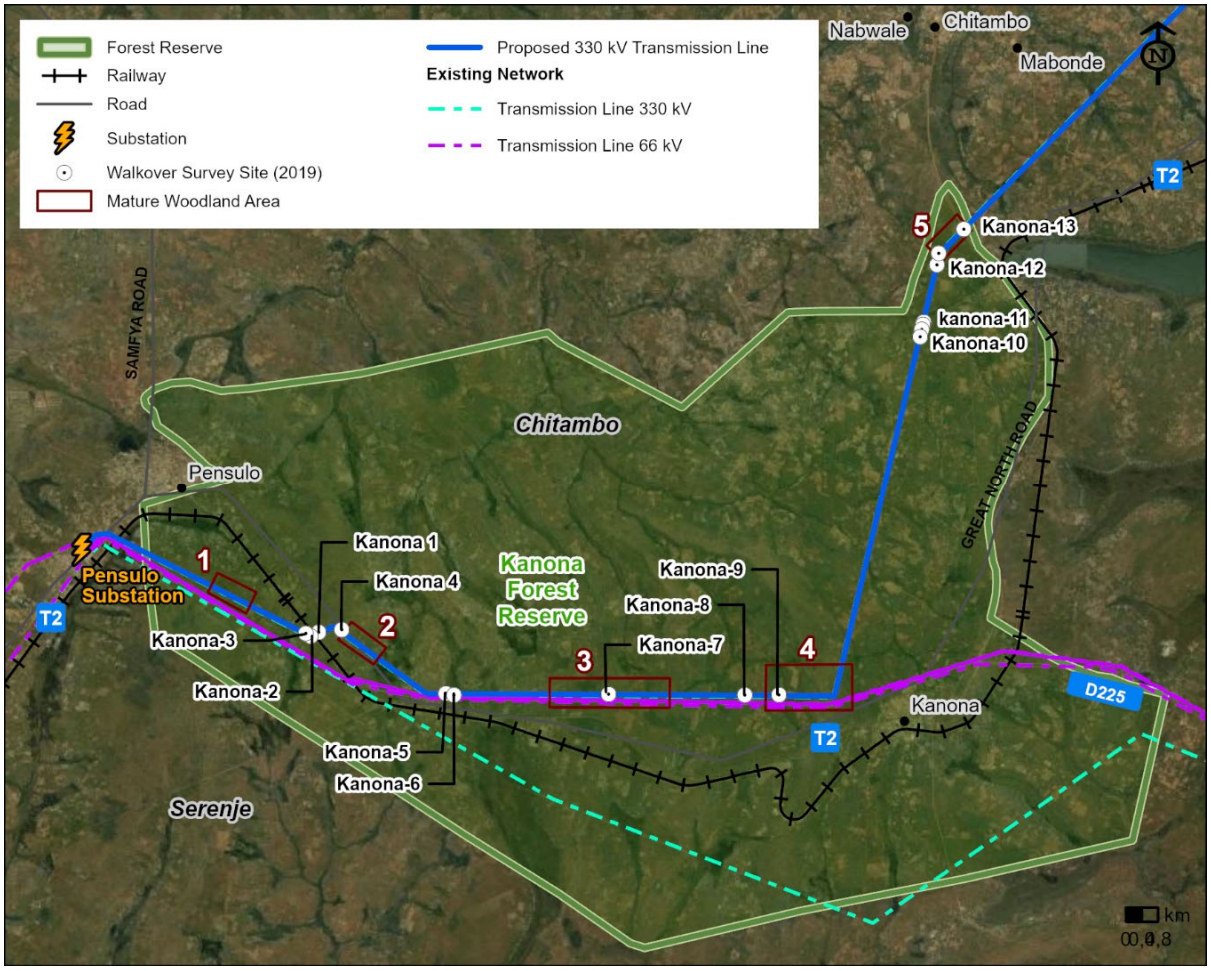



**Figure 5-13 Kanona Forest Reserve**

The remaining forest is primarily Escarpment Miombo Woodland, a habitat type described in Section 5.3.2.2. Due to poor soil conditions in these areas, vegetation remains low between 6-12 m, with some exceptions. Most of the remaining woodland has been disturbed by tree cutting, fires and charcoal burning. Although human disturbance is widespread, some areas of the Kanona Forest Reserve are characteristic of mature miombo woodland (i.e., species composition and height are typical of miombo woodland).

**Photo 5-6 Encroachment by Agriculture in the Kanona Forest Reserve**

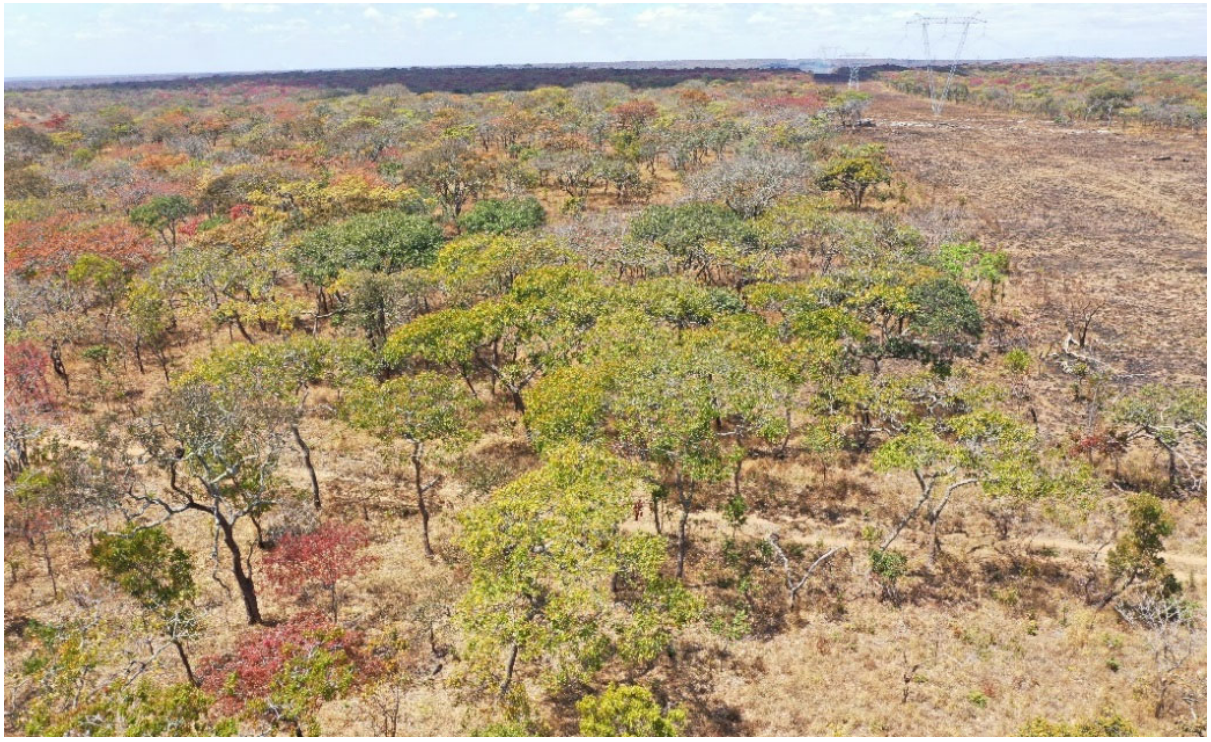


**Photo 5-7 Miombo Woodland and Existing 330kV Powerline in the Kanona Forest Reserve**

## NKOLE MFUMU FOREST RESERVE

Nkole Mfumu National Forest No. P48 is a very large reserve, covering an area of 54,228 ha. It lies to the east of the Kasama-Mpika motor road (M1), and spreads eastwards all the way to the confluence of the Lukashya River with the Chambeshi River. The proposed powerline crosses the western part of the Forest Reserve, where it is composed of two separated arms (Figure 5-14). This section of the Forest Reserve is already crossed by several linear infrastructure: the TAZARA railway, a 66kV transmission line, as well as the M1 motor road.

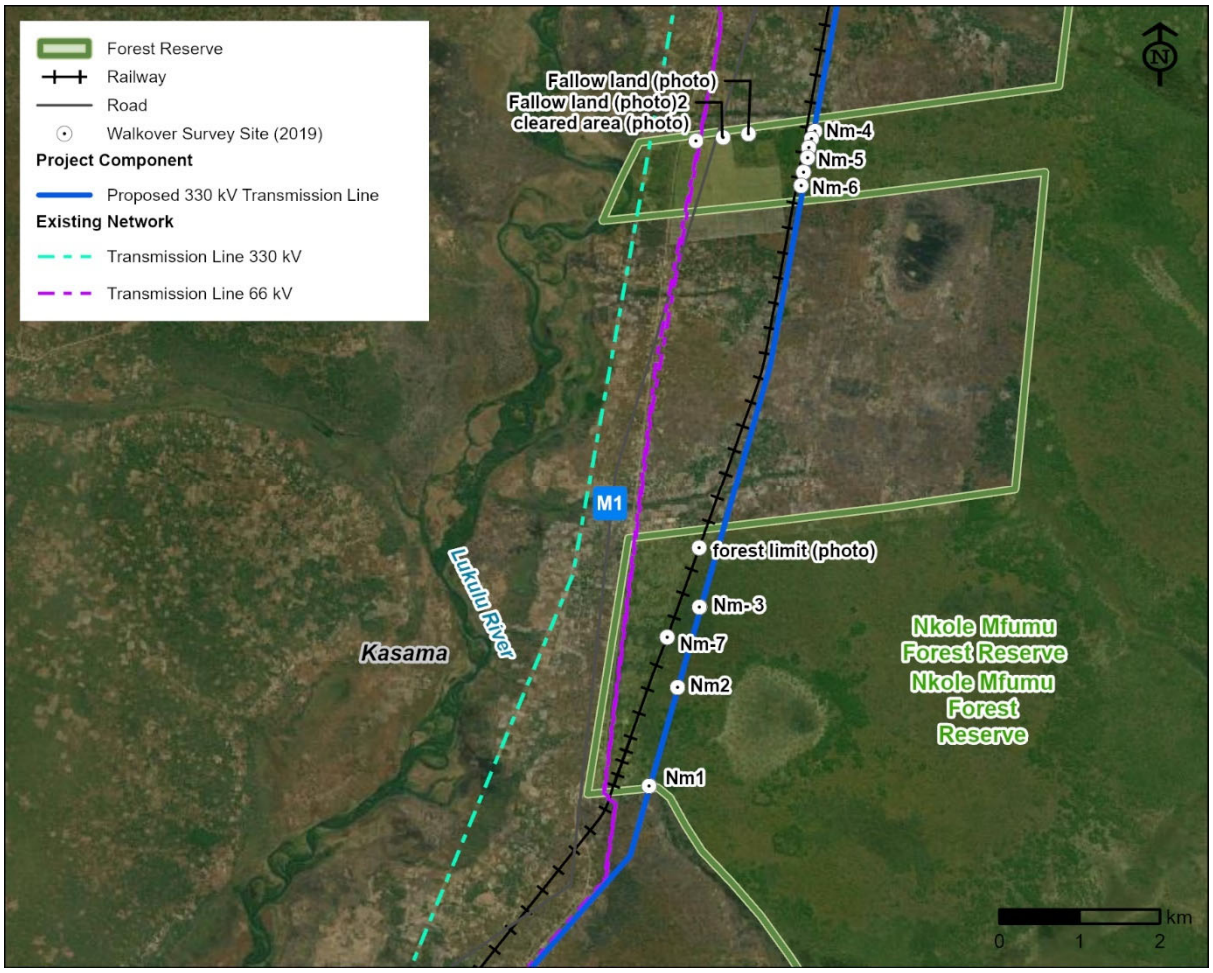



**Figure 5-14 Nkole Mfumu Forest Reserve**

The habitat within this forest reserve is composed of miombo woodland, associated with *Parinari curatellifolia* and *Marquesia obtusifolia*. The woodland within the area where the proposed line passes is generally disturbed by tree cutting, charcoal burning and fire. Relic patches of mature trees are still present within the disturbed forest, especially in the northern section of the Forest Reserve, where the line crosses the area (Photo 5-8). However, even in these patches with mature trees, the under cover has been severely disturbed by fire and tree cutting for charcoal. Large plantations were exploited in the forest reserve in the area west of the TAZARA railway. These have been harvested in recent years, leaving now place to large areas of cleared or fallowland.

**Photo 5-8 Mature Original Woodland Trees in the Nkole Mfumu Forest Reserve with Disturbed Undercover**

## AMENSHI FOREST RESERVE

The Amenshi Local Forest No. P298 is found around the town of Kasama and is composed of several separate fragments that cover sections of watercourses and surrounding wetlands. These seem to have been created to protect small water catchments, Amenshi meaning “Water” in the Bemba language. The section crossed by the powerline covers an area of 38.2 ha. Satellite imagery shows it covers a wetland area along a small watercourse that is used for agricultural purposes. Only small areas with trees are present, the vast majority of the area being composed of rice fields.

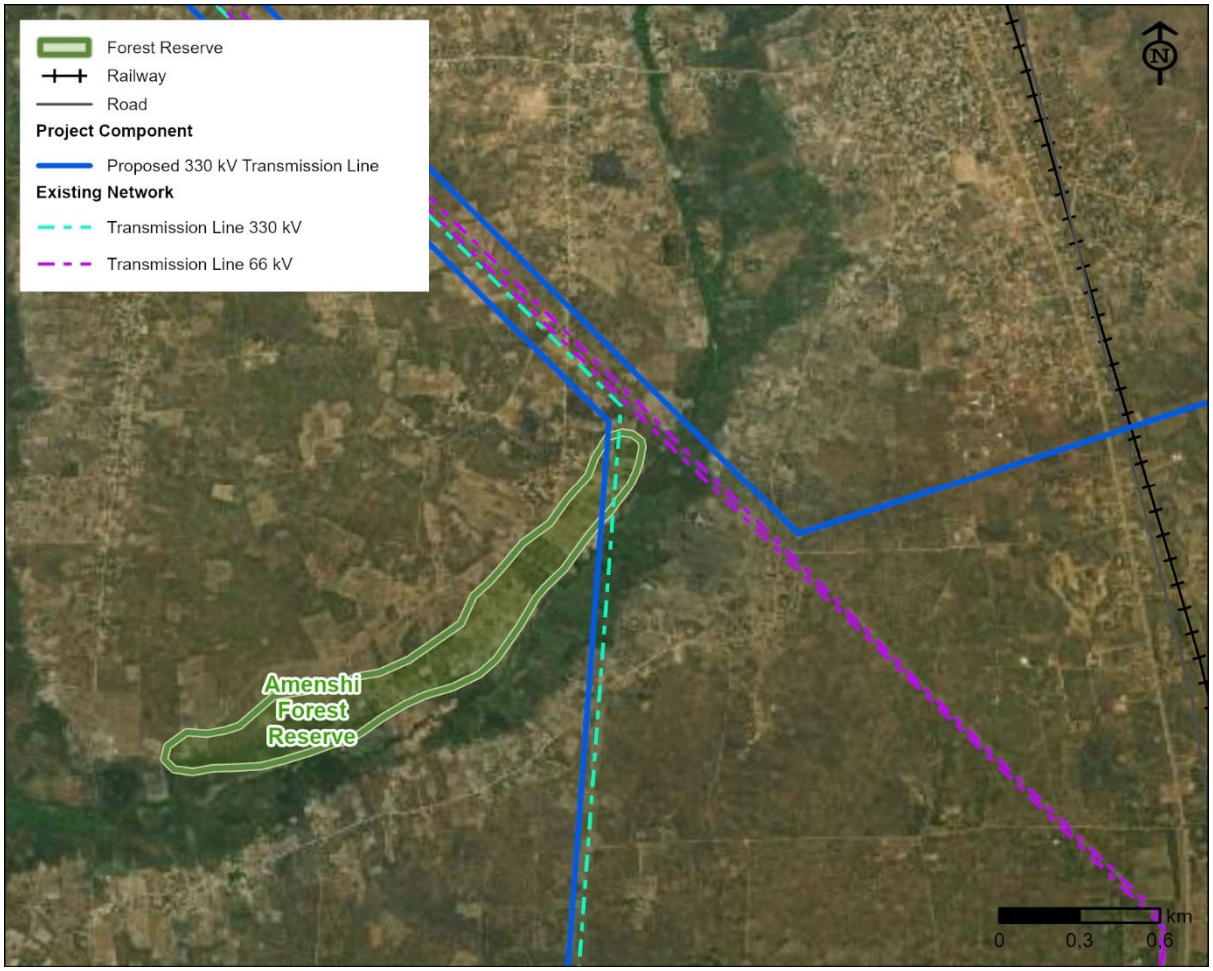



**Figure 5-15 Amenshi Forest Reserve**

## KASAMA FOREST RESERVE

The Kasama National Forest Reserve No. 47 is found in the immediate Project area, the line crossing the eastern section of the Reserve. According to the Kasama Province Forestry Department, the forest reserve covers an area of 1,086 ha. Part of the forest reserves was degazetted in 2015, where the area north of the railway was excised from the protected area. The Mwela Rock Art Heritage site is found within the Kasama Forest Reserve (Figure 5-16). It is described in more detail in section 5.4.8.

The forest is primarily Miombo Woodland but is highly disturbed by human activities. The northern part of the forest reserve is composed of heavily disturbed woodland. The area is strongly affected by fire and tree cutting for charcoal burning and vegetation has been modified by human activity (Photo 5-9). The southern part of the forest reserve where the line passes is a large area of rock outcrop characterized by sparse vegetation (Photo 5-10). Tree cutting and fire have affected the vegetation on these rock outcrops. Cactus from the *Euphorbia* genus, an endemic and rare species in Zambia, was observed on these outcrops, although the species is not on the IUCN Red List.

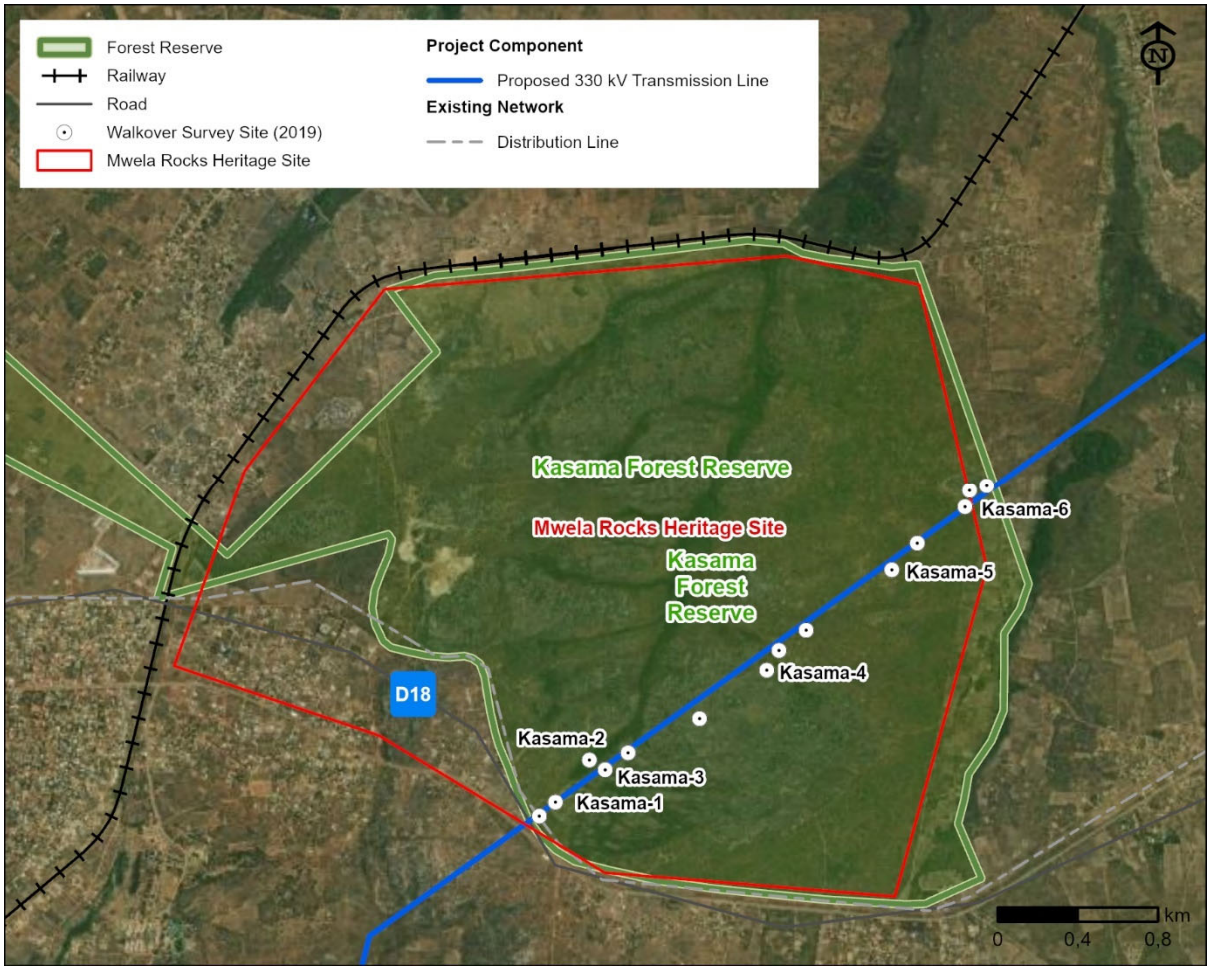



**Figure 5-16 Kasama Forest Reserve**

**Photo 5-9 Rock Outcrop on the Southeast of the Kasama Forest Reserve**

**Photo 5-10 Disturbed Woodland in the Northeast of the Kasama Forest Reserve**

## MUNGWI FOREST RESERVE

The Mungwi Local Forest No. 335 protects a catchment area of the Mungwi and Chibile rivers over an area of 130 ha (Figure 5-17). The protected area is composed of a dambo area that is partly natural and partly used for agriculture. It is traversed by small streams, some of which have been canalized to support local agriculture. Forestry agents consulted at the Mungwi Forestry Department stated that some illegal timber harvesting occurs in the Forest Reserve and that wetlands in the Forest Reserve are used for gardens.

Riverine forests are also present, particularly in the area where the proposed line crosses the forest reserve is found a 150 m strip of mature riverine forest, dominated by *Khaya nyanscica*, *Rothmania engleriana*, *Syzygium cordatum*, *Syzygium guineense* and *Diplorhynchus condylocarpo* (Photo 5-11). Disturbances in this forest are minor, as local communities seem to recognize the importance of preserving the forest and granting it protection.

When this riparian ecosystem is looked at as an ensemble, even though some patches of less disturbed riverine forest and dambos are present, the Mungwi forest reserve is largely disturbed as most areas are used for agriculture and natural water flow has been modified for agricultural purposes. For these reasons, it does not qualify as natural habitat, nor does it qualify as critical habitat. However, the habitats present play an important role in protecting the water catchment and maintaining important ecological functions, such as water retention and purification, which support local communities.

**Figure 5-17 Mungwi Forest Reserve**

**Photo 5-11 Preserved Riverine Forest within the Mungwi Forest Reserve**

## CHITIMUKULU FOREST RESERVE

The Chitimukulu Local Forest No. 305 covers a total area of 3,180 ha in the Mungwi District (see Figure 5-18). It is mainly composed of disturbed woodland.

The Mungwi District Forestry Department mentioned that legal charcoal burning takes place in the Chitimukulu Forest Reserve (where charcoal producers pay the Forestry Department for their activities), as well as illegal charcoal burning. It also stated that people have encroached On the forest, mostly for cassava and ground nuts cultures.

Few mature trees remain within this forest, largely affected by agriculture, tree cutting, charcoal burning and fires (see Photo 5-12). Human activity has essentially modified the area's primary ecological functions. Hence, the area should be considered a modified habitat and does not qualify as a natural habitat or critical natural habitat.

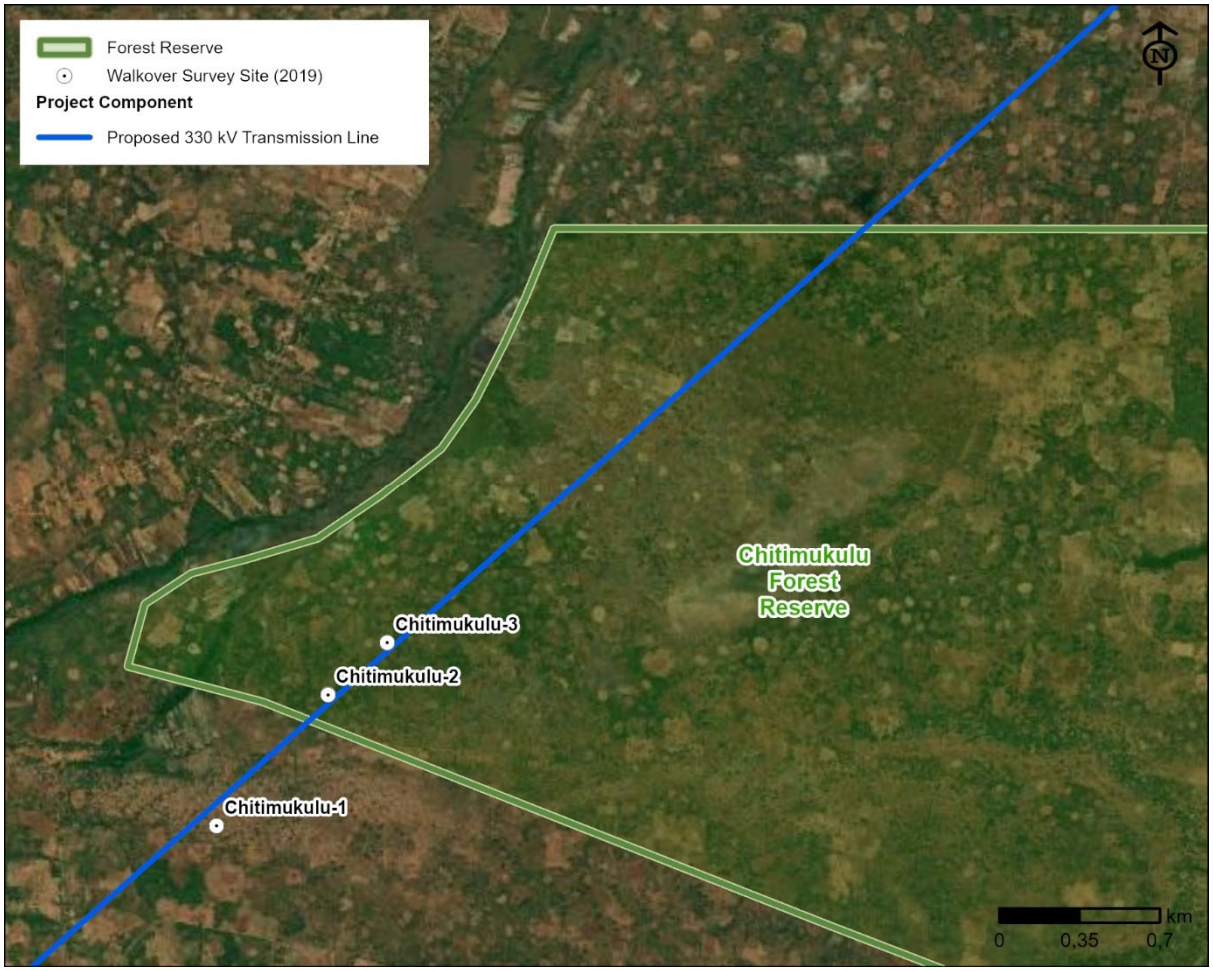



**Figure 5-18 Chitimukulu Forest Reserve**

**Photo 5-12 Area Affected by Tree Cutting and Fire in the Chitimukulu Forest Reserve**

### NAKONDE FOREST RESERVE

The Nakonde Local Forest No. P303 covers a total of 417 hectares in extent. The FR is almost entirely composed of plantations that have been planted and are being managed by the Zambia Forestry and Forest Industries Corporation PLC (ZAFFICO) with the permission of the Forest Department. The forest department has also planted 10 hectares of pine trees within the forest reserve. ZAFFICO has initiated discussions with the forestry department for them to get a separate title deed for the land the company is using. At the time of writing this report, validation by the Forestry Department of the detailed limits of the forest reserve, as well as the coordinates of the 10 hectares the department has used in the forest reserve, is pending.

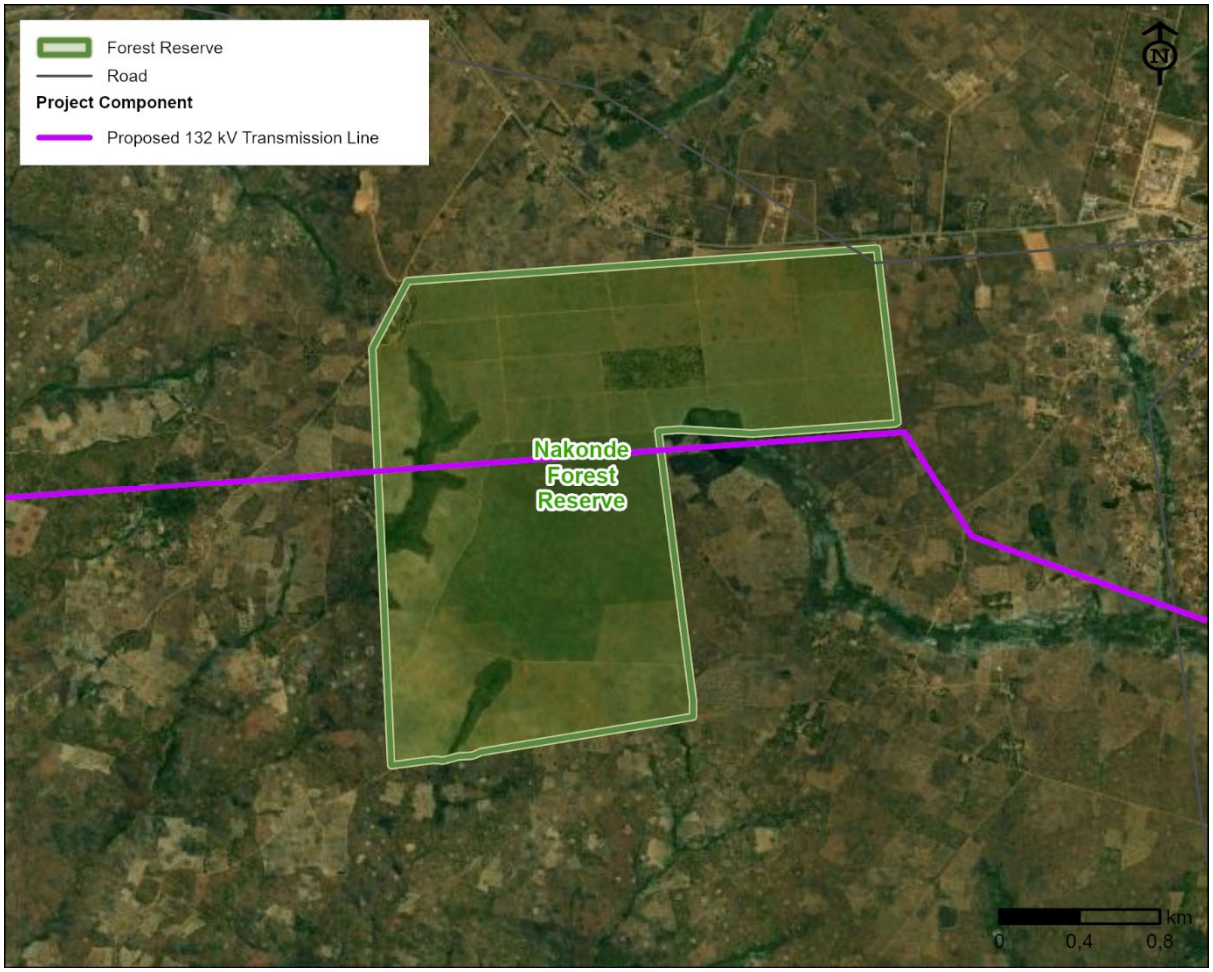


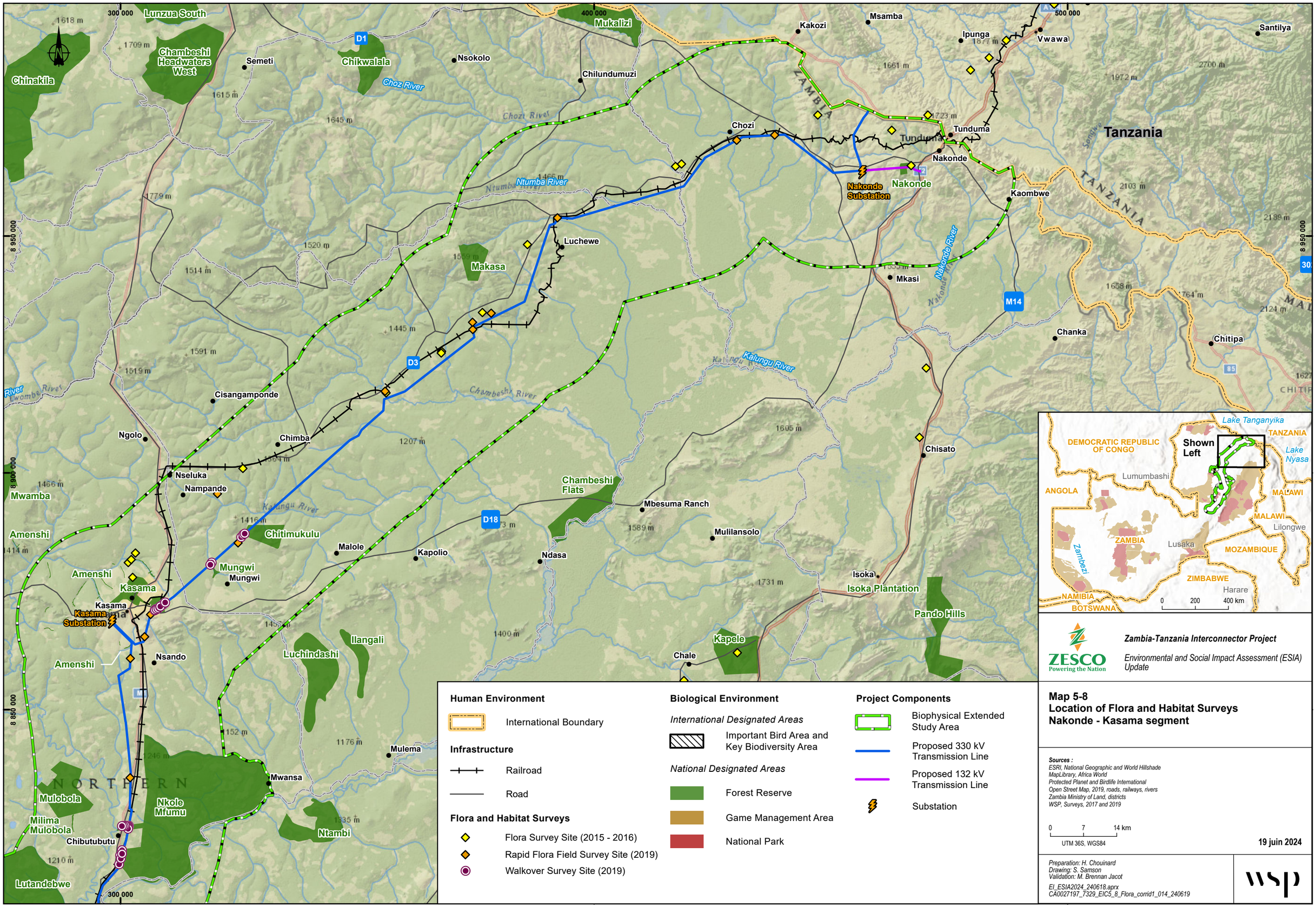

**Figure 5-19 Nakonde Forest Reserve**

## 5.3.2 HABITAT TYPES AND FLORA

The characterization of habitat types and flora communities inside the Project area is based on several field investigations and flora occurrence data from the Global Biological Information Facility (GBIF, 2024) in the last 20 years (2004-2024).

Vegetation surveys were conducted during three different campaigns. A first campaign of field surveys was completed in September 2015 and June 2016. Later, in September 2019, a walkover survey was explicitly held to characterize habitats in forest reserves crossed by the line. Finally, in October- November 2019, a third rapid flora field survey was completed. The detailed methodology for each campaign is detailed in Appendix 5-2. Survey sheets from the 2019 walkover survey and rapid flora survey are available in Appendix 5-3.

Maps 5-8 to 5-10 illustrate the location of vegetation and walkover survey points.




**Human Environment**

- International Boundary

**Infrastructure**

- Railroad
- Road

**Flora and Habitat Surveys**

- Flora Survey Site (2015 - 2016)
- Rapid Flora Field Survey Site (2019)
- Walkover Survey Site (2019)

**Biological Environment**

*International Designated Areas*

- Important Bird Area and Key Biodiversity Area

*National Designated Areas*

- Forest Reserve
- Game Management Area
- National Park

**Project Components**

- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Proposed 132 kV Transmission Line
- Substation

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*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-8**
**Location of Flora and Habitat Surveys**
**Nakonde - Kasama segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*WSP, Surveys, 2017 and 2019*

0 7 14 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

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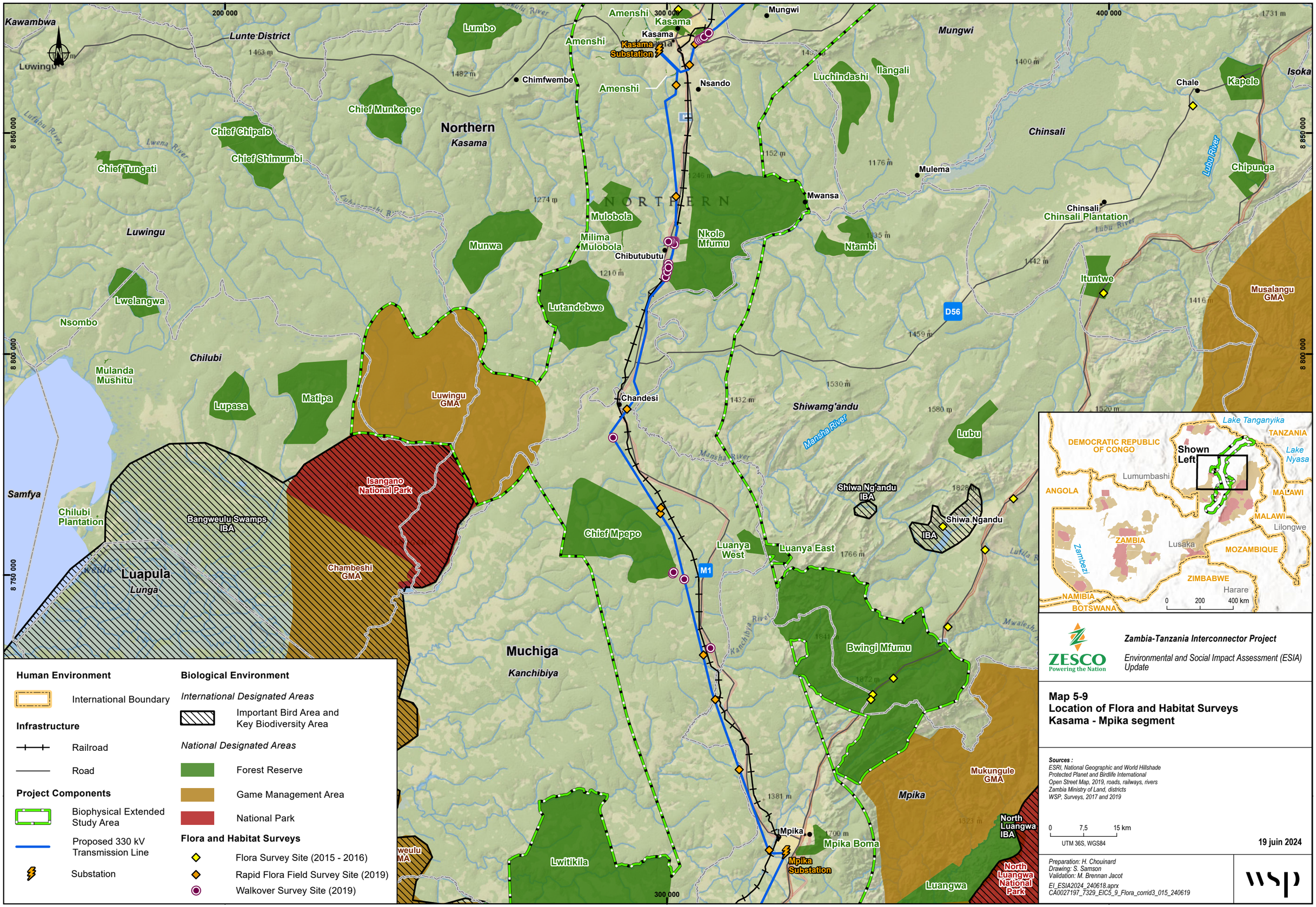
*CA0027197_7329_EIC5_8_Flora_corrid1_014_240619*

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.*




**Human Environment**

- International Boundary

**Infrastructure**

- Railroad
- Road

**Project Components**

- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Substation

**Biological Environment**

*International Designated Areas*

- Important Bird Area and Key Biodiversity Area

*National Designated Areas*

- Forest Reserve
- Game Management Area
- National Park

**Flora and Habitat Surveys**

- Flora Survey Site (2015 - 2016)
- Rapid Flora Field Survey Site (2019)
- Walkover Survey Site (2019)

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*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-9**
**Location of Flora and Habitat Surveys**
**Kasama - Mpika segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*WSP, Surveys, 2017 and 2019*

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UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*
*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_9_Flora_corrid3_015_240619*

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*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.*

**Human Environment**

International Boundary

**Infrastructure**

Railroad

Road

**Biological Environment**

*International Designated Areas*

Important Bird Area and Key Biodiversity Area

*National Designated Areas*

Forest Reserve

Game Management Area

National Park

**Project Components**

Biophysical Extended Study Area

Proposed 330 kV Transmission Line

Substation

**Flora and Habitat Surveys**

Flora Survey Site (2015 - 2016)

Rapid Flora Field Survey Site (2019)

Walkover Survey Site (2019)

Bangweulu GMA

Bangweulu Swamps IBA

Kafinda GMA

Mulembo

Lavushi Manda National Park

Lavushi Manda IBA

Kasanka National Park

Kasanka IBA

D235

Zambia

Musola

Musola River

Lukulu River

Chitambo

Serenje

Musangashi

Munte

Luombwa

Lwitikila

Luchembe

Mpika

Mpika Boma

Mpika Substation

Chilonga

Mpika

LUWESA

Kalonje

Mutinondo Wilderness IBA

Luangwa

Lavushimanda

Mukungule GMA

North Luangwa National Park

North Luangwa IBA

Munyamadzi GMA

T2

Lake Lusiwasi

Pensulo Substation

Kanona

Mailo

South Luangwa National Park

South Luangwa IBA

1192 m

1182 m

1284 m

1323 m

1234 m

1563 m

1433 m

1426 m

1605 m

1686 m

1726 m

1684 m

1665 m

1705 m

1604 m

1737 m

1788 m

1727 m

1850 m

1761 m

1700 m

651 m

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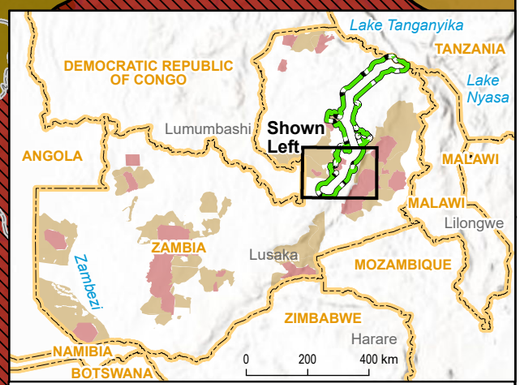


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*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-10**
**Location of Flora and Habitat Surveys**
**Mpika - Pensulo Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*WSP, Surveys, 2017 and 2019*

0 6 12 km

UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_10_Flora_corrid7_016_240618*

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.*

### 5.3.2.1 HABITAT TYPES

The study area features various habitat types that are distributed across the landscape according to diverse biophysical and anthropogenic factors. Habitat types and land uses inside the ROW were identified using satellite imagery and a GIS. The habitats have been modified to a various extent by human activities, including cultivation, grazing, urban expansion, and industry. The main habitat types encountered within the ROW are presented in Table 5-8. The vegetation types are described below.

**Table 5-8 Habitat Types and Land use Encountered within the Proposed ROW**

| Habitat Type/Land use | Area (ha) | Proportion |
|---|---|---|
| Agriculture | 632,3 | 23% |
| Build-environment | 8,0 | 0% |
| Fallow land | 441,6 | 16% |
| Grassland - Open area | 241,0 | 9% |
| Riverine forest | 48,5 | 2% |
| Rock outcrop | 4,8 | 0% |
| Wetland | 322,1 | 12% |
| Degraded Woodland | 813,0 | 29% |
| Woodland-Mature | 25,2 | 1% |
| Woodland-Secondary | 233,3 | 8% |
| Plantation | 4,2 | 0% |
| **TOTAL** | **2774,1** | **1,00** |

#### MIOMBO WOODLANDS

The dominant habitat type along the proposed transmission line route is the Miombo woodland. This habitat type occurs where it is warm year-round and may receive several hundred centimetres of rain yearly. The Miombo woodland includes a wide range of plant communities varying in terms of their structure and their dominant vegetation layer. Due to disturbance or environmental characteristics, some Miombo woodland areas can be dominated by grasses or shrub species. These plant communities are usually in transition and the woodland is probably the climax plant community. A picture of typical miombo woodland observed on the field is presented in Photo 5-13.

Wet Miombo occurs on the plateau and escarpment and receives average rainfall of 1,500 mm/annum. When not disturbed it is a two-layered woodland up to 20 m in height and made up of *Brachystegia* species (*B. boehmii, B. longifolia, B. manga, B. spiciformis and B. utilis*), *Julbernardia paniculata* and *Isoberlinia angolensis* on the plateau and *Brachystegia bussei, B. microphylla or B. taxifolia and B. utilis* on the escarpment. The shrub layer was usually sparse, with the most common species being *Landolphia kirkii*, *Indigofera podocarpa, Kotschya carsonii*, and *Vellozia equisetoides*. The herbaceous layer was often recently burnt.

The tree canopy cover on the plateau is low. Such areas had tree heights that were, on average, 10m or below. The vegetation type at most of the surveyed sites was affected by tree cutting, clearance for agriculture and bush burning. Most tree species were, therefore, either regenerating, exemplified by multi-stems, or had suffered die-back and remained as snags. Shrubs that were recorded in this vegetation type were *Landolphia kirki*, *Indigofera podocarpa*, *Kotschya carsonii*, and *Vellozia equisetoides*. These shrub layers had an abundance cover of 5-25 %.

Some grass species were also recorded, with an average ground cover of 50-75%. By the time vegetation survey took place in September 2015 and September 2019, most grasses in areas other than wetlands had been burnt off.

The escarpment Miombo woodland is separated from the plateau Miombo woodland for the simple reason that it is largely confined to hilly, rocky and practically inaccessible areas for most rural communities. In terms of composition and structure, it is basically host to *Brachystegia* species, which are rarely found on flat areas, such as Brachystegia bussei, B. microphylla, B. taxifolia, and occasionally *B. wangermeeana* (Fanshawe, 1971). Areas and the woodlands that occur in them are ecologically associated with catchment forests draining most major river systems (Fanshawe, 1971). Based on these considerations, several subtypes have been separated from the main Miombo woodland subtypes.

The density of plants was relatively higher on the escarpment and hilly areas compared to the lowlands, especially near settlements. This was equally true of most Forest Reserves and the National Park. Areas easily accessible to local people suffered the most damage, especially from charcoal production and slash-and-burn agriculture, or Chitemene in the local Bemba dialect.

**Photo 5-13 Miombo Woodland**

Zambezian Chipya is a fire-derived woodland type, and characterized by fire-resistant trees, a luxuriant herbaceous component and tall grass (see Photo 5-14). The Zambezian Chipya, which was recorded, is a vegetation type that results from degraded semi-evergreen or dry evergreen woodland or forest. An abundance of grasses on the forest floor, fire scars on surviving trees, and Chipya indicators is evidence of the degradation process from Miombo to Chipya woodland, for example. The composition and structure are largely characterized by the presence of fire indicators and moderately to fire-hardy tree species, which may be both herbaceous and woody.

Typical tree species include *Amblygonocarpus andongensis*, *Albizia atunesiana*, *Pericopsis angolensis*, *Pterocarpus angolensis*, *Burkea africana*, *Erythrophleum africanum* and *Parinari curatellifolia*. Smaller trees are *Combretum spp*. (C. *zeyheri, C. molle, C. collinum*), *Hymenocardia acida, Diplorhynchus condylocarpon, Oldfieldia dactylophylla, Pseudolachnostylis maprouneifolia, Maprounea africana* and *Terminalia sericea*. The grass layer is dominated by *Andropogon gayanus* and *Hyparrhenia spp*. Three herbaceous species are generally present in these woodlands and serve as indicators: *Aframomum alboviolaceum*, *Pteridium aquilinum* and *Smilax anceps* (Fanshawe, 1971).

**Photo 5-14 Zambezian Chipya Woodland**

## WETLANDS (EDAPHIC GRASSLAND ON DRAINAGE-IMPEDED OR SEASONALLY FLOODED SOILS AND FRESHWATER SWAMPS)

Within the main watersheds of the study area, low-lying areas consist of seasonally or permanently flooded wetlands or dambos. These habitats usually have a very low tree and shrub cover and a very dense herbaceous layer. Some common wetland grass species include: *Phragmites mauritiana, Cyperus papyrus, Loudetia simplex*, and *L. angolensis*. Wetland edges are often used for agriculture and their herbaceous layer was often burnt. Large wetland far from settled area or located in protected areas such as Shiwa Ngandu, show a more diverse herbaceous layer with rushes (*Juncus spp*.), flatsedges (*Cyperus spp*.), bulrushes (*Scirpus spp*.), and carnivorous plants such as *Drosera spp*, forming a larger proportion of the herbaceous layer cover (see Photo 5-15). Permanent wetlands have areas of open water where submerged and floating plant species are present.

**Photo 5-15 Permanently Flooded Wetland in Shiwa Ngandu**

## RIVERINE HABITAT

With agricultural activities often taking place along the banks of streams and rivers, riverine habitats are most often narrow strips of natural or semi-natural vegetation along watercourses (see Photo 5-16). The tree layer is usually sparse and composed of small trees, usually less than 5 m high, such as Acacia polyacantha, Diospyros mespiliformis, Rauvolphia caffra, Syzygium cordatum, S. Guineense, and *Xylopia odoratissima*. The main species of shrub present is *Rhus longipes*. The herbaceous layer is dense and dominated by *Hyparrhenia rufa, Loudetia simplex* and *Phragmites mauritiana*.

**Photo 5-16 Riverine Habitat**

## MOSAIC CROPLANDS-VEGETATION

Mosaic croplands-vegetation habitats are made of a mosaic of agriculture and non-forest vegetation. Croplands are mixed with natural vegetation representing up to 30% of the total cover (rchx et al., 2003). This vegetation type is found mostly around larger towns and villages and is expanding as population increases and small-scale farmers move to new areas. A large portion of the mosaic croplands in the areas covered by the proposed transmission line route are interspersed with Dambos/Grasslands or disturbed miombo woodlands. Most of the Grasslands are found in the lower areas which get flooded during the rainy season. Croplands often reach streams and riverbanks, leaving very little natural vegetation around most watercourses. Slash and burn practices are used within the area, involving coppicing or pollarding of standing trees in primary or secondary growth stands, stacking of the removed biomass and, eventually, burning it to create a thicker layer of ash recognized as fertilizer (see Photo 5-17).

**Photo 5-17 Slash and Burn Practices**

### 5.3.2.2 HABITAT QUALITY AND LAND USE IN FOREST RESERVES

Habitats within protected or sensitive areas in study area were considered in greater detail, and more specifically within the five Forest Reserves that are crossed by the proposed transmission line. Satellite imagery analysis, walkover surveys and expert and stakeholder consultation were carried out to better understand land uses within these areas and to describe habitat type and quality. These works also aimed to categorize the forests and habitats as degraded, modified, or unmodified/natural habitats.

Listings are based on systematic evaluations of such factors as species richness; the degree of endemism, rarity, and vulnerability of component species; representativeness; and integrity of ecosystem processes.

### 5.3.2.3 SPECIES DIVERSITY

A total of 424 species were identified during flora surveys in 2015, 2016, and 2019. 262 species were additionally detected within the BESA according to the GBIF database, for a total of 686 plant species from 127 families. The most abundant family is the Fabaceae, with 66 species, followed by Orchidaceae, Rubiaceae, Leguminosae, and Lamiaceae, with 65, 32, 31, and 30 species, respectively. The detailed list of species is provided in Appendix 5-4.

### 5.3.2.4 INVASIVE SPECIES

As shown in Table 5-9, a total of 21 invasive species from 15 families are reported in Zambia according to Global Invasive Species Database (GISD). These species generally occur in grasslands and disturbed areas, and tolerate a great variety of conditions, facilitating their colonization to new habitat. Some of them are found in aquatic ecosystems, such as *Lagarosiphon major* and *Trapa natans*.

Three species from this list have been observed in the study area, which are *Bidens pilosa*, *Imperata cylindrica*, and *Lantana camara*.

**Table 5-9 List of Invasive Species and their Respective Habitats Found in Zambia**

| Family | Scientific Name | Habitats |
|---|---|---|
| *Asteraceae* | *Bidens pilosa* | Grassland, heathland, forest clearings, wetlands, plantations, streamlines, roadside, pasture, coastal areas, and agriculture areas |
| *Bignoniaceae* | *Tecoma capensis* | Bush or scrub, occasionally on forest margins. |
| *Commelinaceae* | *Commelina benghalensis* | Disturbed sites, forest edges, roadsides, agricultural sites, and home gardens. |
| *Cyperaceae* | *Cyperus rotundus* | Cultivated fields, farmlands, neglected areas, wastelands, grasslands, at the edges of forests, and on roadsides, sandy or gravelly shores, riverbanks and irrigation canal banks |
| *Cyperaceae* | *Oxycaryum cubense* | Wetland-river |
| *Fabaceae* | *Leucaena leucocephala* | Open (often coastal or riverine) habitats, semi-natural, disturbed, degraded habitats and other ruderal species |
| *Hydrocharitaceae* | *Lagarosiphon major* | Clear, still or slow-moving fresh water with silty or sandy bottoms |
| *Lygodiaceae* | *Lygodium microphyllum* | Cypress stands, but also infests pine flatwoods, wet prairies, sawgrass marshes, mangrove communities. Mesic forests, rain forest, and open swampy areas |
| *Poaceae* | *Cenchrus ciliaris* | Favours alkaline soils and within arid areas establishes best in pockets of high nutrients and moisture |
| *Poaceae* | *Cenchrus polystachios* | Disturbed, mostly dry, lowland areas and cultivated fields up to 2,100m elevation |
| *Poaceae* | *Imperata cylindrica* | Degraded forests, grasslands, arable land, and young plantations within tropical and subtropical climates |
| *Poaceae* | *Panicum repens* | Moist, often sandy soil along beaches and dunes, margins of lagoons, marshy shorelines of lakes and ponds, drainage ditches and canals |
| *Poaceae* | *Paspalum scrobiculatum* | Along the ditch, roadsides, upland and tidal rice fields, rubber plantations; wet, open, cultivated areas |
| *Poaceae* | *Rottboellia cochinchinensis* | Roadside and in other open, well-drained sites but it can be found in wet places, and even in shallow water. |
| *Polypodiaceae* | *Phymatosorus scolopendria* | Degraded areas, sclerophyll forest. |
| *Pontederiaceae* | *Eichhornia crassipes* | Shallow temporary ponds, wetlands and marshes, sluggish flowing waters, lakes, reservoirs and rivers |
| *Salviniaceae* | *Salvinia molesta* | Still or slow-moving water bodies, including ditches, ponds, lakes, slow rivers, and canals. |
| *Sapindaceae* | *Cardiospermum grandiflorum* | Often near riverbanks. |
| *Scrophulariaceae* | *Striga asiatica* | Agricultural lands, especially those with light soils and/or low nitrogen fertility where it infests a wide range of grass crops (maize, millet, rice, sorghum, sugarcane) and some broadleaf crops (e.g., sunflower, tomatoes, some legumes). |
| *Trapaceae* | *Trapa natans* | Lakes, ponds, canals, and slow water. |
| *Verbenaceae* | *Lantana camara* | Open, unshaded situations such as wastelands, rainforest edges, beachfronts, and forests recovering from fire or logging |

### 5.3.2.5 FLORA SPECIES OF CONSERVATION CONCERN

*Ansellia Africana* is the only species encountered in the study area during field surveys that is listed on the IUCN Red List of threatened species. It is classified as Vulnerable. This widespread orchid grows in riverine vegetation and mopane or miombo woodlands near rivers, growing on trees and shrubs. The species, however, has many traditional uses within Africa and is a very desirable orchid for collectors. It is harvested both legally and illegally throughout Africa, where entire areas are destroyed during its collection (Crook, 2013).

Six other threatened species according to the IUCN Red-List are considered potentially present along the proposed line route according to the observation registered in the Global Biological Information Facility in the BESA (GBIF, 2024). Four of these are ornamental species occurring outside their natural distribution range, namely *Kalanchoe daigremontiana* (Endangered), *Jacaranda mimosifolia* (Vulnerable), *Cedrela odorata* (Vulnerable), *Brugmansia suaveolens* (Extinct in the wild).

*Disa aequiloba,* an endangered species growing in wetlands (swamps, wet grassland, wet meadows), has been recorded east of the line, near the Mutinundo Wilderness Area. This species is endangered due to habitat loss caused mainly by agriculture, expansion of tea plantations and potato farming (IUCN SSC East African Plants Red List Authority, 2019).

*Encephalartos schmitzii*, a vulnerable species, occurs along the Muchinga Escarpment in the Muchinga province in Zambia. In the BESA, there would be a disjunct population in wet Miombo woodlands of Bwingi Mfumu Forest Reserve, which is about 20 km to the east of the proposed line (Dr Mulongwe, Principal Research Officer, Forestry Department, personal communication) GBIF also has a record of the species from the Mutinondo Wilderness area. It grows in sandy quartzitic soils in Miombo woodlands. The species is threatened due to over-collecting for ornamental purposes and as a result of habitat loss caused by bush clearing for agricultural purposes. Too frequent fires may also have driven this cycad's pollinator to extinction (Bösenberg, 2022).

Other species present or potentially present in the Project's wayleave or study area are of conservation value because of endemism. These are presented in Table 5-9 below. Amongst the threatened and endemic species, *Euphorbia perplexa var. kasamana, Gladiolus serenjensis, Encephalartos schmitzii*, can be considered as restricted range (RR) according to IFC PS6 definition (EOO smaller than 50,000 $km^2$).

**Table 5-10 Flora Species of Conservation Interest Potentially Present in the Study Area**

| Scientific Name | Family | Habitat | Endemic/ Restricted-range | IUCN Redlist Status | Occurrence in Relation to Wayleave |
|---|---|---|---|---|---|
| *Rhus fanshawei* | Anacardiaceae | – On rocky hills and in woodlands. | Endemic to Zambia | NE | Near the line crossing with Chambeshi River Crossing.<br>Found in Northern, Muchinga and Western Provinces |
| *Euphorbia cooperi var. ussanguensis* | Euphorbiaceae | – Rock outcrops<br>– Sandy area base of outcrops | Endemic to Zambia | NE | Found within wayleave<br>Found in Northern, Central, Eastern and Luapula Provinces |
| *Euphorbia jubata* | Euphorbiaceae | – Rocky outcrops | Endemic to Zambia | NE | Found less than 1 km from wayleave.<br>Found in the Northern, Luapula and Muchinga Provinces |
| *Euphorbia speciosa* | Euphorbiaceae | – Rocky outcrops | Endemic to Zambia | NE | Found within wayleave.<br>Found in the Northern and Muchinga Province |
| *Euphorbia perplexa var. kasamana* | Euphorbiaceae | – Rocky outcrops | Endemic to Zambia, Restricted Range | NE | Found within wayleave<br>Recorded only from Kasama and north of Kasama |
| *Gladiolus serenjensis* | Iridaceae | – Hilly area | Endemic to Zambia, Restricted Range | NE | Herb, on thin soils and rock crevices. Muchinga Escarpment, Serenje District. |
| *Ansellia africana* | Orchidaceae | – Epiphyte on wood-land trees | NA | VU | Found within wayleave |
| *Disa aequiloba* | Orchidaceae | – Wetland or swamps | | EN | Wetland or swamps in the Northern, Luapula and Muchinga Provinces |

| Scientific Name | Family | Habitat | Endemic/ Restricted-range | IUCN Redlist Status | Occurrence in Relation to Wayleave |
|---|---|---|---|---|---|
| *Habenaria macrotidion* | Orchidaceae | – Wetland or swamps | Endemic to Zambia | NE | Wetland or swamps in the Copperbelt, Central, Muchinga, Northern and North-western Provinces |
| *Otiophora angustifolia* | Rubiaceae | – Rock outcrops and faces in riverine vegetation | Endemic to Zambia | NE | Rock outcrops in the the Northern, Luapula and Muchinga Provinces |
| *Encephalartos schmitzii* | Zamiacea | – Sandy quartzitic soils in Miombo woodlands | Endemic to Zambia, Restricted Range | VU<br>Restricted range | Approximately 20 km from wayleave in the Mutinondo Wilderness area and the Bwingi Mfumu FR |

VU = Vulnerable; LC: Least Concern; NE: Not Evaluated.

#### 5.3.2.6 SPECIES OF USE-VALUE

Miombo woodlands are important sources of livelihood for local communities, providing, in some cases, many edible mushrooms (Harkonen et al., 2015), edible insects, beekeeping opportunities (Mickels-Kokwe, 2006), wild fruits, medicinal plants, and wild vegetables (Cavendish, 2002). These products are, to a large extent, dependent on the woodland's management condition, with intact mature woodlands usually being more productive and the over-exploited and degraded ones being less so (Mickel Kokwe, 2006).

Table 5-11 summarizes the main provisioning and regulating services provided by flora species in the study area. The information was collected through discussion with local communities and by compiling the ethno-botanical uses of species as recorded on herbarium records.

**Table 5-11 Main Ecosystem Services provided by Local Habitats**

| Ecosystem Services | Plant Parts Utilized | | | | Growth Form | | | Number of Surveyed Plants |
|---|---|---|---|---|---|---|---|---|
| | Leaves | Branches | Trunk | Roots | Herb | Shrub | Tree | |
| Provisioning | | | | | | | | |
| Timber | | | √ | | | | √ | 31 |
| Poles | | | √ | | | | √ | 30 |
| Firewood | | √ | | | | √ | √ | 26 |
| Animal fodder | √ | | | | √ | √ | | 23 |
| Tannins & dyes | | √ | | √ | | | √ | 41 |
| Food | √ | | √ | √ | | | √ | 31 |
| Medicine | √ | √ | √ | √ | √ | √ | √ | Many |
| Regulating | | | | | | | | |
| Soil & water stability and quality | | | | √ | | | √ | 12 |

## 5.3.3 BIRDS

### 5.3.3.1 BIRDS CONTEXT

Zambia is rich in avifaunal diversity, with 734 species recorded across the country. Three percent of these species (n=22) are globally threatened, with an IUCN Red List status of Critically Endangered, Endangered or Vulnerable (BirdLife International, 2024). Zambia's only true endemic species is the Zambian Barbet (*Lybius chaplin*). However, due to its restricted range, the Black-cheeked Lovebird (*Agapornis nigrigenis*), the most endangered and localized of all Africa's parrot species, is also considered endemic to Zambia.

The region is also a major staging post and destination for avifauna migrating south during the boreal winter. Well-known avifauna include vultures, raptors, ostrich, bustards, cranes and storks (BirdLife International, 2024). While many of the aforementioned species feature prevalently in protected areas such as Lavushi Manda National Park, which contains more pristine habitats compared to those habitats found within the confines of the proposed power line alignment, their presence within the proposed study area cannot be discounted. This is especially true for far-ranging species that may forage out of protected areas.

GMAs also host important ecosystems for birds. Relevant to this assessment, both the Kafinda and Luwingu GMAs are adjacent to other protected areas and the Kafinda GMA contains an important wetland ecosystem, which is likely to support various avifaunal species associated with wetland habitats. In addition, the presence of ungulates and the commercial and subsistence hunting practices taking place in these areas are likely to attract vultures and Marabou Stork (*Leptoptilos crumenifer)* because of the availability of carcasses on which to feed. These species are particularly susceptible to interactions with transmission line developments.

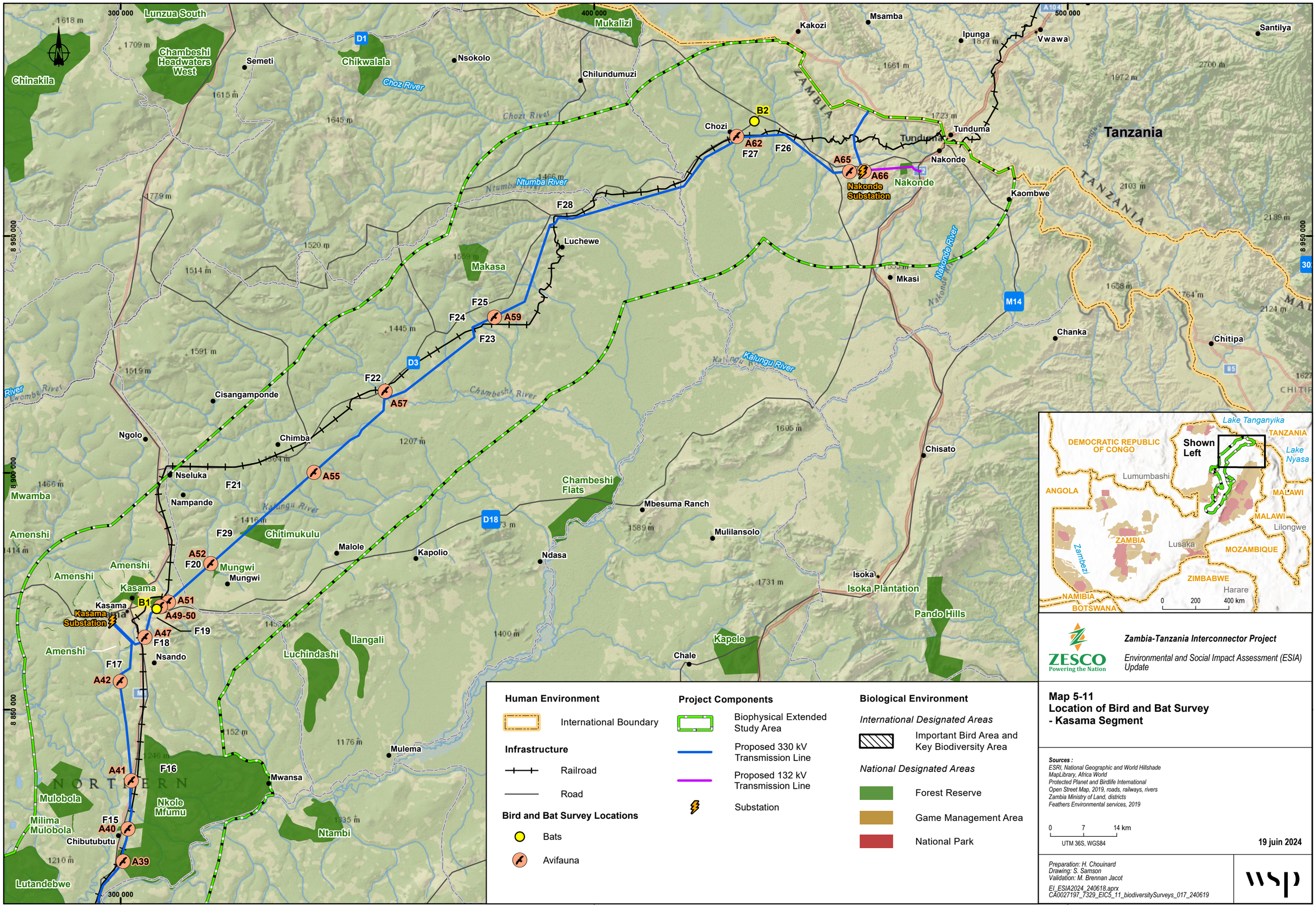
#### 5.3.3.2 BIRDS SPECIES DIVERSITY

Bird occurrence data was obtained from field surveys conducted in November 2019. This field data was completed by consulting various data sets, including GBIF (2024) or the Southern African Bird Atlas Project 2 (SABAP 2, 2019) to complete the list of species of conservation concern potentially present within the BESA. The detail on data sources and survey methodology is described in Appendix 5-2. Location of Bird survey locations are illustrated on Maps 5-11 to 5-13.

Priority bird species were defined in terms of i) global and/or regional (species that are considered to be threatened within Zambia) status, ii) uniqueness or endemism, iii) susceptibility to powerline-associated impacts, and iv) relative use of the habitats within the proposed development area, e.g., migratory species. The list of priority species is available in Appendix 5-5.

The field survey conducted within the LSA produced a combined list of 168 species. Twenty-one priority species were observed, with most of the records occurring between Pensulo and Kasama. Most observations were of small passerine species that are common to this area.

The detailed observations from each survey method are described below. The list of all bird species surveyed is available in Appendix 5-6.

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**Map 5-11**
**Location of Bird and Bat Survey - Kasama Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*Feathers Environmental services, 2019*

0 7 14 km
UTM 36S, WGS84

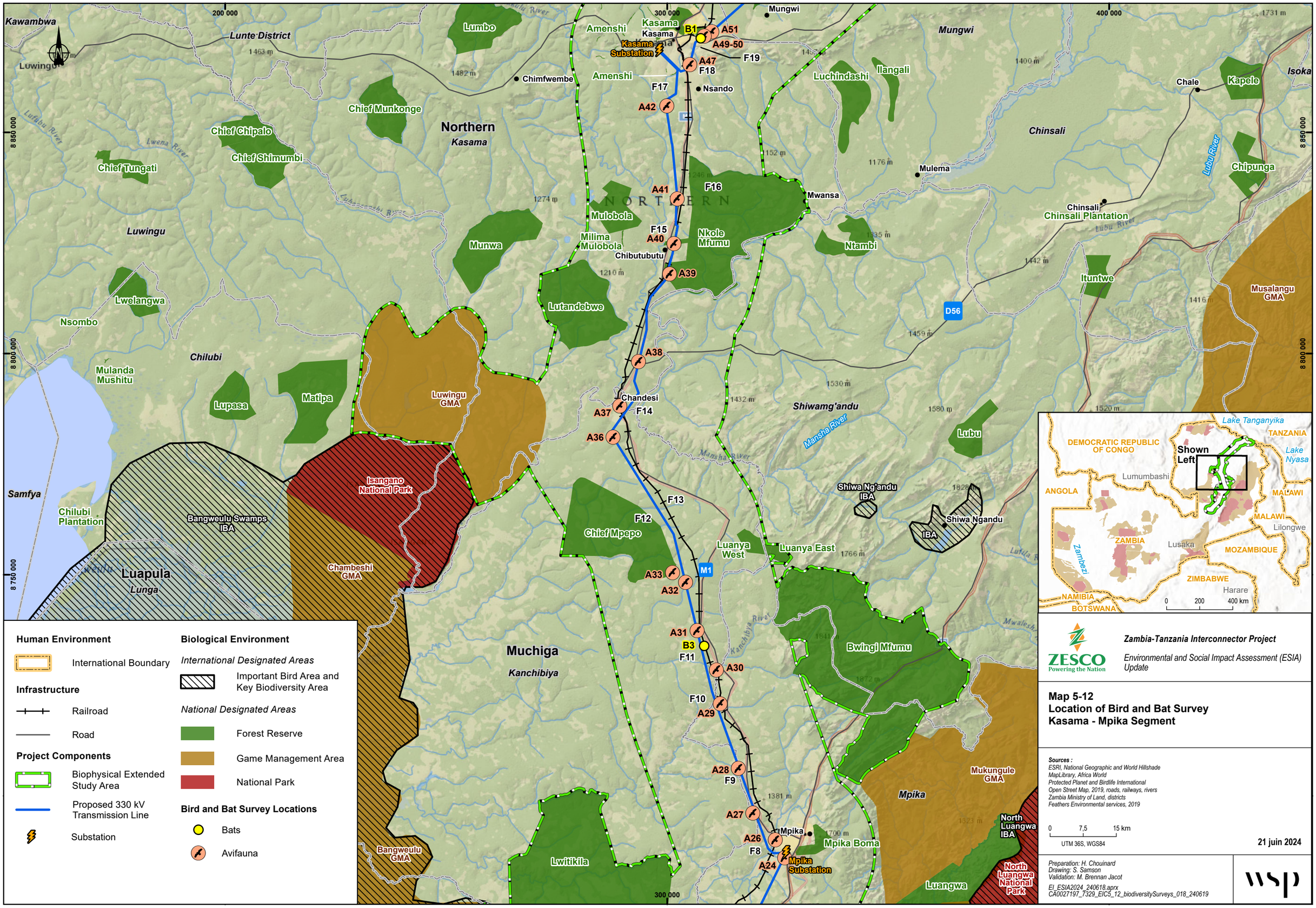
**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_11_biodiversitySurveys_017_240619*

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.*




**Human Environment**

- International Boundary

**Infrastructure**

- Railroad
- Road

**Project Components**

- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Substation

**Biological Environment**

*International Designated Areas*

- Important Bird Area and Key Biodiversity Area

*National Designated Areas*

- Forest Reserve
- Game Management Area
- National Park

**Bird and Bat Survey Locations**

- Bats
- Avifauna

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*Environmental and Social Impact Assessment (ESIA) Update*

# Map 5-12
# Location of Bird and Bat Survey
# Kasama - Mpika Segment

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*Feathers Environmental services, 2019*

0 7,5 15 km
UTM 36S, WGS84

**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

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*CA0027197_7329_EIC5_12_biodiversitySurveys_018_240619*

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**Human Environment**

International Boundary

**Infrastructure**

Railroad

Road

**Bird and Bat Survey Locations**

Bats

Avifauna

**Biological Environment**

*International Designated Areas*

Important Bird Area and Key Biodiversity Area

*National Designated Areas*

Forest Reserve

Game Management Area

National Park

**Project Components**

Biophysical Extended Study Area

Proposed 330 kV Transmission Line

Substation

Kanchibiya
Lwitikila
Luchembe
Mpika
Mpika Boma
Mpika Substation
Chilonga
Mukungule GMA
North Luangwa National Park
North Luangwa IBA
Luangwa
Munyamadzi GMA
Bangweulu GMA
Bangweulu Swamps IBA
Kafinda GMA
Mulembo
Lavushi Manda National Park
Lavushi Manda IBA
Kalonje
Mutinondo Wilderness IBA
Lavushimanda
Kasanka National Park
Kasanka IBA
D235
Zambia
Musola
Chitambo
Lukulu River
Musola River
Serenje
Musangashi
Kanona
Pensulo Substation
Lake Lusiwasi
A-Focal
Mailo
South Luangwa National Park
South Luangwa IBA
Munte
Luombwa
T2
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A14 A15 A17 A18 A19 A20 A21 A22 A24 A26
B4 B5 B6
F1 F2 F3 F4 F5 F6 F7 F8
300 000
8 650 000
8 600 000
8 550 000

Lake Tanganyika
TANZANIA
DEMOCRATIC REPUBLIC OF CONGO
Lake Nyasa
Lumumbashi
Shown Left
ANGOLA
MALAWI
Lilongwe
ZAMBIA
Lusaka
Zambezi
MOZAMBIQUE
ZIMBABWE
Harare
NAMIBIA
BOTSWANA
0 200 400 km

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**Map 5-13**
**Location of Bird and Bat Survey**
**Mpika - Pensulo Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*Feathers Environmental services, 2019*

0 6 12 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_13_biodiversitySurveys_019_240618*

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## POINT COUNTS OF PRIORITY AND SMALL TERRESTRIAL SPECIES

A total of 166 species were recorded across the point count locations and the associated walked transects. Small passerine species, i.e., Dark-capped Bulbul (*Pycnonotus tricolor*), Bronze Mannikin (*Lonchura cucullata*), Blue Waxbill (*Uraeginthus angolensis*), Common Waxbill (*Estrilda astrild*), Fork-tailed Drongo (*Dicrurus adsimilis*), Yellow Bishop (*Euplectes capensis*) and Yellow-mantled Widowbird (*Euplectes macroura*), Black-backed Puffback (*Dryoscopus cubla*), Black-collared Barbet (*Lybius torquatus*), Little Bee-eater (*Merops pusillus*) and various sunbird species, were common in most habitat types. Six survey points (i.e., 26, 33, 41, 62, 65, and 66) yielded the highest species richness, with > 20 species recorded at each location. Habitats that dominated these locations included watercourses, mature woodlands, and dambos. Figure 5-20 illustrates bird species richness recorded during field surveys.

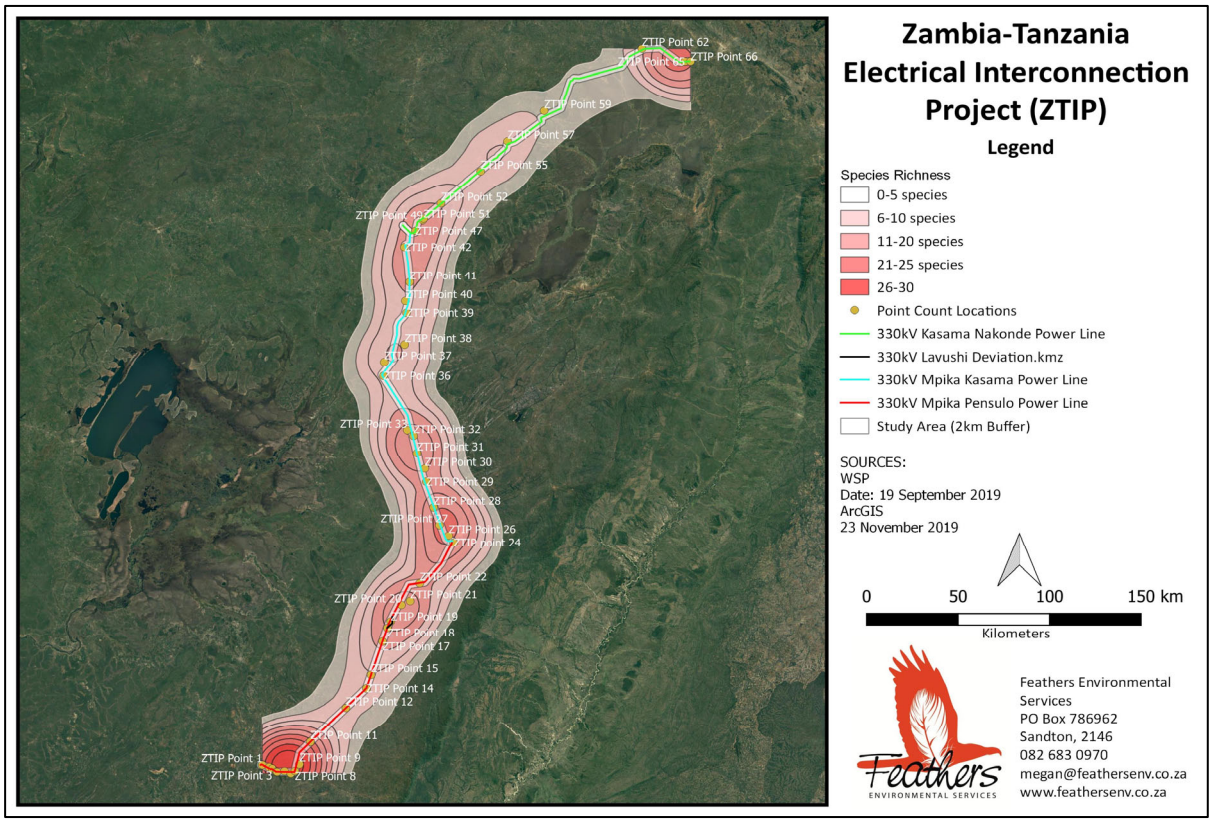
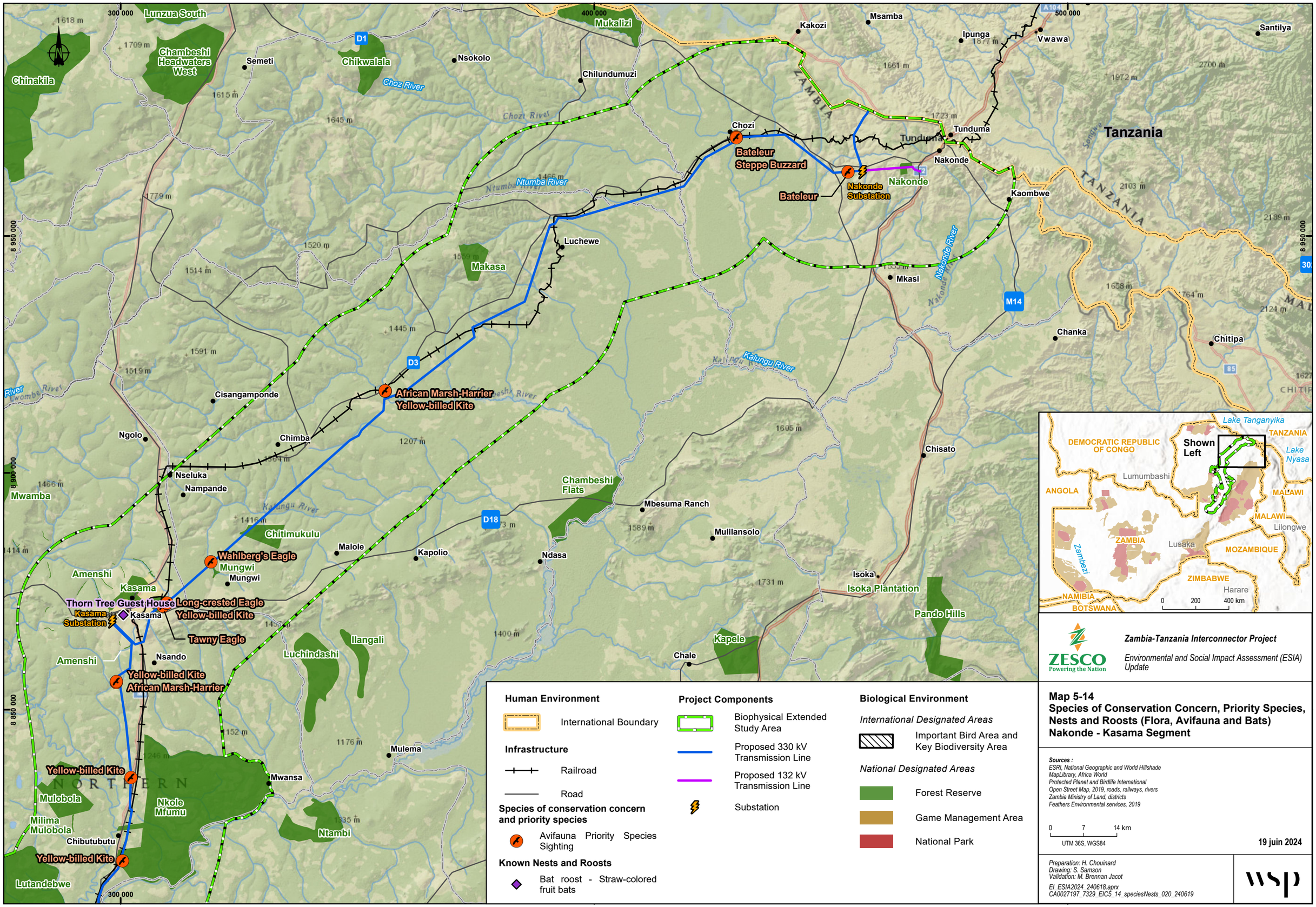



**Figure 5-20 Species Richness Along the Proposed - ZTIP 330kV Powerline Alignment**

Fourteen raptor species were observed, with the global Red List species Bateleur (*Terathopius ecaudatus)*, Tawny Eagle (*Aquila rapax)*, Steppe Eagle (*Aquila nipalensis)* and the regional Red List African Marsh-Harrier *Circus ranivorus)* (Willems & Leonard, 2019) being the most noteworthy. The location of priority species observed during the field surveys is shown in Maps 5-14 to 5-16. Although the Martial Eagle (*Polemaetus bellicosus)* was not observed during the field surveys, suitable habitat exists to support this species. Due to the timing of the site visit, breeding activity specific to raptors could not be confirmed. The avifaunal assessment contained within the ESIA highlighted the potential presence of the Lappet-faced Vulture (*Torgos tracheliotos)* and White-headed Vulture (*Trigonoceps occipitalis)* within the study area. No vulture species were recorded during the survey period. Although a mature *Acacia* woodland was present at certain locations, the Miombo woodland features prevalently, a vegetation type that vultures do not commonly utilize.

In Tanzania, vultures actively avoid Miombo woodlands (Dr. Corinne Kendall, pers. comms.). This, coupled with the prevailing land-use practices and the unavailability of food, is likely to preclude these species from regularly occurring along the proposed route alignment.




**Human Environment**

International Boundary

**Infrastructure**

Railroad

Road

**Species of conservation concern and priority species**

Avifauna Priority Species Sighting

**Known Nests and Roosts**

Bat roost - Straw-colored fruit bats

**Project Components**

Biophysical Extended Study Area

Proposed 330 kV Transmission Line

Proposed 132 kV Transmission Line

Substation

**Biological Environment**

*International Designated Areas*

Important Bird Area and Key Biodiversity Area

*National Designated Areas*

Forest Reserve

Game Management Area

National Park

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**Map 5-14**
**Species of Conservation Concern, Priority Species, Nests and Roosts (Flora, Avifauna and Bats)**
**Nakonde - Kasama Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*Feathers Environmental services, 2019*

0 7 14 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_14_speciesNests_020_240619*

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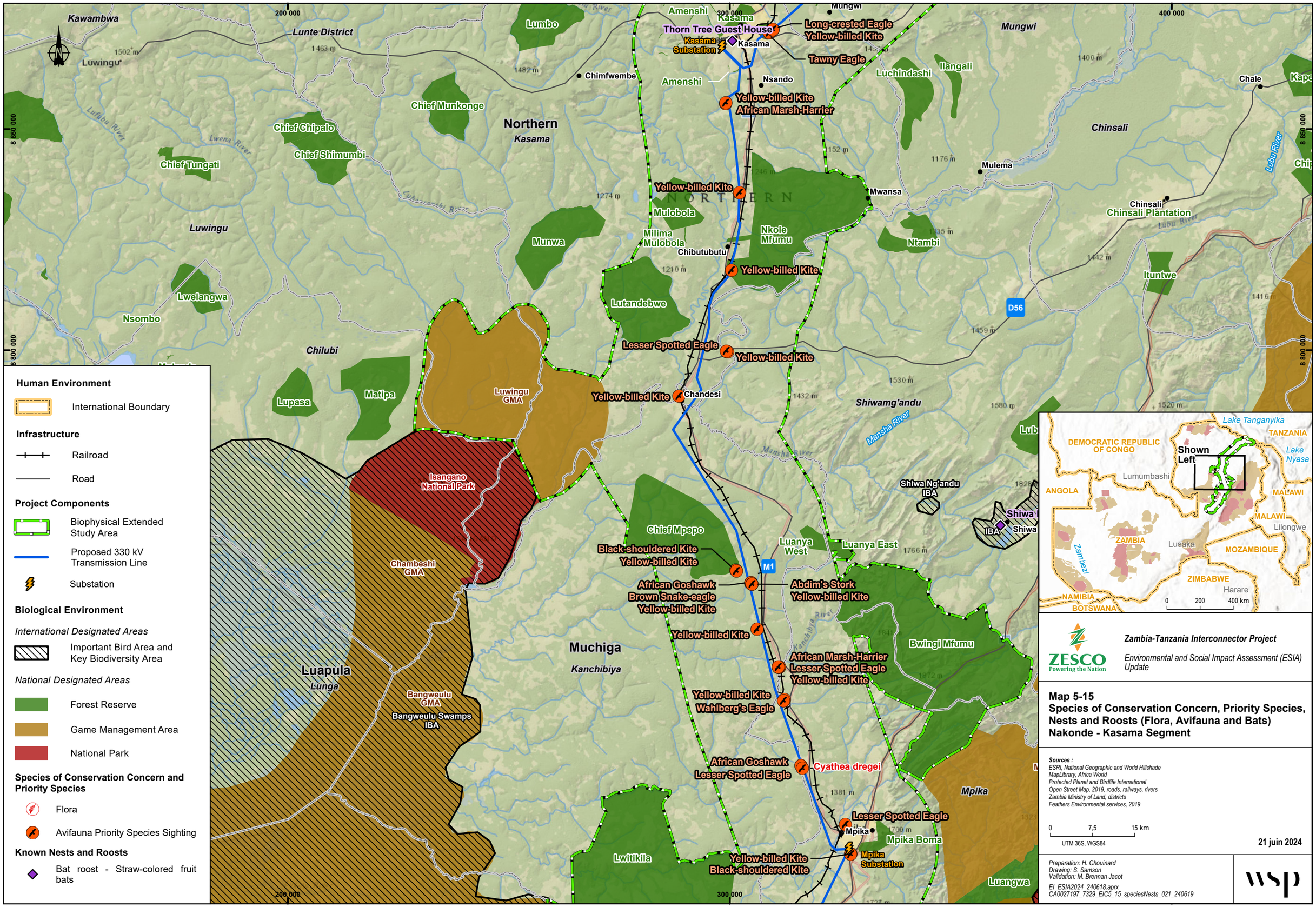



*Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.*

**Human Environment**

International Boundary

**Infrastructure**

Railroad

Road

**Project Components**

Biophysical Extended Study Area

Proposed 330 kV Transmission Line

Substation

**Biological Environment**

*International Designated Areas*

Important Bird Area and Key Biodiversity Area

*National Designated Areas*

Forest Reserve

Game Management Area

National Park

**Species of Conservation Concern and Priority Species**

Bats

Flora

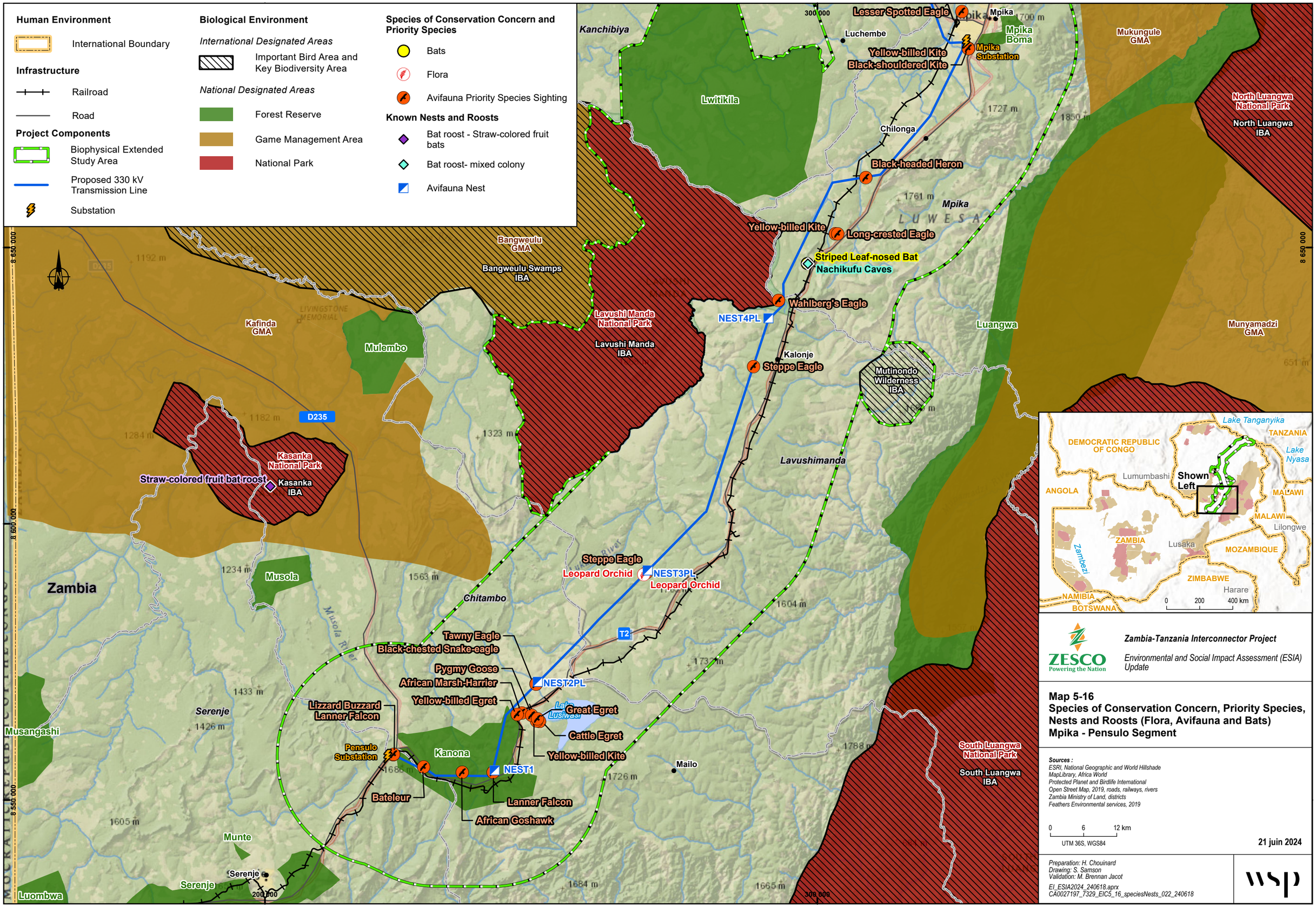
Avifauna Priority Species Sighting

**Known Nests and Roosts**

Bat roost - Straw-colored fruit bats

Bat roost- mixed colony

Avifauna Nest

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**Map 5-16**
**Species of Conservation Concern, Priority Species, Nests and Roosts (Flora, Avifauna and Bats)**
**Mpika - Pensulo Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*Feathers Environmental services, 2019*

0 6 12 km
UTM 36S, WGS84

**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_16_speciesNests_022_240618*

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.*

A flock of seven Abdim's Stork (*Ciconia abdimii)* was observed flying at a height of approximately 100 m in a northwesterly direction at point count A-32, mainly comprised of floodplains.

Their presence and flight pattern suggest that they (and other species) may commute through this area on route to the Bangweulu Swamps, an Important Bird Area (IBA) located approximately 50 km west of point count A-32. This is a relatively short distance for far-ranging and migratory species. This area may be an important flyway for both migratory and resident wetland-dependent species.

## COUNTS OF LARGE TERRESTRIAL SPECIES AND RAPTORS

Species diversity and density were low with only 12 priority species observed over the survey period, 11 of which were previously recorded during the point count surveys (Appendix 5-6). The African Harrier-hawk (*Polyboroides typus*), not previously recorded, was observed during vehicle-based survey 3. The Yellow-billed Kite (*Milvus aegyptius*), one of the most common raptors in Africa and one of the most visible birds in urban areas, was recorded most frequently. Disturbed areas, i.e., roadsides and villages, suit this bird well, as it is incredibly opportunistic in its behaviors. Its diet is varied, and it will feed on any prey small enough to be caught and eaten, such as small mammals, reptiles, birds, and insects. Carrion is regularly eaten, as well as human leftovers and scraps. The Cattle Egret (*Bubulcus ibis*) was the only large terrestrial bird observed during the vehicle-based surveys. Vehicle-based surveys 3 and 7 yielded the highest species richness with nine and five species observed, respectively.

## FOCAL SITE SURVEYS

### WATERBODIES AND WETLANDS

A relatively low total of 16 species were observed (Appendix 5-6). Seven of these species were only recorded at this focal site and include: Cuckoo-finch (*Anomalospiza imberbis*), Cattle Egret *Bubulcus ibis*), Great Egret (*Egretta alba*), Yellow-billed Egret (*Egretta intermedia*), Common Moorhen (*Gallinula chloropus*), African Pygmy-goose (*Nettapus auritus*) and Red-billed Quelea (*Quelea quelea*). The lake is heavily utilized by the surrounding community resulting in a limited food supply. In addition, the significant levels of disturbance emanating from the nearby roads, railways, and villages have likely displaced many species that would ordinarily inhabit this important habitat feature. The flight behaviour of priority species was observed at this focal site to determine if flights occur across the proposed powerline located to the west of the lake.

Flights were short in distance and associated with foraging (African Marsh-harrier and Yellow-billed Kite) and a single direct commute to another side of the lake (Great Egret) in an easterly direction.

### NEST SITES

Due to the timing of the field surveys, no active raptor nests were observed. Typically, raptor breeding activity peaks between March and August. Several passerine nests were observed, mostly belonging to various weaver species. Three active Pied Crow (*Corvus albus*) nests were observed within the lattice towers of the existing 330kV transmission powerline, between Pensulo and Mpika (NEST2-4PL). All three nests were in the earth peaks, i.e., the attachment point of the powerline's earth wire-ground wire, as illustrated in Figure 5-21.

**Figure 5-21 Example of a Pied Crow Nest in the Earth Peak of the Existing 330kV Transmission Powerline**

A single bird was observed in each nest and it is likely that the adult was incubating eggs. Crows are quick to nest on any man-made infrastructure, which may have implications for the quality of the electrical supply since crows often use wires as part of their nest material, which could cause an electrical flashover. Pied Crows are not a protected species and while it may not be illegal to remove an unoccupied nest that may be posing a quality of supply risk, the removal of nests that contain eggs, chicks, or adult birds may require a permit. In addition, another unidentified and inactive nest was found in the dense riverine forest near point count A-8, within the Mungwi Forest Reserve (NEST 1).

This nest is located approximately 300 m from the proposed powerline and will need to be reassessed prior to construction to determine if construction activities need to be delayed to accommodate the breeding birds, particularly if this is a species of conservation concern. No other breeding sites were noted during the site survey. All nest locations recorded are illustrated in Maps 5-14 to 5-16.

## POWERLINE INFRASTRUCTURE

Although no mortalities were observed at the various survey locations, it cannot be concluded that the existing infrastructure does not pose a collision or electrocution risk to resident and migratory species. Survey locations were largely based on accessibility and were dove-tailed with point count surveys in order to maximize the limited amount of time available to conduct the surveys. Quantifying collision and electrocution impacts, in terms of the likely number of birds impacted, is extremely difficult because of the many variables that play a role in determining the risk, factors that may not have presented themselves yet.

A more structured monitoring approach is needed, whereby a sample of powerline spans and towers, within various habitat types, be systematically surveyed at regular intervals to account for factors like seasonal variability and availability of food resources.

### INCIDENTAL SIGHTINGS

No notable incidental observations were made along the proposed powerline alignment. However, it is worth noting that several Abdim's Stork and White Stork (*Ciconia ciconia*) were observed feeding in and flying above the commercial agricultural lands in the Mkushi area, 130 km southwest of the proposed powerline alignment. Commercial agriculture does not occur within the immediate surroundings of the proposed powerline, so concentrations of Abdim's Stork and White Stork are unlikely; however, as mentioned previously, dambo areas may attract migratory species both in terms of potential staging grounds and flyways.

#### 5.3.3.3 BIRDS SPECIES OF CONSERVATION CONCERN AND PRIORITY SPECIES

Of all the species sighted during the rapid bird surveys, three are listed in the IUCN Red List, Bateleur (*Terathopius ecaudatus*)-EN, Tawny Eagle (*Aquila rapax)*-VU, Steppe Eagle (*Aquila nipalensis*)-EN, and one in the regional Red List, African Marsh-Harrier (*Circus ranivorus*) (Willems & Leonard, 2019).

A further eight Red-Listed species are potentially present, based on GBIF and SABAP2 records in the BESA. These include the Crowned Eagle (*Stephanoaetus coronatus*)- NT, the Martial Eagle (*Polemaetus bellicosus*) - EN, the Pallid Harrier (*Circus macrourus*) - NT, the Lappet-faced Vulture (*Torgos tracheliotos*) – EN, the White-backed Vulture (*Gyps africanus*)- CR, the White-headed Vulture (Trigonoceps occipitalis)-CR, the Southern Ground-hornbill (*Bucorvus leadbeateri*) – VU and the Cape Parrot *(Poicephalus robustus*)- VU. One additional potentially present species is in the regional Red List, the Bar-winged Weaver (*Ploceus angolensis*) (Willems & Leonard, 2019).

Of the 400 species recorded during surveys and in the GBIF and SABAP2 databases, 60 are considered priority species, 21 of which were observed during surveys, including twelve of the special status species listed above. The full list of species of conservation concern and priority species present and potentially present in the BESA is available in Appendix 5-7. The ecology of Red-listed species and threats is further discussed below.

Table 5-12 lists UCN Red List and regional Red List present or potentially present in the BESA. The table also details the potential for each species to occur in a specific habitat class and potential interactions with powerline Projects. These potential impacts are further discussed in Chapter 6.

**Table 5-12 Bird Species of Conservation Concern and Priority Species Recorded in the Relevant Pentads Surrounding the Proposed Study Area**

| Common Name | Global Conservation Status | Migration | Source | Habitat | | | | | Potential interactions with powerline | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Miombo Woodland | Dambos | Rivers, Wetlands & Waterbodies | Mountainous Areas | Agricultural Lands | Displacement (habitat loss disturbance) | Powerline Collision | Substation Electrocution | Quality of Supply Impact (fecal pollution & nesting) |
| Bateleur *Terathopius ecaudatus* | EN | Par /Pos | 2019 Survey; GBIF, 2024; SAPAB2. 2019 | x | - | - | - | - | x | x | - | - |
| Eagle, Crowned *Stephanoaetus coronatus* | NT | | GBIF, 2024 | x | - | x | - | x | x | x | - | - |
| Eagle, Martial *Polemaetus bellicosus* | EN | | GBIF, 2024; SAPAB2, 2019 | x | - | - | - | - | x | x | - | x |
| Eagle, Steppe *Aquila nipalensis* | EN | PM | 2019 Survey; GBIF, 2024; SAPAB2. 2019 | x | - | - | - | - | - | x | - | - |
| Eagle, Tawny *Aquila rapax* | VU | | 2019 Survey; GBIF, 2024; SAPAB2, 2019 | x | - | - | - | - | x | x | - | x |
| Ground-hornbill, Southern *Bucorvus leadbeateri* | VU | | GBIF, 2024; SAPAB2, 2019 | x | dry | - | - | - | x | x | - | - |
| Marsh-harrier, African *Circus ranivorus* | Regional | | 2019 Survey; GBIF, 2024; SAPAB2, 2019 | - | x | x | - | - | - | x | - | - |
| Harrier, Pallid *Circus macrourus* | NT | PM | GBIF, 2024; SAPAB2, 2019 | - | x | x | - | - | - | x | - | - |
| Parrot, Cape *Poicephalus robustus* | VU | | GBIF, 2024 | - | - | - | x | - | - | | - | - |
| Vulture, Lappet-faced *Torgos tracheliotus* | EN | | GBIF, 2024; SAPAB2, 2019 | x | - | - | - | - | x | x | - | x |

| Common Name | Global Conservation Status | Migration | Source | Habitat | | | | | Potential interactions with powerline | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Miombo Woodland | Dambos | Rivers, Wetlands & Waterbodies | Mountainous Areas | Agricultural Lands | Displacement (habitat loss disturbance) | Powerline Collision | Substation Electrocution | Quality of Supply Impact (fecal pollution & nesting) |
| Vulture, White-backed *Gyps africanus* | CR | | GBIF, 2024 | x | - | - | - | - | x | x | - | x |
| Vulture, White-headed *Trigonoceps occipitalis* | CR | | GBIF, 2024; SAPAB2, 2019 | x | - | - | - | - | x | x | - | x |
| Weaver, Bar-winged *Ploceus angolensis* | Regional | | SAPAB2, 2019 | x | - | - | - | - | - | - | x | - |

CR= Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near-threatened; PM = Palearctic Migrant; AM = Afro-tropical Migrant; PAR/POS = Partial/Possible Migrant.

Seven of Zambia's eight vulture species are threatened. The availability of both habitat and food means that vultures are well represented in the area. The vulture's ability to travel vast distances and the high proportion of time they spend foraging outside protected areas and particularly in the vicinity of power lines makes them especially vulnerable to negative interactions (e.g., collision and electrocution) with the Project. Three threatened vulture species are potentially present in the study area: the White-backed Vulture (*Gyps africanus*), the Lappet-faced Vulture (*Torgos tracheliotos*) and the White-headed Vulture (*Trigonoceps occipitalis*).

- The White-backed Vulture (*Gyps africanus*) (CR) is the most widespread and common vulture in Africa, although it is now undergoing rapid declines. It is primarily a lowland species of open wooded savanna, particularly areas of Acacia. It requires tall trees for nesting, but has also been recorded nesting on electricity pylons in South Africa. It is a gregarious species congregating at carcasses, in thermals and at roost sites. It nests in loose colonies (BirdLife International, 2021d).

- The Lappet-faced Vulture (EN) inhabits dry savannah habitats, with tall isolated trees such as *Acacia, Balanites* and *Terminalia* that are utilized for roosting and breeding activities. Lappet-faced Vultures often build only one nest, although it is also common to have one to three nests that are used alternately. Little is known about the breeding locations of Lappet-faced Vulture in the study area, however, the presence of large trees within the study area offering a suitable nesting substrate means that breeding (nest) locations cannot be discounted.

- The White-headed Vulture (CR) has an extremely large range in sub-Saharan Africa. In southern Africa it is now largely confined to protected areas. It generally avoids human habitation. It may generally fly lower than other vultures and is often the first vulture species to arrive at carcasses. It nests and roosts in trees, most nests being in Acacia spp. or baobabs (Mundy et al. 1992).

Five additional threatened species from the Accipitridae family are of conservation concern.

- Bateleur *Terathopius ecaudatus* (EN) are widespread across southern Africa and prefer savannah woodland with long grass. These diurnal scavengers and hunters locate prey aerially, swooping down on prey from several hundred metres in the sky. They follows roads, looking for roadkill and attracted to veld fires to scavenge dead animals and hunt small mammals.

- Martial Eagle *Polemaetus bellicosus* (EN) inhabits open woodland, wooded savannah, bushy grassland, thornbush and, in southern Africa, more open country and even subdesert, from sea level to 3,000 m but mainly below 1,500 m. The main prey are sizeable mammals, birds and reptiles. Mating seasons vary across the geographic range, although it generally occurs during the dry season, from February until November in South, Central and East Africa. Martial Eagles tend to breed once every two years (BirdLife International. 2020b).

- Steppe Eagle *Aquila nipalensis* (EN) is a common non-breeding Palaearctic migrant that arrives in October-November and departs again in March-April. Usually localized and gregarious, they are found in flocks where good rains have fallen. It favours open savannah woodland and feeds largely on termites and Red-billed Quelea nestlings.

- Tawny Eagle *Aquila rapax* (VU)are common in protected areas and prefer lightly wooded savannah. These eagles can colonize treeless grasslands by breeding on powerline towers and in alien trees. Birds hunt from a perch or in flight, swooping to catch agile prey. They can kill flamingos in flight and will compete with vultures and Marabou Stork at carcasses, and regularly with scavengers at roadkill. Most nest locations are used for 1-3 years but the same nesting area is used for 50-60 years.

- African Marsh-harrier *Circus ranivorus* (Regional Red-List) has an extremely large range and is a resident of wetlands from South Africa north to the Democratic Republic of Congo and southern Sudan. The species breeds in wetlands, foraging primarily over reeds and lake margins. Its diet consists largely of small mammals (BirdLife International, 2016a).

Three more threatened species have past occurrences in the BESA and are considered potentially present.

- Southern Ground-Hornbill *Bucorvus leadbeateri* (VU) inhabits woodland and savannah, also frequenting grassland adjoining patches of forest up to 3,000 m in parts of its range in eastern Africa. The species fares well in protected areas where human threats are excluded and rural areas where cattle assist in maintaining their preferred short grass habitat. Laying occurs in large cavities in trees, cliffs or earth banks, mainly from September to December, with a clutch of one to three (usually two) eggs, although only one survives to fledging (BirdLife International, 2016b). Atlas data implies extensive occupancy. However, expert opinion suggests large declines in the north-western and southern provinces but stable populations in protected areas and sparsely inhabited rural areas. Local extirpation is reported to be greatest for areas with intensive and rapidly expanding agricultural activity and dense human populations (estimated 25% of the country), likely due to hunting, rapid deforestation for large-scale charcoal production and degazetting of forest reserves (Kemp, 2017). The loss of trees in the Miombo woodland due to excess logging has severe negative impacts on all cavity nesters . In a meeting with WWF Zambia, representatives noted that Southern Ground-Hornbill is prevalent in the Miombo woodland habitat within the study area and that congregations and nesting sites may be present along the proposed route alignments (WWF Zambia, personal communication). Unfortunately, detailed locations of these sites were not made available.

Cape Parrot (*Poicephalus robustus*) (VU) is restricted to South Africa, which has small, isolated populations. This species inhabits the temperate zone, particularly the montane mist-belt evergreen *Podocarpus* forest. This resident of Africa undertakes three different types of excursions related to the availability of the *Podocarpus* fruits, including daily flights, overnight stops or more extensive wanderings.

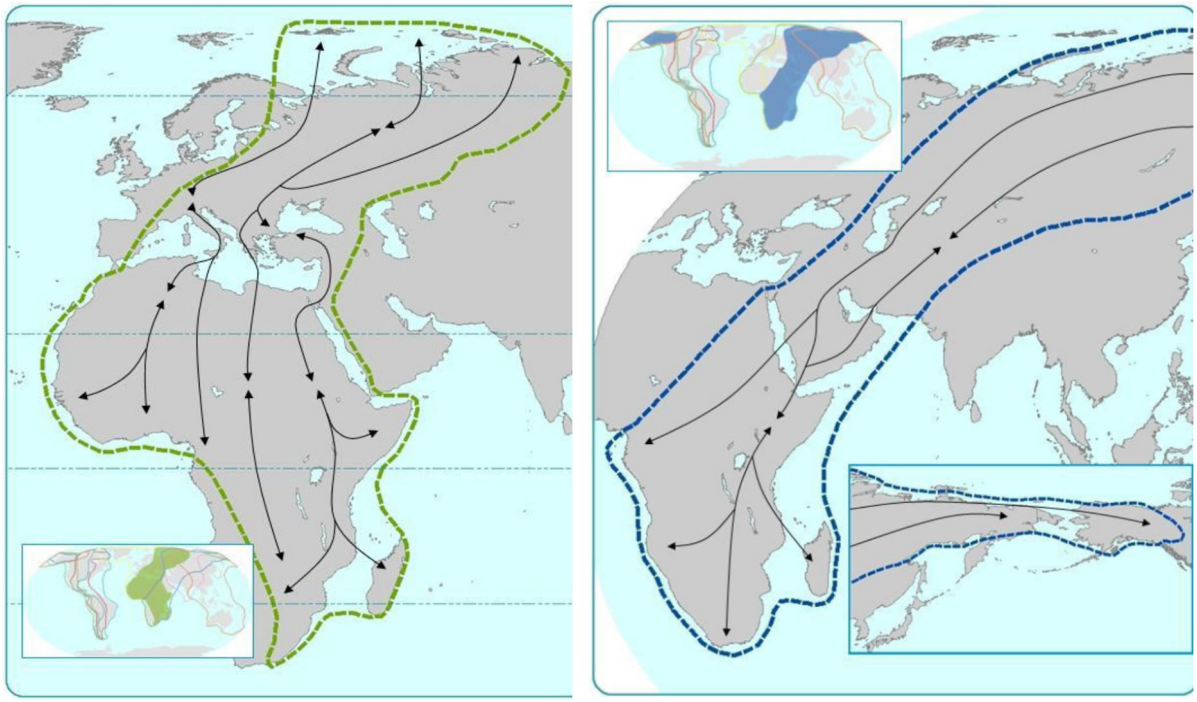
Bar-winged Weaver (*Ploceus angolensis*) (Regional Red-List) occurs in miombo woodland from Angola to Zambia. It inhabits mature, tall Brachystegia woodland where it is moist enough to grow copious Usnea lichen on the trees (Weaver Watch, 2024). The presence of threatened crane species has been documented in the area between Nakonde and Chozi, approximately 5 km north of the proposed power line (WWF Zambie, personal communication).

#### 5.3.3.4 MIGRATION FLYWAYS

Despite their ability to adapt, birds have specific food, water and habitat requirements. The seasonal variability of these resources necessitates migration for many species. Familiar and widely known migrations occur annually, connecting breeding areas to non-breeding areas. Opportunistic, nomadic movements also occur amongst some species in response to rainfall. These species move into areas where it has recently rained to capitalize on the seeds, insects and other food sources that sporadically become available. When the area is no longer attractive or viable, they move on again (UNEP/CMS, 2012).

Migration patterns are extremely species-specific. Passerines, especially insectivorous birds, tend to migrate by night on a very broad front, crossing expansive seas and deserts, while finches and larks migrate for a few hours just before and after sunrise – all needing closely spaced staging points to rest and forage. Shorebirds adopt a different strategy altogether, migrating over long distances between fixed staging points, traversing large stretches of land, often without being seen. Soaring birds, e.g., storks, pelicans, albatrosses, petrels, terns, and many birds of prey, rely on thermal currents associated with mountain chains, allowing them to gain height and glide for extended periods of time along these ranges. Birds that flap their wings to gain height and propel themselves forward consume a great deal of energy to do so. These species migrate over broader fronts and can be concentrated in favourable areas along the route to restore depleted energy levels. Similarly, migrating waterbirds depend on distinct sites of suitable habitat along their flyways and are often found concentrated at coastal and/or inland wetlands (UNEP/CMS, 2012).

The proposed powerline is contained within the Mediterranean/Black Sea and East Asia/East Africa migratory flyways, two of three Palearctic-African flyways that connect Europe with Africa, which are illustrated in Figure 5-22. Collectively, these three flyways constitute the world's largest bird migration system (BirdLife International, 2019), with over two billion passerines and near-passerines, 2.5 million ducks, and two million raptors migrating from their breeding grounds in Europe and central and western Asia to winter in tropical Africa.



Mediterranean/Black Sea Flyway

The East Asia/East Africa Flyway

Source: BirdLife International, 2019

**Figure 5-22 Flyways Overlapping the Region of the Project**

The Luangwa Valley, located approximately 50-90 km east of the study area, is an important migratory route for White Stork (Gerkmann et *al.*, 2008). The valley's topographical characteristics provide the thermals necessary for flight. Three national parks situated along the Luangwa River (i.e., North Luangwa National Park, Luambe National Park, and South Luangwa National Park) protect this critical part of the migration corridor, particularly during their southward migration.

However, the northward flyway directs storks towards the escarpment and the more populated areas. It is also likely that these and other migratory species, which are dependent on water sources, will move between the Luangwa Valley and Lake Bangweulu and the associated Bangweulu swamps located 30 km west of the proposed powerline at its closest point. In addition, the presence of Important Bird Areas, National Parks and Forest Reserves in the area between the Luangwa Valley and Lake Bangweulu, make it an attractive flyway option.

Finer scale, migratory flyways along the proposed powerline route are largely associated with the avifaunal microhabitats that occur along the alignment. Most of the migratory priority species recorded in the study area during the survey are raptors. As soaring birds, raptors are likely to utilize mountain plateaux and escarpment areas, especially those areas located to the east of the proposed powerline alignments. Mass migratory movement across the powerline alignments is unlikely, but for those birds of prey that do not continue their journey southwards, sections of the proposed powerline that traverse mixed habitats containing mature woodlands and dambos will require mitigation to minimize the potential displacement and collision impacts. During the survey, observations of Abdim's Stork suggest that dambos associated with watercourses and large-scale commercial agriculture are favoured habitats for these species. Typically, for species dependent on water, river systems, wetlands, and large waterbodies are key staging areas that provide suitable roosting and foraging habitats while en route to their terminal staging grounds. The river systems and waterbodies present along the route alignment are heavily utilized by the surrounding communities and, as such, may not provide the necessary foraging opportunities. However, topographic features, like rivers, may aid certain species in their navigation during migration. The smaller passerine migratory species recorded in the study area are not susceptible to collision impacts. Still, disturbance associated with construction activities may displace these species from areas that they utilize to replenish their energy reserves.

Potential migration flyways have been delineated and illustrated in Maps 5-17 to 5-19. The section below provides details pertaining to their sensitivity.

### 5.3.3.5 AREAS OF HIGH ECOLOGICAL IMPORTANCE FOR BIRDS

The following section describes the areas of high ecological importance in the study area that fall outside the protected areas but should be considered important bird conservation features. These areas host endemic or threatened species and support ecological processes needed to increase or at least maintain local bird biodiversity.

Areas of high ecological importance include IBAs, which are sites carefully identified based on the bird numbers and species complements they hold that are exceptionally important for maintaining the taxa dependent upon the habitats and ecosystems in which they occur.

The Lavushi Manda National Park (ZM026) and Mutinondo Wilderness (ZM027) IBAs are within the BESA and host species that could also occur within LSA. Several other IBAs are present in other areas surrounding the Project (i.e., Shiwa Ng'andu, Bangweulu Swamp, Kasanka National Park, and South Luangwa National Park), which are strongholds for a significant diversity and abundance of bird species. However, these sites are associated with specific ecological features which are not characteristic of the habitats found within the study area.

Wetland and riparian areas, as well as specific microhabits, are other areas of high ecological importance for birds.

Wetlands and riparian habitats provide important corridors for waterbirds that will regularly utilize rivers not only as a source of drinking water and food but also for bathing and cover for skulking species. In addition, thick riverine woodland with large shady riparian trees offers an important breeding substrate for a variety of birds, including raptors (Hockey *et al.* 2005). Relevant to this study, the rivers, drainage lines, and surrounding riparian habitat could, on occasion, attract species such as Reed Cormorant and African Black Duck, as well as heron, egret, and ibis species.

Wetlands are usually rich in both the number of birds and the variety of species, which include Grey Crowned Crane (*Balearica regulorum*), Saddle-billed Stork (*Ephippiorhynchus senegalensis*), Squacco Heron (*Ardeola ralloide*)*s* and Rufous-bellied Heron (*Ardeola rufiventris*), Yellow-billed Egret (*Egretta intermedia*), African Sacred Ibis (*Threskiornis aethiopicus*) and Glossy Ibis (*Plegadis falcinellus*), Fulvous Duck (*Dendrocygna bicolor*) and White-faced Duck (*Dendrocygna viduata*), Spur-winged Goose (*Plectropterus gambensis*), Comb Duck (*Sarkidiornis melanotos*) and Yellow-billed Duck (*Anas undulata*), Red-billed Teal (*Anas erythrorhyncha*), Hottentot Teal (*Anas hottentota*), Greater Painted-snipe *Rostratula benghalensis*), Black-winged Stilt (*Himantopus himantopus*), Long-toed Lapwing (*Vanellus crassirostris*), Malachite Kingfisher (*Alcedo cristata*), and Sedge Warbler (*Acrocephalus schoenobaenus*) (WWF, 2014).

Several fairly extensive wetlands occur within the study area and will represent attractive foraging habitats for collision-sensitive species such as the Pallid Harrier (*Circus macrourus*). They are also the preferred roosting and foraging habitats for the African Marsh Harrier (Hockey et al., 2005). Various common species, such as ibis, herons, and geese, will also utilize wetlands for their foraging needs.

#### MICRO HABITATS

It is important to understand the habitats available to birds at a smaller spatial scale, i.e., microhabitats. Micro habitats are shaped by factors other than vegetation, such as topography, land use, food sources, and anthropogenic factors, which are critically important in mapping the site in terms of avifaunal sensitivity and ultimately informing the mitigation requirements.

Dryland subsistence cultivation is the dominant form of agricultural activity in the study area. The agricultural activity is largely centred around villages and towns. These areas have been cleared of trees and bushes to grow crops. Frequently, these open areas have weedy forbs replacing grass cover. Ground cover may be sparse or completely absent. Cultivated areas provide diverse habitats: they may be recently ploughed, planted with growing crops or with stubble and weeds after harvesting. Cultivated areas may attract Common Buzzard, Amur Falcon, Black Kite, Wahlberg's Eagle, Lanner Falcon (*Falco biarmicus*), Black-headed Heron, Black-shouldered Kite and African Woollyneck. Although not recorded in the study area, White Stork and Abdim's Stork, Capped Wheatear (*Oenanthe pileata*) and Temminck's Courser (*Cursorius temminckii*) are also attracted to ploughed fields or bare fallow land, whilst weedy stubble and older fallow land may be used by open grassland species, e.g., the global Red List Secretarybird (*Sagittarius serpentarius*). Kori Bustard (*Ardeotis kori*) could also be attracted to agricultural clearings in woodland.

Residential areas include surface infrastructure such as buildings and roads. Built-up areas generally are of little value to sensitive Red List bird species due to their degraded nature and the associated disturbance factor, apart from the Lanner Falcon, which hunts feral pigeons and possibly free-ranging poultry. These areas may play an important role in providing safe refuge and foraging opportunities for small passerine species that have become common in urban, peri-urban, and rural environments.

#### 5.3.3.6 HABITAT SENSITIVITY CLASSIFICATION

Habitat and species observations made during the field surveys enabled the classification of sensitivity zones along the proposed powerline alignment. According to the mitigation hierarchy, measures to minimize the identified impacts depend on the sensitivity of each of these zones. Four types of sensitivity were identified and classified based on the presence of IBAs, mature reserves, forest reserves, microhabitats, the species richness within the habitat, the presence of priority species, and levels of existing disturbance in the immediate area: The High, Medium-High and Medium Sensitivity zones are illustrated in Maps 5-17 to 5-19.

##### HIGH SENSITIVITY ZONES

These areas contain mature riverine forests and associated dambos. These are key water recharge areas and support a diversity of woodland and wetland avifaunal species. Impacts in these areas are likely to be significant. Four High Sensitivity Zones occur along the proposed powerline alignment.

##### MEDIUM-HIGH SENSITIVITY ZONES

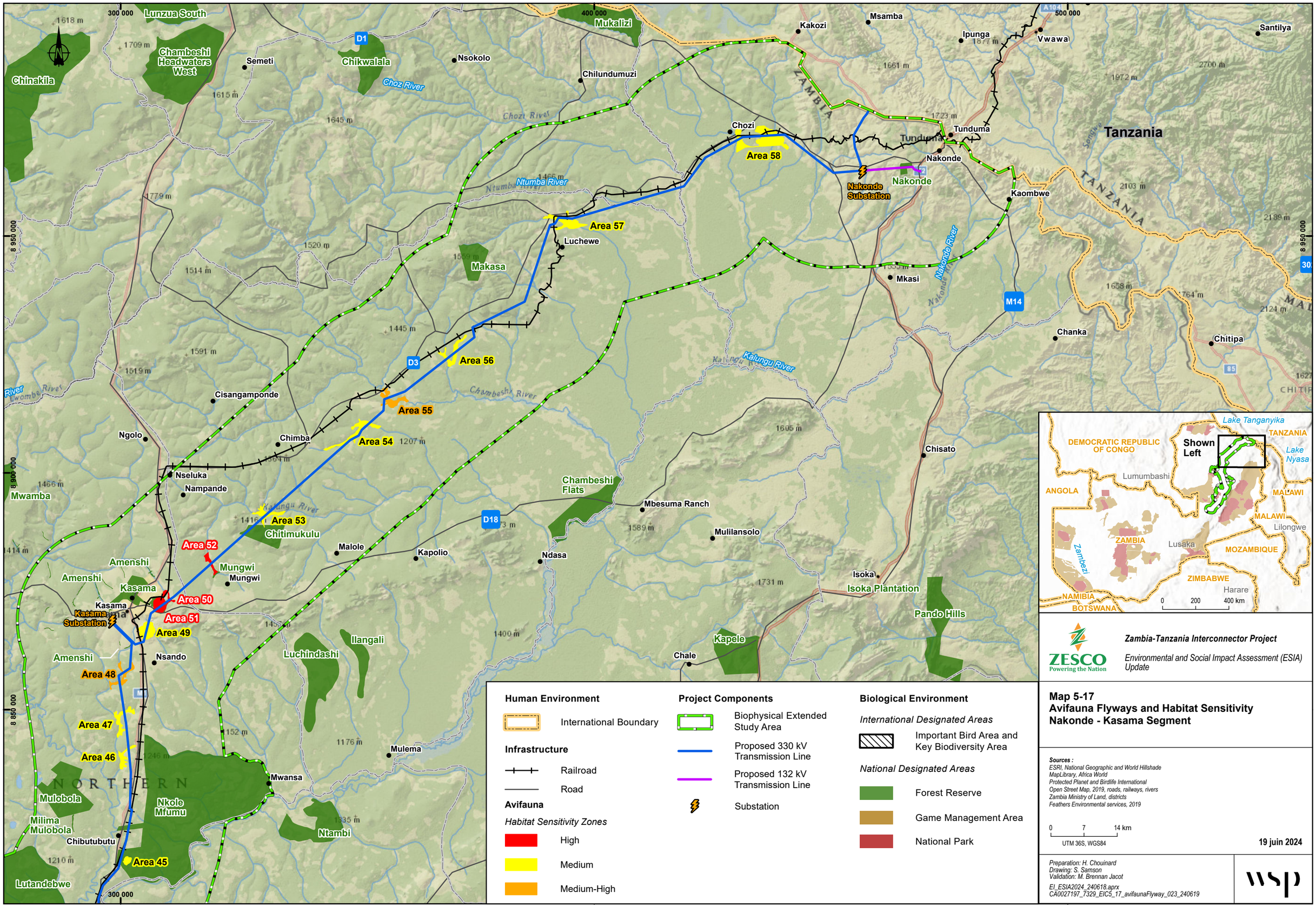
These zones contain river systems, watercourses, floodplains, large dambos, and mature woodlands, often in combination. These areas yielded the highest species richness. Groups of these zones in a particular area could denote potential migration flyways and may increase the likelihood of collision. Twenty-two areas of Medium-High Sensitivity have been identified.

##### MEDIUM SENSITIVITY ZONES

All other dambos, particularly isolated examples and those close to disturbed or transformed habitats, were classified as having medium sensitivity. Thirty-one areas of Medium Sensitivity have been identified.

##### LOW SENSITIVITY ZONES

These areas contain subsistence agriculture, heavily degraded or transformed habitats, urban centres, and villages. Species richness is relatively low, and impacts are likely to be minor. All areas outside of the High, Medium-High, and Medium Sensitivity zones, denoted in Map 5-17 to Map 5-19, can be considered areas of Low sensitivity.




**Human Environment**

- International Boundary

**Infrastructure**

- Railroad
- Road

**Avifauna**

*Habitat Sensitivity Zones*

- High
- Medium
- Medium-High

**Project Components**

- Biophysical Extended Study Area
- Proposed 330 kV Transmission Line
- Proposed 132 kV Transmission Line
- Substation

**Biological Environment**

*International Designated Areas*

- Important Bird Area and Key Biodiversity Area

*National Designated Areas*

- Forest Reserve
- Game Management Area
- National Park

ZESCO Powering the Nation

***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-17**
**Avifauna Flyways and Habitat Sensitivity**
**Nakonde - Kasama Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*Feathers Environmental services, 2019*

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*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

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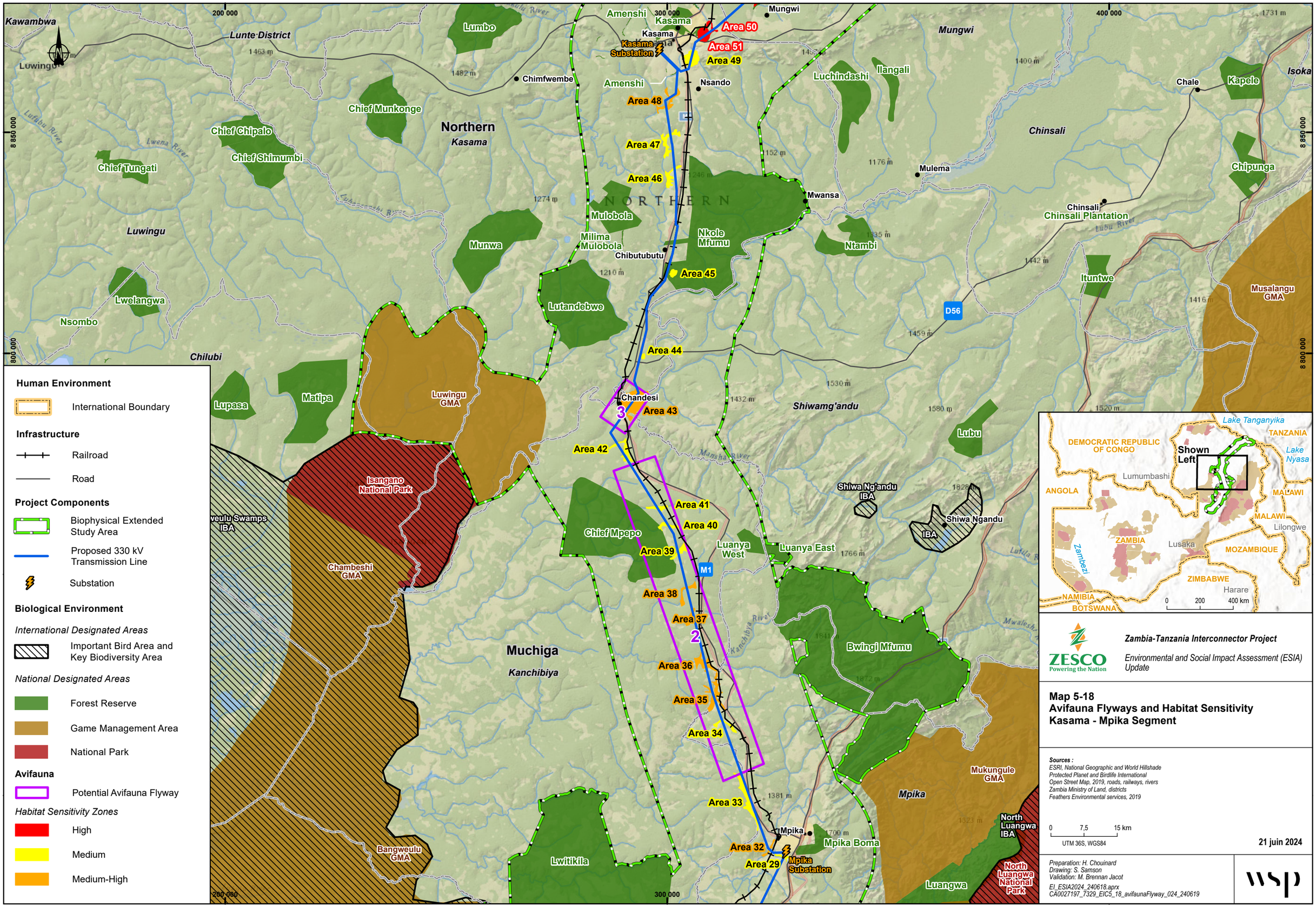
*Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.*

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**Human Environment**

International Boundary

**Infrastructure**

Railroad

Road

**Project Components**

Biophysical Extended Study Area

Proposed 330 kV Transmission Line

Substation

**Biological Environment**

*International Designated Areas*

Important Bird Area and Key Biodiversity Area

*National Designated Areas*

Forest Reserve

Game Management Area

National Park

**Avifauna**

Potential Avifauna Flyway

*Habitat Sensitivity Zones*

High

Medium

Medium-High

Kanchibiya
Lwitikila
Luchembe
Mpika
Mpika Boma
Mpika Substation
Mukungule GMA
North Luangwa National Park
North Luangwa IBA
Chilonga
Mpika
LUWESA
Luangwa
Munyamadzi GMA
Bangweulu GMA
Bangweulu Swamps IBA
Kafinda GMA
Mulembo
Lavushi Manda National Park
Lavushi Manda IBA
Kalonje
Mutinondo Wilderness IBA
Lavushimanda
Kasanka National Park
Kasanka IBA
D235
Zambia
Musola
Chitambo
Lukulu River
Musola River
Serenje
Musangashi
Kanona
Pensulo Substation
Mailo
South Luangwa National Park
South Luangwa IBA
Munte
Luombwa
Area 1
Area 2
Area 3
Area 4
Area 5
Area 6
Area 7
Area 8
Area 9
Area 10
Area 11
Area 12
Area 13
Area 14
Area 15
Area 16
Area 17
Area 18
Area 19
Area 20
Area 21
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Area 25
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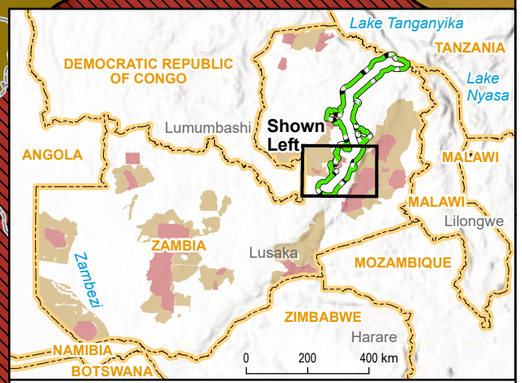


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*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-19**
**Avifauna Flyways and Habitat Sensitivity**
**Mpika - Pensulo Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*
*Feathers Environmental services, 2019*

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UTM 36S, WGS84

**21 juin 2024**

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*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

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*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.*

## 5.3.4 BATS

Bat species within the study area have been described using information collected from a literature review and review of existing data, including known occurrences from the Global Biological Information Facility (GBIF, 2024) and the African Chiroptera Report (ACR, 2018). Field surveys were also conducted within the study area in November 2019. Field survey methodology is described in Appendix 5-2. Survey sheets and photos from the 2019 surveys are available in Appendix 5-8. Location of Bat surveys are illustrated on Map 5-11 to 5-13

Consultations with conservation NGOs, such as Kasanka Trust, have allowed further information on species and migration routes to be gathered.

### 5.3.4.1 BAT SPECIES DIVERSITY

A total of 42 species of bats from 10 families are known to occur in Zambia (GBIF, 2024; ACR, 2018),

A total of 19 bats were captured during the surveys. In addition, one species was not captured but was identified by an echolocation call. These comprised 10 species from 5 families. This information is summarized in Table 5-13.

**Table 5-13 Bat Species Recorded during Field Surveys**

| Family | Species | Common Name | IUCN Status | Habitats where the Species was Recorded | | | Notes |
|---|---|---|---|---|---|---|---|
| | | | | Miombo Woodland | Wetlands | Caves/Rocky Outcrops | |
| Hipposideridae | *Hipposideros caffer* | Sundevall's Leaf-nosed Bat | | x | | x | |
| Macronycteridae | *Macronycteris (Hipposideros) vittatus* | Striped Leaf-nosed Bat | NT | | | x | Echolocation call only |
| Pteropodidae | *Epomophorus crypturus* | Peters's Epauletted Fruit Bat | | x | x | | |
| Pteropodidae | *Epomophorus dobsonii* | Dobson's Epauletted Fruit Bat | | x | x | | |
| Pteropodidae | *Epomophorus labiatus* | Little Epauletted Fruit Bat | | x | x | | |
| Rhinolophidae | *Rhinolophus mossambicus* | Mozambican Horseshoe Bat | | | x | x | |
| Vespertilionidae | *Eptesicus hottentotus* | Long-tailed Serotine | | | | x | |
| Vespertilionidae | *Laephotis botswanae* | Botswana Long-eared Bat | | x | x | | |
| Vespertilionidae | *Neoromicia nana* | Banana Bat | | x | x | | |
| Vespertilionidae | *Pipistrellus group* | (Pipistrelle) | | | | | Could not be identified to species |

IUCN Red-list status: CR: Critically endangered; EN: Endangered; VU: Vulnerable; NT: Near-Threatened.

From the acoustical data compiled from the bat detectors (which only recorded insect bats since most fruit bats – Pteropodidae - do not echolocate), an estimated number of 19 insect bat species were recorded. Other than those already identified through capture of individual bats, only one of these could be identified to species level from the acoustical data, the Striped leaf-nosed Bat. The rest could only be identified to family level. With the addition of the 3 species of fruit bats captured, this resulted in a total number of approximately 22 species recorded during the field surveys. Table 5-14 gives the estimated number of species by family (excluding Pteropodidae).

**Table 5-14 Number of Insect Bat Species Estimated from Acoustical Data**

| Family | Estimated Number of Species |
|---|---|
| *Hipposideridae* | 1 |
| *Macronycteridae* | 1 |
| *Molossidae* | 6 |
| *Rhinolophidae* | 3 |
| *Vespertilionidae* | 8 |
| **Total** | **19** |

The average number of passes (or calls) per hour was calculated for each site as a measure of bat activity. These calls were recorded between 18:00hrs and 22:00. The number of species per site (excluding Pteropodidae) was also estimated. These figures are given in Table 5-15.

**Table 5-15 Comparison of Activity and Species by Site Based on Acoustical Data**

| Survey Site | Average Passes per Hour | No. of Species |
|---|---|---|
| B1 - Kasama Forest Reserve | 3 | 7 |
| B2 - 40km E of Nakonde | 19 | 13 |
| B3 - 50km NW of Mpika | 2 | 4 |
| B4 - Nachikufu Caves | 6 | 8 |
| B5 - Kanona Forest Reserve | 0 | 0 |
| B6 - Lake Lusiwasi | 4 | 3 |

By adding the *Pteropodidae* (Fruit Bat) species captured in nets during the survey to the echolocation calls recorded from other bat families, a total estimated number of bat species per site was calculated, as seen in Table 5-16 and Figure 5-23. The table shows the highest activity and diversity at site B2, followed by site B4.

**Table 5-16 Comparison of Activity and Species by Site Based on Acoustical Data**

| Survey Site | Insect Bat Species Heard | Fruit Bat Species Captured | Total no. of Species Recorded |
|---|---|---|---|
| B1 - Kasama Forest Reserve | 7 | 1 | 8 |
| B2 - 40km E of Nakonde | 13 | 3 | 16 |
| B3 - 50km NW of Mpika | 4 | 1 | 5 |
| B4 - Nachikufu Caves | 8 | 1 | 9 |
| B5 - Kanona Forest Reserve | 0 | 0 | 0 |
| B6 - Lake Lusiwasi | 3 | 0 | 3 |

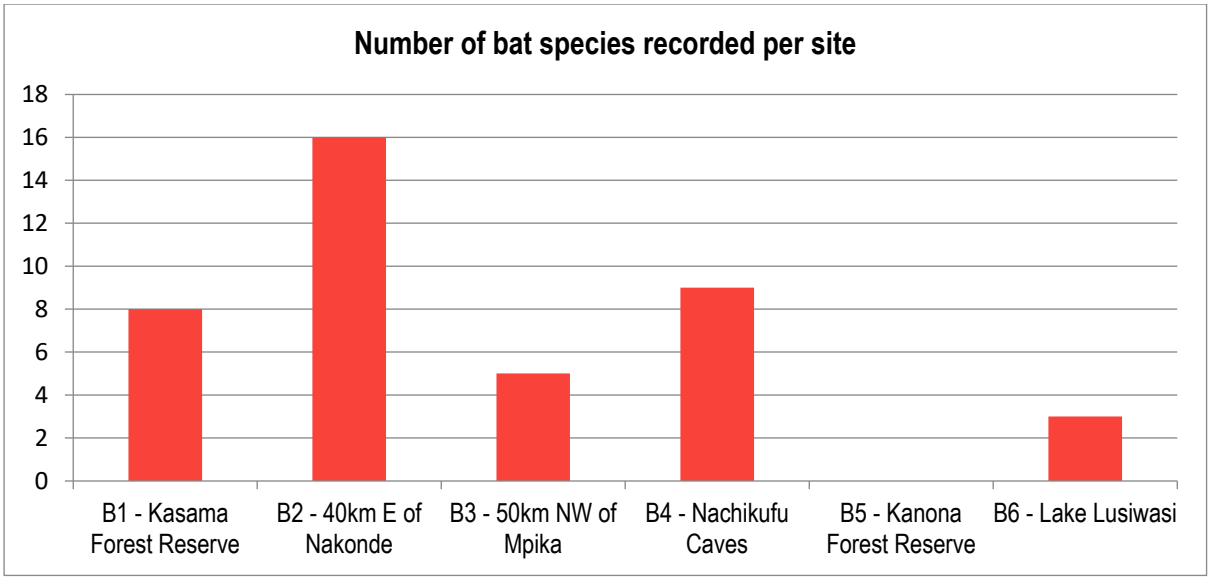



**Figure 5-23 Number of Bat Species Recorded per Site**

These results, like the results from bat captures alone, tend to show a higher diversity of bats in wetlands and rocky areas with caves, and sites with mixed habitats. This is likely due to the high availability of roosting sites as well as the diversity of available food. Bat species diversity was found to be highest in wetland areas during the survey, but caves and rocky outcrops were also identified as important areas for bats during the survey because of the roosting options they provide.

Three of the species recorded during field surveys were not previously known from the study area. These were the Mozambican Horseshoe Bat (*Rhinolophus mossambicus*), Striped Leaf-nosed Bat (*Macronycteris vittatus*) and Long-tailed Serotine (*Eptesicus hottentotus*). The Striped Leaf-nosed Bat is listed by IUCN as Near Threatened.

A total of 12 additional species are potentially present in the BESA, based on GBIF 2024, making a total of 21 bat species. The detailed list of bat species, known to be present in the study area from literature and confirmed through the field surveys, is provided in Appendix 5-9.

The known roost of the African Straw-coloured Fruit Bat at Thorn-Tree Guest House in Kasama was visited. However, the specialist was informed by the co-owner, Hazel Powel, that the bats had first arrived by the thousands in October, two years previously, and had left early the following year. They had arrived again the next year at the same time and left again in January or February. They were thought to have arrived from the southwest and gone foraging each day in the east. However, in 2019, there was no sign of the bats, even though colonies of the same species had arrived at the usual time at known roosts in Kasanka National Park and Ndola. It was not known why they had not turned up. However, the area is still considered a potential roost site for large numbers of this migratory species.

The Mwela Rock Art Site to the east of Kasama was also visited as a likely important bat roosting area. However, only bat droppings and one bat were observed during the daytime visit. The guide reported that sometimes there were many bats and crevices in the small caves. Since the rocky area was vast, it was quite possible that there were more bat roosts in the area. Site B1 was not far from this area, and some cave-roosting bats were captured here.

At site B4, Nachikufu Cave, the caretaker informed the specialist that during the cold months of the year, thousands of bats roost in the caves in the rocky hills (this had also been reported by another acquaintance previously). However, he said he thought that most of the bats had now left. During a day-time survey, only one or two bats were observed in one of the higher caves, not the main cave. However, after dark, individuals of Sundevall's Leaf-nosed Bat (*Hipposideros caffer*) were observed exiting the cave and flying around the entrances of the cave tunnels. Newly born juveniles of the same species were also observed. Most of the adult bats captured were either pregnant or lactating. The colony, which is estimated at over 100 individuals, was therefore determined

to be a maternity colony. It is possible there were still more bats deeper in the tunnels. Another species of cave/crevice-roosting bat (*Eptesicus hottentotus*) was captured near the cave entrance and was not previously known from the study area. The distribution of this species is very sparse and is limited to the availability of rocky outcrops as roosting sites. Meanwhile, echolocation recordings in the cave indicated the possible presence of another cave-dwelling bat (Striped Leaf-nosed Bat, *Macronycteris vittatus*), a Near Threatened species, although it was not observed or captured during the survey, could not be confirmed. It is not known which species is present during the cool months of the year, but it can be concluded that this is an important roosting and breeding site for bats and is less than 3 km from the line route.

#### 5.3.4.2 BAT SPECIES OF CONSERVATION CONCERN

Two bat species known to be present within the study area are classified as Near Threatened on the IUCN Red List: the Striped Leaf-nosed Bat (*Macronycteris vittatus*), indicated by echolocation calls recorded during the bat surveys at Nachikufu Caves, and the African Straw-coloured Fruit Bat (*Eidolon helvum*) (GBIF, 2024).

##### AFRICAN STRAW-COLOURED FRUIT BAT (*EIDOLON HELVUM*) - NT

The African Straw-coloured Fruit Bat is the second-largest bat on mainland Africa and occurs widely across Africa's lowland rainforest and savannah regions (Monadjem *et al*., 2010). It is also present in the extreme southwest Arabian Peninsula (Cooper-Bohannon *et al*., 2020). The species has been recorded from various habitats through moist and dry savannah woodland mosaics, including tropical rainforests, coastal forests, and riverine forests. It also exists in modified landscapes and is often recorded in urban areas (Cooper-Bohannon *et al*., 2020). Colonies are rarely found in protected areas or forests but frequently near human habitations, especially gardens, probably because fruit trees are nearby (Webala *et al*. 2014). In central Africa, the species has been recorded using Zambezian Miombo woodlands, forest-savannah mosaics, lowland forests, and riverine forests (Richter & Cumming, 2008).

This common species forms large colonies of thousands to even millions of individuals. Within colonies, they form tight clusters of up to 100 animals. During migration, this species disperses into small groups (Cooper-Bohannon *et al*., 2020). Its well-known daily migration in Kasanka National Park is described in detail in the next section. It primarily feeds on fruit (wild and cultivated) and flowers (Monadjem *et al*. 2016). In southern Africa, its seasonal appearances and disappearances likely reflect the responses of these bats to changing food supplies (Richter and Cumming, 2008). The role of frugivorous bats is crucial in ecosystems as these species perform key functions as pollinators and seed dispersers. This species has been shown to retain ingested seeds for long periods and to travel large distances, making it an important seed disperser in tropical Africa (Abedi-Lartey *et al*. 2016).

The species is locally threatened in parts of its range by severe deforestation, and more generally across Western and Central Africa by hunting for food and medicinal use (Cooper-Bohannon *et al*., 2020). Large pre-migration colonies are considered particularly vulnerable to threats.

In some areas, it is considered a pest species and roosting locations may be restricted by cutting down trees (P. Racey *pers comm.* [in Mickleburgh *et al.* 2008b]). The species is also persecuted because it often damages fruit plantations (Webala *et al*. 2014).

As tree density is an important factor in roost-site selection (Webala *et al*. 2014), the removal of roost trees could impact this species, especially outside protected areas. In Western and Central Africa, there is evidence of a widespread decline due to harvesting for bushmeat. It is the most heavily harvested bat for bushmeat in these regions, and this is believed to be a major factor in reported population declines (P. Racey pers. comm. in Cooper-Bohannon *et al*., 2020).

There are known seasonal colonies of the African Straw-coloured Fruit Bat in Kasanka National Park, Kasama and Shiwa Ng'andu, all within or near the study area (See Maps 5-14 to 5-16).

The species was not recorded during the field surveys and the known colony in Kasama was not present at the time.

### STRIPED LEAF-NOSED BAT (*MACRONYCTERIS VITTATUS*) - NT

The Striped Leaf-nosed Bat (*Macronycteris vittatus*) is sparsely but widely distributed in southern, eastern and central Africa. It depends entirely on large caves for breeding, where large colonies numbering hundreds of thousands of individuals may aggregate (Monadjem *et al*., 2010). In eastern and southern Africa, it seems to be largely associated with savanna woodland habitats (Skinner and Chimimba 2005). The species can occur locally in very large numbers where suitable cave habitats are available. However, animals have been recorded (presumably in considerably smaller numbers) roosting in tree canopies, hollow trees, and dense vegetation as well as under the eaves of buildings (Skinner and Chimimba 2005).

The species is listed as Near Threatened by IUCN because, although it is still widely distributed, a large proportion of its global population is found in a few very large cave roosting colonies that are threatened by disturbance, habitat loss, and overhunting (Mickleburgh et al., 2008).

During the field surveys, this species was indicated to be present at Nachikufu Cave from echolocation calls recorded using a bat detector. However, no individuals were observed.

## 5.3.4.3 BAT MIGRATIONS

Bat migration pathways have not been well studied in Zambia. However, African Straw-coloured Fruit Bats that roost in large numbers (5-10 million) in Kasanka National Park, approximately 50 km from the transmission line, are known to migrate seasonally from there to the Democratic Republic of Congo as well as to Tanzania and Malawi. This is known as one of the largest wildlife migrations in Africa.

Richter and Cumming (2006) reported that the bats arrived at Kasanka between October 18 and 21 and departed between December 23 and January 9 each year. They come in search of fruit. Richter and Cumming (2006) identified the following tree species (with local or English names in brackets) as food sources for these bats: Ficus spp (Mukunyu), Magnistipula butayeii (Imipande), Mangifera indica (Mango), Musa spp (Banana), Parinari curatellifolia (Mupundu), Syzygium cordatum (Mufinsa), Syzygium guineense (Insafwa), Syzygium guineense huillense (Mufinsa), Uapaca kirkiana (Masuku), Uapaca banguelensis (Makonko) and Uapaca sansibarica (Swebya). Most of these species, other than the exotic mango and banana, occur widely in Miombo woodlands.

The arrival of the colony at Kasanka coincides with a marked increase in the number of fruiting Syzygium and Uapaca species; these trees accounted for more than 80% of all fruit-bearing trees at that time (Richter & Cumming, 2006). Each bat will feast on approximately 5 lbs of fruit nightly. The bats have been recorded travelling up to 59 km from the roost in Kasanka to forage at night.

This means at least some of the bats will travel within parts of the study area daily to feed (Richter & Cumming, 2008). Foraging is done at night, between dusk and dawn.

When migrating, the African Straw-coloured Fruit Bat has been recorded travelling an average distance of 90 km per night but may reach up to 370 km per night. Over a three-month period, bats were found to migrate up to 2,500 km (Richter and Cumming, 2008).

The large colony at Kasanka is thought to be an aggregation of multiple smaller colonies (Richter and Cumming, 2008). Evidence shows that some of the bats at Kasanka also migrate from Tanzania and Malawi (O'Mara pers. comm., 2019). These migrations would cross the study area.

There are two other known seasonal roosts of the African Straw-coloured Fruit Bat that are located within or very close to the study area. These are in Kasama at Thorn Tree Guest House and at Shiwa Ng'andu near Lake Ishiba N'gandu (Taylor-Boyd pers. comm., 2019). The migration routes for these two roosts have not yet been studied, but it is very likely that at least some of these bats migrate annually through the study area and forage within the study area. The roost site at Kasama was visited during the survey. It was reported that the colony of several thousand African Straw-coloured Fruit Bats had first settled at the guest house 2 years previously and had stayed from approximately October to February the last two years. However, by early November 2019, the colony had still not come, and it was not known why. Other known roosts in Zambia are at Mbala and Ndola.

#### 5.3.4.4 AREAS OF HIGH ECOLOGICAL IMPORTANCE FOR BATS

##### ZAMBEZIAN ESCARPMENT

Birdwatch Zambia identified the importance of the Zambezian Escarpment, particularly in front of Serenje, as an important area for bats. They undertake migrations moving north, passing through Kasanka National Park and going to Mbala and Nieka.

##### RIPARIAN HABITATS

Riparian habitats are within the study area known to support some fruit tree species, such as *Syzygium cordatum,* which has been identified as an important food source for some fruit-eating bats (Richter & Cumming, 2006), and the large, leafy trees occurring in riparian habitats provide important roosting sites for many bat species.

##### CAVES

Caves provide important roosting sites for several bat species. There is at least one cave complex within the site. Nachikufu Caves, approximately 55 km southwest of Mpika, is known to house many bats of various species that are likely to be foraging within the study area.

During the field survey, approximately 100 individuals of Sundevall's Leaf-nosed Bat (*Hipposideros caffer*) were found to be present and breeding in the main cave at Nachikufu Caves. An individual Long-tailed Serotine (*Eptesicus hottentotus*) was also recorded and was likely present in smaller numbers. Meanwhile, the Striped Leaf-nosed Bat (*Macronycteris vittatus*), which is classified by IUCN as Near Threatened, was identified from echolocation calls at the same cave. Striped Leaf-nosed bats tend to roost in large numbers in big caves. The caretaker reported that thousands of bats occupy the cave in the cold, dry months of the year. The smaller caves and crevices in the rocky hills in the area likely provide roosts for many more bats of various species. The area was, therefore, identified as a major bat roost. Another area of importance identified was the Mwela Rock Art Site, east of Kasama. This site comprises rocky outcrops and small hills covering a large area. Evidence of small numbers of roosting bats was identified in certain small caves, and certain cave-roosting bats were recorded in nearby areas.

##### PROTECTED AREAS

Protected areas such as national parks, forest reserves, and private reserves tend to have higher levels of biodiversity than other areas due to the level of protection they receive. Many protected areas were chosen because of some important ecological aspects of the area. These areas should continue to be protected from disturbance as much as possible. IBA, though not receiving the same level of attention, have also been identified as important ecological areas, often not only for birds, but for other wildlife as well. Some privately protected areas in or close to the study area should also be considered as possibly having higher biodiversity levels, such as Kapishya Hot Springs and Mutiondo Wilderness.

### *5.3.5 TERRESTRIAL MAMMALS*

Terrestrial mammal species within the study area have been described using information from a review of available literature and other known sources of existing data, including known occurrences from Ansell (1978), Kingdon *et al.* (2013a; 2013b) and the Global Biological Information Facility (GBIF, 2024). Rapid surveys of large mammals were also conducted in November 2019 by consulting eleven key informants in the areas along the powerline. The full methodology is in Appendix 5-2. Signed data collection meeting forms are contained in Appendix 5-10.

## MAMMALS SPECIES DIVERSITY

Generally, all key informants interviewed confirmed that large mammals were more abundant in the Project area in the past than in the present day. Due to the illegal harvesting of large mammals and very limited support for resource protection, the study is mainly dominated by communities of small and medium-sized mammals (Nyangu & Zgozi, pers. comm. 2019). Consultations, available literature and data bases provided a list of the historic and present-day occurrences of large mammals in the Project area (Appendix 5-11), excluding bats, which are discussed separately in the previous section. This suggest that up to 38 species of terrestrial mammals from 16 families may be found in the BESA, although 11 of these are considered a historical distribution and may no longer exist in the Project area, and 10 are considered rare. Species are mainly associated with the Bovidae family, comprising 17 species. The differences in the occurrences of large mammals between historical and present-day were mainly attributed to human influence (100% of respondents indicated this), including encroachment into wildlife habitats for human settlements, agriculture, illegal harvesting of wildlife, fuel wood (charcoal), and, more recently, mining.

Sightings of large mammals in the study area were described as very rare by almost all respondents, with some areas only seeing spoor and scat left by the animals. In areas around Kanona Forest Reserve, primates (e.g., monkeys and baboons) that were once considered a nuisance by farmers are no longer present (Mupeta, pers. comm. 2019). Forestry officers in Serenje accounted for only the bush hare as being the largest mammal sighting in the Kanona area (Kangwa pers. Comm, 2019).

In areas north of Kanona (i.e., Chandesi, Kalonje, Chilonga, Mpika, Kanchibiya, and Chambeshi), hippos, monkeys and baboons were the most frequently sighted animals. Areas where hippos have been reported are illustrated in Maps 5-20 to 5-22. Occasionally, buffalos were sighted, and carnivores (i.e., lions and jackals) encountered are problem animals for livestock. Records of human-wildlife conflicts from DNPW validated the presence of large mammals in these areas.

### 5.3.5.1 MAMMAL SPECIES OF CONSERVATION CONCERN

Among the terrestrial mammals potentially present in the BESA, two are considered endangered and six are considered either Vulnerable or Near Threatened by the IUCN.

The African Savanna Elephants are considered Endangered by the IUCN. It has been described as using the northern section of the study area (Mungwi, via Senga area) during the dry season period. They are migrating in response to human influences in areas where humans heavily settle. Their movements are from Nsumbu National Park and the protected area adjacent to Kalambo falls in Tanzania via Mukalizi area in Nakonde and back. Occasionally, they will come down to Mungwi in Chief Makasa's area [Zulu, Mucleta & Mambwe, pers. Comm, 2019]. Furthermore, according to the DNPW (pers. Comm, 2024). elephants have recently been moving from Kasanka NP passing through Kanona Forest Reserve. These occurence areas are illustrated in Maps 5-20 to 5-22.

The White-bellied Pangolin is also considered Endangered according to the IUCN. In northwestern and central Zambia and southern DRC, this species occurs in dense Miombo (Brachystegia-Julbernardia) woodland, as well as in forest fragments and riparian forests. White-bellied Pangolins are predominantly nocturnal and equally at home in trees and on the ground (Piertersen et *al.*, 2019). The species feeds exclusively on ants and termites. According to Piertersen et *al*. (2019), there are also confirmed records from northwestern Zambia (near Solwezi) and central Zambia (Serenje) close to the DRC border from 2016–2018. According to the DNPW (pers. Comm, 2024) the species is present within the Mungwi area. These are captured for trade

Lions, Hippos, Leopards and Temminck's Pangolins are considered Vulnerable by the IUCN.

The sighting of lions was consistent amongst the key informants north of Kanona. Further, their presence was corroborated by human wildlife conflict reports received and recorded by DNPW. Recent sightings (September 2019) of lions were recorded in the Kalonje area along the Tazara corridor, where they reportedly attacked livestock. Other areas include Chilonga and Chief Chikwanda area in Mpika. Lions are thought to be using these areas as migratory routes from North Luangwa's protected area network via Bwingi Mfumu Forest Reserve and into Mpika, then back to Mukungule GMA and from Munyamadzi GMA via Mutinondo Wilderness to Kalonje and back. Occurrence areas and potential migration routes are illustrated in Maps 5-20 to 5-22. These accounts of lions in the Project area are further corroborated by recent scientific evidence that describes lions as 'sneaky', as they are moving across areas that were previously thought to be inhabitable for them (Curry, 2019).

Almost all the key informants interviewed indicated the presence of hippos in the Project area. In the Kanona area, these sightings were further east of the Project area, in Chitambo. Others were described as occurring in the rivers at Kalonje, Chilonga, Mpika, Kachimbaya, and Chandeshi flowing through the Project area. Occurrence areas are illustrated in Maps 5-20 to 5-22.

Very few respondents described leopards as occurring in the Project area. Only in Nakonde at the DNPW offices did we encounter a leopard skin confiscated from a poacher. The leopard skin was described as having originated from the Mukalizi area, west of Nakonde. Despite this, leopards were earlier described as being widespread by DNPW (Zgozi and Nyangu pers. Comm, 2019). Leopards will most likely inhabit areas along the riparian forests and in forested areas where baboons and monkeys are found, as this may be their preferred food source. No records of human wildlife conflicts involving leopards were disclosed during the interviews/consultation meetings.

Temminck's Pangolin is the most widespread African pangolin species. According to the DNPW (pers. Comm, 2024), the species is present within the Mungwi area. These are captured for trade.

Puku, Plains Zebra and African Clawless Otter are considered or Near Threatened by the IUCN.

Puku are obligate grazers, occupying grasslands near permanent water within the savannah woodlands and floodplains of south-central Africa. Although associated with wet areas and swamp vegetation, Puku avoids deep-standing water and is ecologically distinct from Lechwe (IUCN SSC Antelope Specialist Group, 2016). In the study area, puku may be encountered in the grasslands and dambos along the Lukulu and Lwitikila rivers and around the Luchembe area (Mwansa pers. Comm, 2019). Their populations are extremely low, given the high levels of encroachment in their habitats.

Plains Zebras tend to be found in mid-productive grasslands in areas where there is the highest green standing crop, selecting areas of the highest grass biomass regardless of quality. Across studies, Plains Zebras were found in open savanna with an abundance of grass and the presence of some trees or open woodland. There are between 8,000 and 16,000 Plains Zebra in Zambia, with populations declining in most protected areas (King and Moehlman, 2016).

African Clawless Otters are predominantly aquatic and seldom found far from water. Freshwater is an essential habitat requirement, and it only occurs in marine habitats where there is access to fresh water (Jacques and al., 2021).

Although classified as Least Concern in the IUCN Red-List, the Roan Antelope (*Hippotragus equinus*)is considered Threatened according to an assessment of critical mammals provided in the Fifth National report of Zambia for the Convention on Biological Diversity. The Roan Antelope usually inhabits savannah woodlands and grasslands, where the cover of high grasses and woody plants plays an important role in both grazing and calving. It is a water-dependent grazer and browser (IUCN SSC Antelope Specialist Group, 2017).

#### 5.3.5.2 LARGE MAMMAL MIGRATION PATHWAYS

Despite declining numbers of large game in the study area, large mammals are thought to be making seasonal migrations between the two protected area networks, namely Luangwa and Bangweulu (Curry, 2019; World Bank, 2009). Their numbers are considered extremely low and are often encountered as problem animals in human wildlife conflicts.

According to consultations with Peter S. Indala and Rhoda N. Kachali from DNPW (Mpika office), there are two large distinct ecosystems around the Project area: the Bangweulu swamps ecosystem and the Luangwa valley ecosystem. Both ecosystems see large wildlife migrations within their respective boundaries. There are also records of animal migration between those two large ecosystems, mainly coming from the Luangwa Valley to Bangweulu swamps during dry periods and back to the Luangwa Valley during the wet season. These migrations do not occur yearly as they depend on the quality of grazing resources and the presence of water in the Bangweulu swamps, even in dryer periods. Main migrants include elephants, lions, and buffalos (Kandanga, Zulu & Maimde, pers. Comm. 2019). However, the fragmentation of the area has led to a significant decrease in animal movement.

According to our sources, Lavushi Manda National Park was created notably to improve ecological connectivity. The park's current species diversity and abundance are not exceptionally high, but its habitats have been in a transitional rehabilitation phase since its classification as a national park.

Species described as using the Project area as part of their migration routes include lions, hippos, and elephants. Migration for lions mainly occurs in the dry season and is thought to be in response to the scarcity of habitat resources (i.e., water) in the Luangwa protected area network (Mwansa pers. Comm, 2019; Makombe pers. Comm, 2019; Mwimba pers. Comms, 2019; Zulu, Mucleta & Mambwe pers. Comm, 2019). Lions will move from North Luangwa National Park to Mukungule via Bwingi Mfumu Forest reserve to Mpika and back. They will also move from the North and South Luangwa protected area complex via Munyamadzi GMA to Kalonge. These routes are corroborated by the human wildlife conflict reports recorded in these areas and are schematized in Maps 5-20 to 5-22. The most recent report was at Chilonga, north of Kalonje, in September 2019.

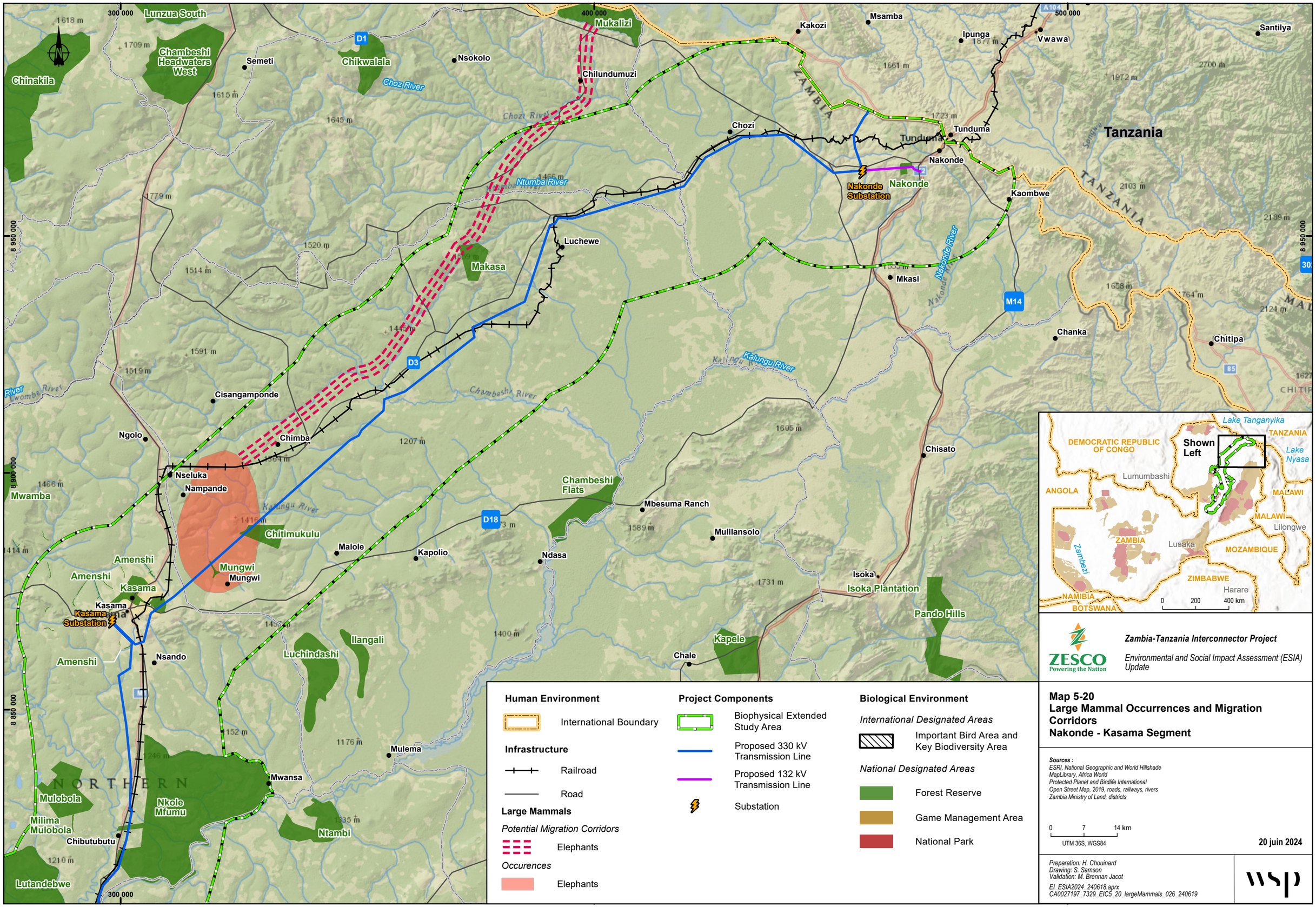
Elephants using the Project area as part of their migration routes occur in the northern section of the Project area, i.e., between Mukalizi and Mungwi. They are thought to be moving from Nsumbu National Park and the protected area in Tanzania that lies adjacent to Kalambo falls via Mukalizi area in Nakonde en route to Mungwi, as schematized in Maps 5-20 to 5-22. Furthermore, as mentioned above, according to the DNPW (pers. Comm, 2024). elephants have recently been moving from Kasanka NP passing through Kanona Forest Reserve. Elephants are thought to be migrating in response to human influence in areas where humans are heavily settled.

Hippos can be found along the tributaries of major rivers in the Project area. Areas where they were mentioned to be present are highlighted in Maps 5-20 to 5-22. These are thought to have daily and monthly migration routes in search of food and water. In areas that are heavily settled, i.e., Kanona, they are extremely rare.

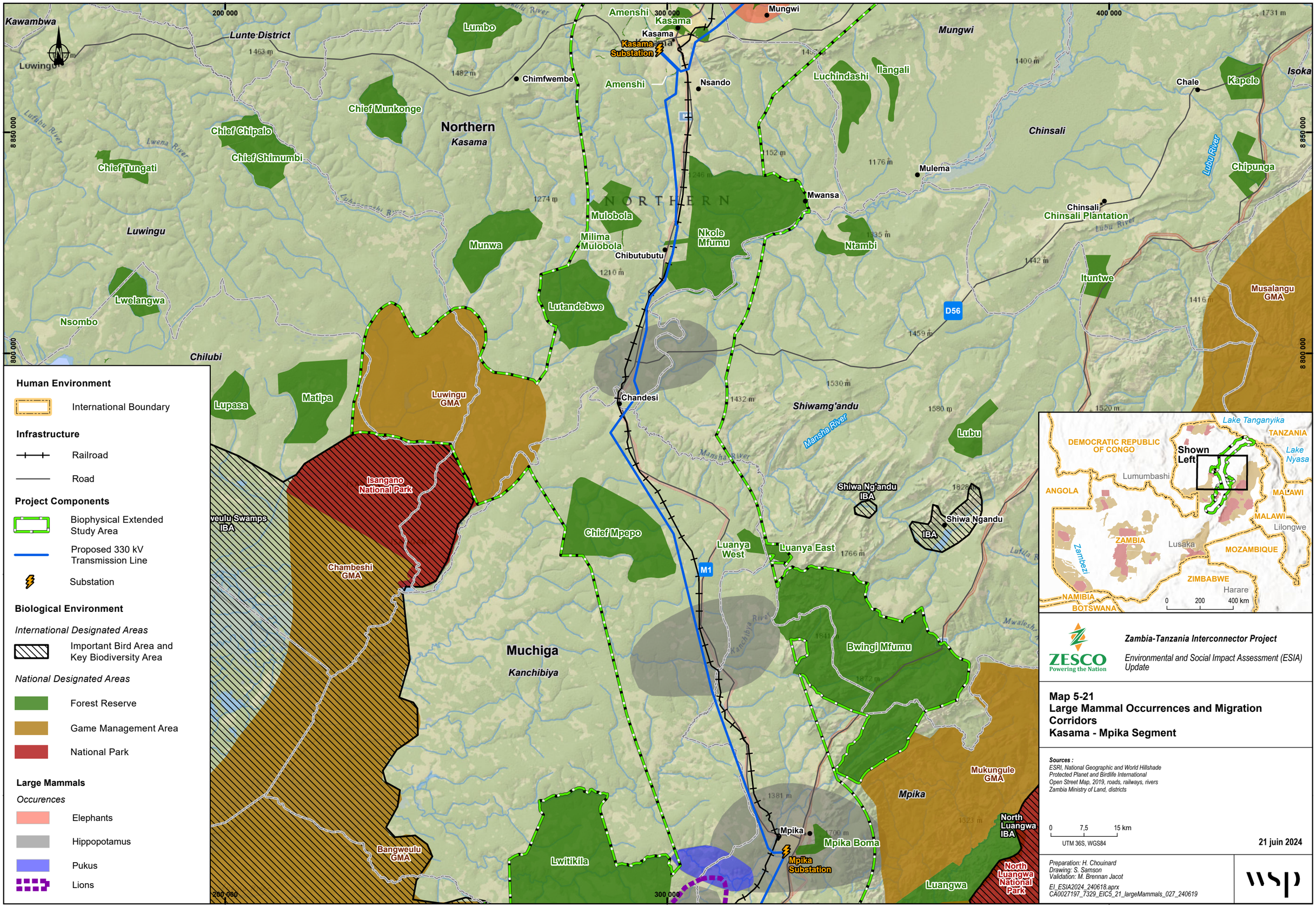
Lechwes (*Kobus leche*) inhabit margins between swamps and shallow floodplains. Lechwes have been reported to aggregate in large numbers (approximately 40,000) in a 100 $km^2$ area in the floodplain around Lake Bangweulu during the wet season.

During the dry season, this large aggregation dissolves as small groups disperse into permanent wetlands.

Thus, this aggregation cannot be considered a mass migration with clearly defined migratory routes, such as the wildebeest or zebra migrations (Harris *et al*. 2009). According to the pattern described above, large lechwe aggregations do not occur in the extended study area. Smaller dispersed groups may use parts of the extended study area in the dry season.




*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.*

**Human Environment**

International Boundary

**Infrastructure**

Railroad

Road

**Project Components**

Biophysical Extended Study Area

Proposed 330 kV Transmission Line

Substation

**Biological Environment**

*International Designated Areas*

Important Bird Area and Key Biodiversity Area

*National Designated Areas*

Forest Reserve

Game Management Area

National Park

**Large Mammals**

*Occurences*

Hippopotamus

Pukus

*Potential Migration Corridors*

Elephants

Lions

Kanchibiya

Lwitikila

Luchembe

Mpika

Mpika Boma

Mpika Substation

Mukungule GMA

North Luangwa National Park

North Luangwa IBA

Chilonga

Mpika

LUWESA

Bangweulu GMA

Bangweulu Swamps IBA

Lavushi Manda National Park

Lavushi Manda IBA

Kafinda GMA

Mulembo

Kalonje

Luangwa

Munyamadzi GMA

Mutinondo Wilderness IBA

D235

Kasanka National Park

Kasanka IBA

Lavushimanda

Zambia

Musola

Musola River

Lukulu River

Chitambo

T2

Lake Lusiwasi

Serenje

Musangashi

Pensulo Substation

Kanona

Mailo

South Luangwa National Park

South Luangwa IBA

Munte

Serenje

Luombwa

Lake Tanganyika

TANZANIA

DEMOCRATIC REPUBLIC OF CONGO

Lake Nyasa

Lumumbashi

Shown Left

ANGOLA

MALAWI

Lilongwe

ZAMBIA

Lusaka

MOZAMBIQUE

Zambezi

ZIMBABWE

Harare

NAMIBIA

BOTSWANA

0 200 400 km

ZESCO Powering the Nation

***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-22**
**Large Mammal Occurrences and Migration Corridors**
**Mpika - Pensulo Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

0 6 12 km

UTM 36S, WGS84

**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: S. Samson*
*Validation: M. Brennan Jacot*

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*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.*

#### 5.3.5.3 AREAS OF HIGH ECOLOGICAL IMPORTANCE FOR TERRESTRIAL MAMMALS

Based on interviews with DPNW (Kandanga, Zulu & Maimde, pers. Comm., 2019; Mwansa pers. Comm., 2019; Makombe, 2019; Zgozi per coms., 2019; Zulu, Mucleta & Mambwe pers. Comm., 2019), accounts from local communities (World Bank 2009) and recent scientific research (Curry, 2019), large mammals occur in extremely low densities and are described as using a combination of habitats including grasslands, Miombo woodlands and riparian forests. These habitats may be considered as having a stepping-stone effect, particularly for migratory species, i.e., lions that are now described as 'sneaky' as they are moving across areas that were previously thought to be inhabitable for them (Curry, 2019). Given the dependency of predators on prey, it may be reasonable to also expect the presence of other large herbivores, such as buffalo and waterbuck (Mwansa pers. Comm., 2019; Zyozi & Ngangu, pers. Comm., 2019), albeit in very low numbers. However, the presence of large carnivores, i.e., lions, particularly those accounted by DNPW (Mwansa pers. Comm., 2019; Makombe pers. Comm., 2019), is mainly associated with livestock predation.

### *5.3.6 HERPETOFAUNA*

#### 5.3.6.1 METHODOLOGY

Reptile and amphibian species within the study area have been described using information collected from a review of existing data and litterature, including known occurrences from the Global Biological Information Facility between 2004 and 2024 (GBIF, 2024).

#### 5.3.6.2 HERPETOFAUNA SPECIES DIVERSITY

According to the GBIF, a total of 26 reptile species from 12 families may be present within the study area. The *Scincidae* family is the most represented, with six species. A total of 20 species of amphibian may occur within the study area. Of course, aquatic habitats, including rivers and permanent or seasonal wetlands, are of great importance for their life cycle. The detailed list of species is provided in Appendix 5-12.

#### 5.3.6.3 HERPETOFAUNA SPECIES OF CONSERVATION CONCERN

According to the IUCN RedList, none of the species potentially present in the BESA is considered threatened. *Zygaspis kafuensis* is endemic to Zambia but is presumed to be widespread and abundant.

### *5.3.7 FISH*

#### 5.3.7.1 METHODOLOGY

Fish species within the study area have been described using information collected from a literature review and review of existing data, including known occurrences from the Global Biological Information Facility between 2004 and 2024 (GBIF, 2024).

#### 5.3.7.2 FISH SPECIES DIVERSITY

The tropical and sub-tropical regions of southern Africa have higher diversity and lower endemicity than the temperate zone. Therefore, several families and genera can be investigated to infer drainage history, mainly associated with the Congo and Zambezian ichthyofaunas (Darwall, 2009). Zambia hosts 440 species of freshwater fish (Fishbase, 2024).

A total of 89 species of fish from 14 families are likely to be present within the study area. Cyprinidae is the most abundant family, with 28 species, followed by the Mormyridae, which has 11 species. The detailed list of species is provided in Appendix 5-13.

#### 5.3.7.3 FISH SPECIES OF CONSERVATION CONCERN

Among the species potentially present inside the study area, only *Chiloglanis elisabethianus* is considered Vulnerable by the IUCN red list. *Chiloglanis elisabethianus* is a benthopelagic species. It is oviparous and has a distinct pairing during breeding. It is known from the outer range of the upper Congo River basin so that the BESA would be at the limit of its range (Moelants, 2010).

### 5.3.8 CRITICAL HABITAT ASSESSMENT

WB ESS6 and IFC PS6 require critical habitat identification 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. The biodiversity value of an area, as determined by species, ecosystems, and ecological processes, is referred to as a modified, natural, or critical habitat.

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 be demonstrated that a Project does not lead to measurable adverse impacts on the biodiversity values for which the critical habitat was designated and on the ecological processes supporting those biodiversity values. The Project's mitigation strategy must be designed to achieve net gains of those biodiversity values. The detailed CHA is presented in Appendix 5-14.

Of the 16 species and ecosystems assessed in detail, 4 flora species trigger critical habitat. Habitats supporting species with critical habitat in the EAAA are:

- Miombo woodland within Mutinondo Wilderness Area and Bwingi Mfumu Forest Reserve for *Encephalartos schmitzii* (Unlikely presence in the LSA, which is west of the escarpment).
- Natural undisturbed wet grasslands and dambos within the BESA for *Disa aequiloba*.
- Rock outcrop in the Kasama Forest reserve for *Euphorbia perplexa var kasamasa*.
- Thin soils and rock crevices on Muchinga Escarpment in Serenje for *Gladiolus serenjensis* (Unlikely presence in the LSA, which is west of the escarpment).

### 5.3.9 ECOSYSTEM SERVICES

Human communities are an integral part of ecosystems and benefit from many goods and services those ecosystems provide. These benefits are recognized as Ecosystem Services (ES). The definition of this concept comes from the Millenium Ecosystem Assessment (MEA) evaluation report, which states that such services are the benefits people obtain from ecosystems (AfDB, 2013; IFC, 2019; MEA, 2005; WBG, 2017). Expanding on this definition, ES are ecosystems' direct and indirect contributions to human well-being.

ES are grouped into four categories:

- Provisioning services: which refer directly to products people obtain from ecosystems (e.g., agricultural products, plants to eat, game, 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, protection from natural hazards, 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 divided into two types according to IFC's Performance Standard 6 (2019):

- Type I: Those services on which Project operations are most likely to have an impact and, therefore, which result in adverse impacts to affected communities.
- Type II: Those services on which the Project directly depends for its operations.

Ecosystem services provided by habitats located within the LSA have been identified and assessed based on the results from biological surveys and community surveys. Priority ecosystem services (PES) were identified following the methodology presented in Appendix 5-1. Description of each ES, along with a categorization of the level of dependence, interactions, and replaceability, are presented in Table 5-16.

Based on the ES analysis, the identified PES are as follows:

- Agricultural potential and production;
- Wild food products; and
- Recreation and tourism.

**Table 5-17 Description of ES Provided in the LSA and their Prioritization**

| Ecosystem Service | Definition and description of ES within the Project LSA | Level of dependence on ES | Interaction of ES with drivers of change | Replaceability of ES | Identification of PES |
|---|---|---|---|---|---|
| **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.<br>Agriculture is the most widespread livelihood and economic activity in affected communities (see section 5.4.4). In rural areas, 90.5% of households grow crops and/or raise livestock. Crops cultivated include maize, cassava, millet, rice and sorghum. Agricultural land is also widespread, covering 633.69 ha (23% of the total 2773 hectares ROW). As such, local communities depend highly on ecosystems' agricultural potential and production, both for revenues and food.<br>It is expected that Project activities disrupt agricultural land. Some agricultural areas will be permanently lost at the location of the pylons. Interactions with drivers of change should be limited to the construction phase, as crops will be allowed within the ROW during the operation phase. Further damages could arise during maintenance activities but should be of a limited extent. As for replaceability, there were some concerns in affected communities about the lack of replacement land for agricultural activities, mainly in the southern part of the study area (Central Province). However, as agriculture is a widespread land use in the LSA, replaceability is deemed medium. | High | Medium | Medium | PES |
| Livestock and forage resources | Forage resources, water and others supporting livestock and animals owned for domestic or commercial consumption.<br>According to community surveys, many households own livestock, though in small numbers. The main livestock species are goats, pigs, chickens, sheep, and cattle, which are used for food and revenue by households.<br>Aside from these areas, interactions should be limited. Fallow lands and degraded woodland are usually used as pasture areas. Replaceability is high as fallow land and degraded woodland land uses represent over 45% of land uses in the ROW and neighbouring areas. | Medium | Low | High | Not a PES |
| Fishing and fishery resource | Fishing stock caught or harvested for consumption or commercial purposes in marine and coastal ecosystems.<br>In communities along the ROW, fishing is a key economic activity. Northern Province is dependent on fishing for livelihood. However, none of these communities are located within the ROW thus Project activities will not directly impact them. There could be an indirect impact on fisheries during work near water bodies due to water contamination or fish disruption. Replaceability is medium as there are lots of water bodies in the BESA, though some communities may have limited capacities to move to new fishing locations. | Medium | Medium | Medium | Not a PES |

| Ecosystem Service | Definition and description of ES within the Project LSA | Level of dependence on ES | Interaction of ES with drivers of change | Replaceability of ES | Identification of PES |
|---|---|---|---|---|---|
| Hunting and bush meat | Animal species trapped or hunted for consumption, including insects, mammals, birds, amphibians and reptiles.<br>Hunting and bush meat were reported in some areas within the ROW, namely in Kafinda GMA and Luwingu GMA. Dependence on hunting and bush meat remains low. Project activities may affect hunting areas, mainly due to restricted access and disruption of game. However, nothing indicates that the ROW provides a unique habitat for the game. Thus, it is expected that replaceability is high. | Low | Medium | High | Not a PES |
| Wild food products | Products collected in the wild for food other than animal proteins (vegetal products, mushrooms, or honey).<br>Miombo woodlands are important sources of livelihood for local communities, providing, in some cases, many edible mushrooms, edible insects, beekeeping opportunities, wild fruits, and wild vegetables.<br>A variety of wild food products are used within the ROW and in the LSA. Few flora species recorded during flora surveys (see Table 5-10) are known to be used as wild food products.<br>During the operation phase, trees over 2 m won't be allowed in the ROW, meaning that some wild food product areas will be lost permanently. Replaceability is expected to be medium as wild food products are numerous and are expected to be easily accessible elsewhere in the LSA. | High | Medium | Medium | PES |
| Traditional medicine | Mineral, plants, or animals are used in order to maintain people's health as well as to prevent, diagnose, treat, or care for physical and mental diseases.<br>A variety of medicinal plants are used within the ROW and in the LSA. Flora species used for their medicinal virtues are many. With communities having limited access to healthcare facilities, medicinal species can be of great importance. It is expected that replacement supply areas will be readily available within the LSA, and modern medicine could also play a role in its replaceability. | Medium | Medium | High | Not a PES |
| Biofuel | Animal or vegetal products are used as energy sources.<br>A total of 26 flora species recorded during flora surveys (see Table 5-10) are known to be used as biofuel. Wood can be sourced in various habitat types, both modified and natural ones. Loss of biofuel resources and supply areas was not mentioned as a concern during community surveys. As such, level of dependence is estimated to be low. Interaction with drivers of change will mostly be due to loss of trees and disruption of supply areas during construction work. As woody species will be regularly cut during ROW maintenance, loss of trees will be permanent. Replaceability is deemed high, as other supply areas can be found in the LSA. | Low | Medium | High | Not a PES |
| Water resources | Groundwater and surface water used as tap water for domestic, commercial, or agricultural purposes comprise all the natural processes that regulate its quality or quantity.<br>Water resources are quite widespread in the LSA, with many rivers and streams draining the territory. The northern part of the Project line route is in the Chambeshi – Luapula Watershed, with the Chambeshi and its tributaries being the main river in this area. After Mpika, however, the Project line route advances approximately on the split line between the two watersheds. Kafue and Luangwa Rivers are the main tributaries of the Zambezi River Basin.<br>Communities depend heavily on water resources, but the LSA is highly replaceable due to the number of rivers. Interactions with drivers of change are expected to be limited to contamination risks during construction activities near waterbodies and watercourses. | High | Medium | High | Not a PES |

| Ecosystem Service | Definition and description of ES within the Project LSA | Level of dependence on ES | Interaction of ES with drivers of change | Replaceability of ES | Identification of PES |
|---|---|---|---|---|---|
| **Regulating Services** | | | | | |
| Air quality control | Ecosystems influence the exchange of gases or the filtration of physical or chemical particles in the air (e.g., dust, $O_2$, $CO_2$).<br>In accordance with the World Health Organization's guidelines (2021), the air quality in Zambia is considered moderately unsafe (European Commission and UNEP GRID-Geneva, 2024). Air quality is thus somewhat degraded in the LSA. Trees and forest ecosystems help with air quality control by exchanging gases and providing filtration of particles. Project-related activities could increase air avert locally during a limited amount of time and lead to the removal of trees, reducing the ecosystem's air quality regulating capacity. However, trees are widespread in the LSA, thus replaceability is deemed high. | Medium | Medium | High | Not a PES |
| Climate regulation | Global: Ecosystems influence the absorption or emission of greenhouse gases and in the regulation of air masses.<br>Regional and local: Ecosystems influence on regional and local temperatures, rainfalls or on other climatic parameters.<br>The miombo woodland is the main habitat type within the ROW, which is expected to be representative of the LSA.<br>Degradation of habitats and riverbeds may lead to increased climate change-related risks. As mentioned in section 5.2.2., climate risks in the LSA include drought, extreme temperature and flash flooding, both of which could be enhanced by degraded habitats and altered watercourses. However, Project activities are not expected to significantly change land cover and habitat and riverbeds' degradation. As such, interactions are expected to be limited. | Medium | Low | Medium | Not a PES |
| Water regulation and erosion control | Ecosystems influence on the amplitude and period of water flow, water storage, aquifer filling and flood prevention as well as their ability to prevent erosion.<br>Vegetation, especially forested habitats, plays a significant role in soil erosion control. Their role is increased in areas with strong slopes. Riverine forests also play an important role in the control of erosion from water action. Flooding and droughts are known climate risks in the LSA. These were not mentioned as key issues during consultation activities, leading to a medium level of dependence. Project activities near watercourses may lead to the removal of trees on the bank, resulting in increased erosion risk. However, mitigation measures are expected to limit these interactions. | Medium | Medium | Medium | Not a PES |

| Ecosystem Service | Definition and description of ES within the Project LSA | Level of dependence on ES | Interaction of ES with drivers of change | Replaceability of ES | Identification of PES |
|---|---|---|---|---|---|
| **Cultural Services** | | | | | |
| Sacred components | Cultural or religious value that a population attaches to an ecosystem, a place, or a species.<br>Several sites were reported in surveyed communities; neither the 2021 RAP nor the 2017 RCAP for the Kasama-Nakonde section have reported any private sacred assets located within the wayleave. | NA | NA | NA | Not a PES |
| 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.<br>There will be a permanent loss of land from heritage conservation and potential tourism development at the Mwela Rock Art site, considering that this whole area is meant for tourism trails and sustainable tourism development. The Mwela Rock Art site is affected by the ROW. While the ROW does not impact the cave with the paintings, the site's natural environment may be affected. NHCC judges all the environmental features as important for the sites. | Medium | High | Medium | PES |
| **Supporting 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 LSA but are known to contribute to all types of ES.<br>Refuge habitat for birds, pollinator insects, nursery and spawning grounds for fish. | | | |
| Nutrients cycle | Nutrients cycle in the ecosystems (phosphorus, nitrogen, carbon, sulfur, etc.). | | | | |
| Habitat | Natural or modified areas that 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). | | | | |

# 5.4 HUMAN ENVIRONMENT

This section details the information collected on the human environment in the Project area. It is based on secondary data from national statistics, as well as primary data collected during surveys of communities and households affected by the Project. Some primary data was collected in 2017 through the completion of social surveys conducted along the future wayleave of the transmission line, and additional primary data was collected in 2019 through further social surveys conducted in selected impacted communities. In addition, ZESCO has conducted a census of Project Affected Persons (PAPs), some statistics from which are also presented in this report.

Secondary data are presented for both urban and rural areas, while primary data mainly relates to rural areas since the transmission line largely crosses rural areas.

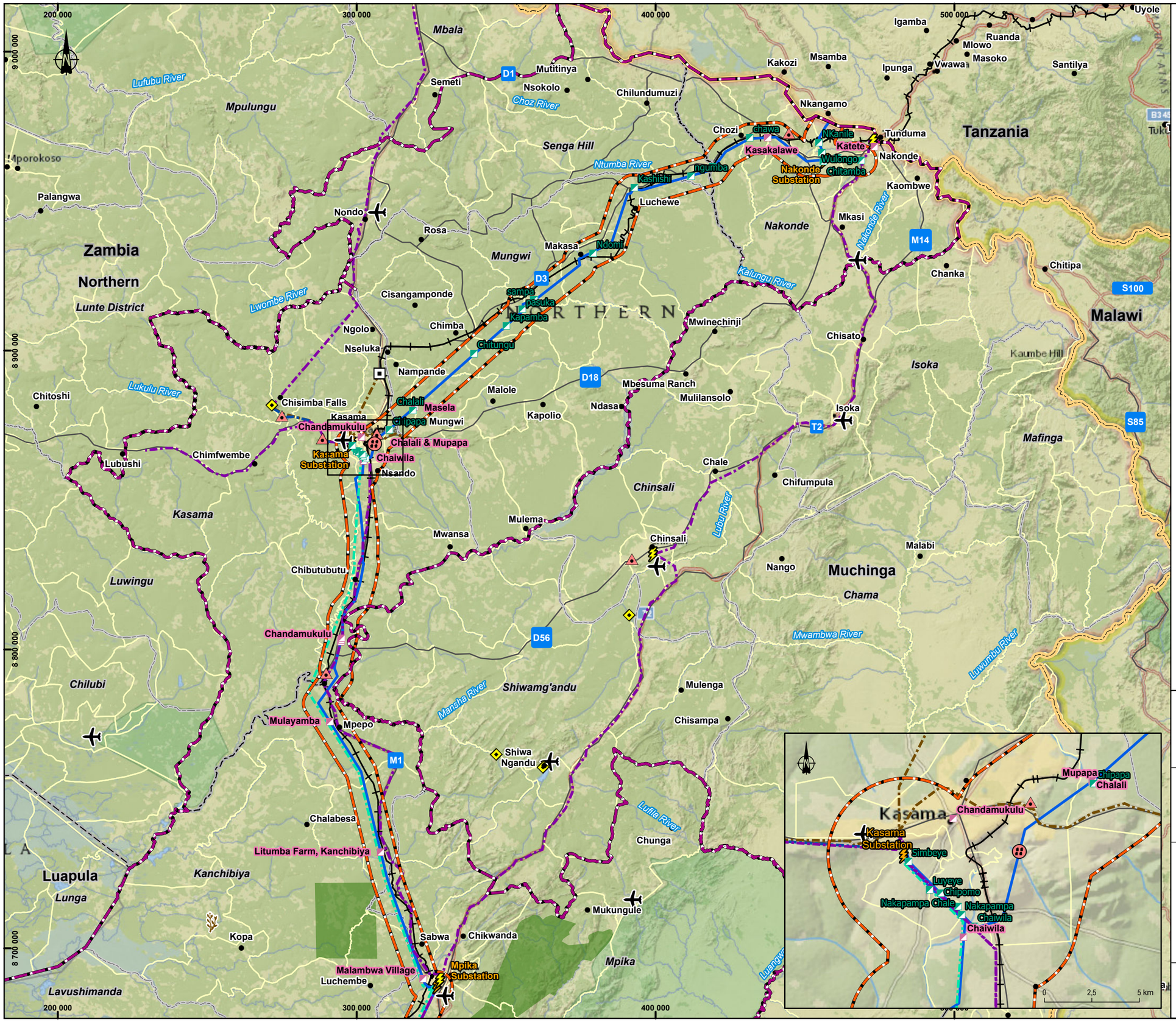
## *5.4.1 LOCATION AND ADMINISTRATION*

Relevant components of the human environment are illustrated in Maps 5-23 and 5-24.

The Republic of Zambia is a landlocked country at the crossroads of Central, Southern and East Africa. It is bordered to the north by the Democratic Republic of the Congo, Tanzania to the north-east, Malawi to the east, Mozambique to the southeast, Zimbabwe and Botswana to the south, Namibia to the southwest, and Angola to the west. The country is divided into ten provinces (Figure 5-24). Each of these is divided into districts for a total of 117 districts. The line route crosses the three (3) following provinces:

- Central Province, which covers an area of 94,394 km$^2$ and has 15 districts, two (2) of which are crossed by the line route.
- Muchinga Province, which covers an area of 87,806 km$^2$ and has eight (8) districts, four (4) of which are crossed by the line route.
- Northern Province, which covers an area of 77,650 km$^2$ and has 13 districts, four (4) of which are crossed by the line route.

**Figure 5-24 Provinces of Zambia**




**Human Environment**

- City / Village (Nakonde)
- International Boundary (Zambia)
- Province Limit (Northern)
- District Limit (Nakonde)
- Ward Limit
- Community Site
- Affected communities from the RCAP
- Surveyed affected communities in 2019

**Agriculture**

- ZAMPALM Plantation
- Emerging Farm Block

**Infrastructure**

- Existing Substation
- Cultural or Archaeological Site
- OLAM Northern Coffee Corp.
- Airport
- Touristic Site
- Road
- Railroad
- Oil Pipeline
- Existing Distribution Line
- Existing Transmission Line, 33 kV
- Existing Transmission Line, 66 kV
- Existing Transmission Line, 330 kV

**Project Components**

- Local Study Area
- Social Extended Study Area
- Proposed 330 kV Transmission Line
- Proposed 132 kV Transmission Line
- Substation

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*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-23**
**Human Environment**
**Nakonde - Mpika Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

0 12,5 25 km
UTM 36S, WGS84

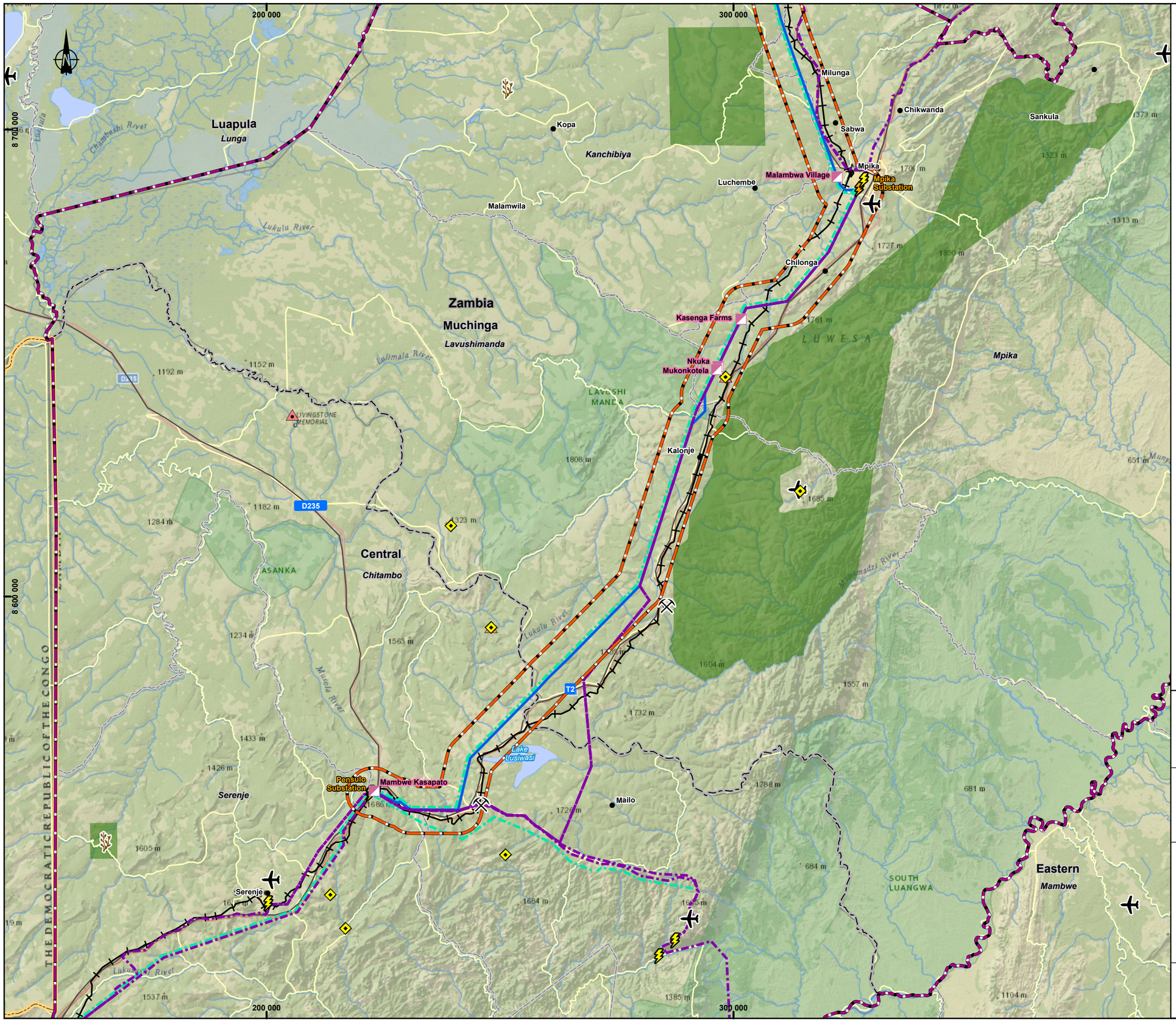
**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: F. St-Hilaire-Dorion*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_23_24_HumanEnviro_029_030_240621*

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.*




**Human Environment**

- Nakonde — City / Village
- Zambia — International Boundary
- Northern — Province Limit
- Nakonde — District Limit
- Ward Limit
- Community Site
- Surveyed affected communities in 2019

**Agriculture**

- ZAMPALM Plantation
- Emerging Farm Block

**Infrastructure**

- Existing Substation
- Cultural or Archaeological Site
- OLAM Northern Coffee Corp.
- Airport
- Touristic Site
- Road
- Railroad
- Oil Pipeline
- Existing Distribution Line
- Existing Transmission Line, 33 kV
- Existing Transmission Line, 66 kV
- Existing Transmission Line, 330 kV

**Project Components**

- Local Study Area
- Social Extended Study Area
- Proposed 330 kV Transmission Line
- Substation

ZESCO Powering the Nation

***Zambia-Tanzania Interconnector Project***

*Environmental and Social Impact Assessment (ESIA) Update*

## Map 5-24
## Human Environment
## Nakonde - Mpika Segment

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

0 8 16 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
*Drawing: F. St-Hilaire-Dorion*
*Validation: M. Brennan Jacot*

*EI_ESIA2024_240618.aprx*
*CA0027197_7329_EIC5_23_24_HumanEnviro_029_030_240619*

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.*

The Project wayleave crosses nine (9) districts and several (28) wards, the smallest administrative unit. Table 5-17 presents districts from south to north. District divisions are presented in relation to other socioeconomic components on Map 5-23 and Map 5-24 above.

**Table 5-18 Provinces and Districts along the RoW**

| Provinces | Districts | Wards |
|---|---|---|
| Central Province | Serenje | Kabamba |
| | Chitambo | Muchinka |
| | | Chitambo |
| Muchinga Province | Lavushimanda | Chikanda |
| | Mpika | Nachikufu |
| | | Lubambala |
| | | Mukungwa |
| | Kanchibiya | Mumbubu |
| | | Chambeshi |
| | Nakonde | Mulalo |
| | | Popomozi |
| | | Ngumba |
| | | Isunda |
| | | Musyani |
| Northern Province | Kasama | Chibundu |
| | | Kapongolo |
| | | Lualuo |
| | | Chiba |
| | | Mulilansolo |
| | Mungwi | Ngulula |
| | | Mungwi |
| | | Chamfubu |
| | | Fube |
| | | Iyaya |
| | | Kabisha |
| | | Mpanda |
| | | Lubala |
| | Senga Hill | Chozi |

In Zambia, chiefdoms are the custodians and administrators of most of the Zambia's land and natural resources. They control access to lands and forests, and their decisions are binding on the individuals who live within their chiefdoms. The chiefdoms are under the supervision of the Ministry of Local Government and Rural Development through Zambia's House of Chiefs. The Project line crosses 13 chiefdoms in different provinces (Table 5-18).

**Table 5-19 Chiefdoms crossed by the Project**

| Provinces | Chiefdoms |
|---|---|
| Central Province | Kabamba |
| | Muchinka |
| Muchinga Province | Mpumba |
| | Chikwanda |
| | Luchembe |
| | Mpepo |
| Northern Province | Nkolemfumu |
| | Mwamba |
| | Chitimukulu |
| | Makasa |
| | Nsokolo |
| | Waitwika |
| | Barton |

The presence of sensitive receptors such as schools, hospitals, public health clinics (PHC), places of worship, markets or commercial spaces in proximity to the Project were documented during census of PAPs. The following table summarizes the sensitive receptors documented within each village where surveys were conducted in 2019.

**Table 5-20 Sensitive Receptors in Villages Surveyed in 2019**

| District | Chiefdom | Village | Primary School | Secondary School | PHC | Hospital | Shops | Place of Worship |
|---|---|---|---|---|---|---|---|---|
| Mpika | Chikwanda | Chaila | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Chaile | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Chailo | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Chako | N | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Chalipilwa | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Changila | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Chibaye | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Kafuko | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Kasenga | Y | Y | Y | Y | Y | Y |
| Mpika | Chikwanda | Kawama | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Lubanga | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Malambwa | Y | Y | Y | Y | Y | Y |
| Mpika | Chikwanda | Manyowe | Y | Y | Y | Y | Y | Y |
| Mpika | Mpepe | Masonge | Y | N | Y | N | N | Y |
| Mpika | Chikwanda | Mukonteka | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Ngobesha | Y | N | Y | Y | Y | Y |
| Mpika | Chikwanda | Nkuka | Y | Y | Y | Y | Y | Y |
| Mpika | Chikwanda | Nshitima | N | N | Y | Y | Y | Y |

| District | Chiefdom | Village | Primary School | Secondary School | PHC | Hospital | Shops | Place of Worship |
|---|---|---|---|---|---|---|---|---|
| Mpika | Chikwanda | Sabwa | Y | Y | Y | Y | Y | Y |
| Mpika | Chikwanda | Sotambe | Y | N | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Chaiwila | Y | N | Y | Y | N | Y |
| Kasama | Chanda Mukulu | Chanda Mukulu | Y | Y | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Chibota | Y | N | N | Y | Y | Y |
| Kasama | Nkole Mfumu | Chileshe Mwamba | N | N | Y | N | Y | Y |
| Kasama | Nkole Mfumu | Ishito | N | N | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Kabole | Y | Y | Y | Y | N | Y |
| Kasama | Nkole Mfumu | Kabwe | Y | N | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Kabwe Mukulu | Y | Y | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Kantasha | Y | Y | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Kashata Village | Y | N | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Matemo | N | Y | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Musa | N | N | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Mwalimu | N | Y | Y | Y | Y | Y |
| Kasama | Chanda Mukulu | Mwaushi | Y | Y | Y | Y | Y | Y |
| Kasama | Nkole Mfumu | Sweba | Y | Y | Y | Y | Y | Y |
| Kasama | Chanda Mukulu | Kalukusha | N | N | N | N | N | N |
| Kasama | Chandamukulu | Kanambo | Y | N | Y | Y | Y | Y |
| Kasama | Chanda Mukulu | Makoko Village | Y | Y | Y | Y | Y | Y |
| Kasama | Chanda Mukulu | Safwa Turn Off | Y | N | Y | Y | Y | Y |
| Kasama | Mwamba | Namulundu Iii | Y | Y | Y | Y | N | Y |
| Kasama | Mwaba | Eituna | N | N | Y | Y | Y | Y |
| Mungwi | Chiti Mukulu | Chalali | N | N | Y | Y | N | Y |
| Mungwi | Chitimukulu | Chipapa | Y | Y | Y | Y | Y | N |
| Mungwi | Chiti Mukulu | Mulenga Wachibungu | Y | N | Y | Y | Y | Y |
| Senga Hill | Nsokolo | Nyumba | N | N | Y | Y | Y | Y |
| Serenje | Muchinka | Chakumana | Y | N | Y | Y | Y | Y |
| Serenje | Muchinka | Kapenda | N | Y | N | Y | Y | Y |
| Serenje | Kabamba | Mambwe | N | N | Y | Y | Y | Y |

Note:

The information within this table was extrapolated from survey results from a census of PAPs completed by a party other than WSP. It was not possible for the accuracy of this data to be validated. As such, it is recommended that caution be exercised when drawing conclusions from the information within this table. Furthermore, district limits have changed in 2017 and may not be reflected in the table

## 5.4.2 POPULATION

Table 5-20 provides population details for the Northern, Muchinga and Central provinces, compared with other provinces in the country. Data are from the 2022 census.

**Table 5-21 Population Size by Province**

| Province | Land area (km²) | Population distribution (%) | | 2010 | | 2022 | |
|---|---|---|---|---|---|---|---|
| | | Rural | Urban | Population | Density (persons/km²) | Population | Density (persons/km²) |
| Central | 94,394 | 76.6 | 23.4 | 1,307,111 | 13.8 | 2,252,483 | 23.9 |
| Copperbelt | 31,328 | 17.3 | 82.7 | 1,972,317 | 63.0 | 2,757,539 | 88.0 |
| Eastern | 51,476 | 83.2 | 16.8 | 1,696,555 | 30.9 | 2,454,788 | 35.6 |
| Luapula | 50,567 | 15.1 | 84.9 | 991,927 | 19.6 | 1,514,011 | 29.9 |
| Lusaka | 21,896 | 18.5 | 81.5 | 2,191,225 | 100.1 | 3,079,964 | 140.1 |
| Muchinga | 87,806 | 87.0 | 13.0 | 607,763 | 8.1 | 918,296 | 13.1 |
| Northern | 77,650 | 77.7 | 22.3 | 1,105,824 | 14.2 | 1,618,412 | 20.8 |
| North-Western | 125,826 | 58.3 | 41.7 | 727,044 | 5.8 | 1,270,028 | 10.1 |
| Southern | 85,283 | 74.3 | 25.7 | 1,589,926 | 18.6 | 2,381,728 | 27.7 |
| Western | 126,386 | 80.6 | 19.4 | 902,974 | 7.1 | 1,363,520 | 10.8 |
| **Zambia** | **752,612** | **60.0** | **40.0** | **13,092,666** | **17.4** | **19,610,769** | **26.1** |

Source: Zambia Statistics Agency, 2022

### 5.4.2.1 POPULATION DENSITY AND GENDER DISTRIBUTION

#### MUCHINGA PROVINCE

In 2022, the population density for Muchinga Province was 13.1 persons per km², a 61.7% increase compared to the 2010 average of 8.1 persons per km². This increase is largely associated with the natural population increase (see Table 5-21). According to the 2022 Census, in Muchinga Province, 87.0% of the population resided in rural areas and 13.0% in urban.

In 2010, the proportion of females in the population of Muchinga Province is 1-2% higher than males (CSO, 2012). This is often the result of young men leaving rural areas to find work in the Copperbelt, Lusaka or in neighbouring countries.

**Table 5-22 Muchinga Province Population Density by District, 2022**

| District | Total Population | Land Area (km²) | Density (person/km²) |
|---|---|---|---|
| Kanchibiya | 93,052 | 8,917.7 | 10.4 |
| Lavushimanda | 55,755 | 14,388.4 | 3.9 |
| Mpika | 149,063 | 17,409.1 | 8.6 |
| Nakonde | 149,063 | 4,808.8 | 37.2 |

Source: Zambia Statistics Agency, 2022

In the Muchinga Province, the total population and population density in the wards crossed by the Project are as presented in Table 5-22. In 2010, the average population density of affected wards in the Muchinga Province was about 8 persons per km$^2$.

**Table 5-23 Population and Population Density in the Wards Crossed by the Project in Muchinga Province, 2010**

| District | Ward | Population | Density (rounded figures, persons per km$^2$) |
|---|---|---|---|
| Mpika | Nachikufu | 8,015 | 4 |
| | Lubambala | NA | NA |
| | Mukungwa | 7,884 | 9 |
| Kanchibiya | Mumbubu | 8,424 | 9 |
| | Chambeshi | 6,237 | 10 |
| Lavushimanda | Chikanda | 8,221 | 6 |
| Nakonde | Mulalo | 9,675 | 12 |
| | Popomozi | 6,449 | 12 |
| | Ngumba | 6,728 | 23 |
| | Isunda | NA | NA |
| | Musyani | NA | NA |

## NORTHERN PROVINCE

Northern Province population density increased from 14.2 persons per km$^2$ in 2010 to 20.8 persons per km$^2$ in 2022, which put it near the Zambian average of 26.1 persons per km$^2$ (Table 5-23). This represents a 46.7% increase between 2010 and 2022. As for Muchinga Province, natural population growth explains this tendency.

Similar to the situation in Munchinga Province, the proportion of females in the population of Northern Province is 1-2% higher than males (ZCPH, 2022). The population in Northern Province districts, as well as density, are presented in Table 5-23 below.

**Table 5-24 Northern Province Population Density by Districts, 2022**

| District | Total Population | Land Area (km$^2$) | Density (person/km$^2$) |
|---|---|---|---|
| Kasama | 348,552 | 10,584.1 | 32.9 |
| Mungwi | 205,096 | 9,758.7 | 21.0 |
| Senga Hill | 126,308 | 5,183.7 | 24.4 |

Source: Zambia Statistics Agency, 2022

In Northern Province, the total population and population density in the wards crossed by the Project is as presented in Table 5-24. On average, affected wards in Northern Province have a population density of about 26.1 persons per km$^2$. This figure is influenced by the higher population density in Buseko Ward and the surrounding area, where the city of Kasama is located.

**Table 5-25 Population and Population Density in the Wards crossed by the Project in the Northern Province, 2010**

| District | Ward | Population | Density (rounded figures, persons per km$^2$) |
|---|---|---|---|
| Kasama | Chibundu | 9,095 | 11 |
| | Kapongolo | 6,726 | 8 |
| | Lualuo | 8,569 | 18 |
| | Chiba | 7,818 | 50 |
| | Mulilansolo | NA | NA |
| | Kapumaula | 9,812 | 44 |
| | Buseko | 63,911 | 1967 |
| | Lukupa | 9,437 | 113 |
| Mungwi | Ngulula | 9,870 | 36 |
| | Mungwi | 12,978 | 41 |
| | Chamfubu | 17,739 | 18 |
| | Fube | NA | NA |
| | Iyaya | 11,613 | 16 |
| | Kabisha | 8,825 | 10 |
| | Mpanda | 12,742 | 17 |
| | Lubala | 13,650 | 8 |
| Senga Hill | Chozi | 7,131 | 28 |

Source: adapted from https://www.citypopulation.de data from the CSO 2010

## CENTRAL PROVINCE

In 2022, the population density for Central Province was 23.9 persons per km$^2$, a 73.1% increase compared to the 2010 average of 13.8 persons per km$^2$. This increase is largely associated with the natural population increase. However, the Central Province population density figure is less than the Zambian average of 26.1 persons per km$^2$. The population of Central Province districts is detailed in Table 5-25.

The proportion of females in the province population is following the same trend as other provinces of the study area provinces with a higher percentage of females (50.8 %) than males (49.2%)[3].

**Table 5-26 Central Population – Gender Distribution by District, 2022**

| District | Total Population | Land Area (km2) | Density (person/km$^2$) |
|---|---|---|---|
| Chitambo | 100,603 | 11,884.5 | 8.5 |
| Serenje | 158,192 | 11,455.0 | 13.8 |

Source: Zambia Statistics Agency, 2022

In Central Province, the total population and population density in the wards crossed by the project is as presented in Table 5-26. On average, affected wards in Central Province have a population density of about 23.9 persons per km$^2$.

[3] Chitambo District: Integrated development Plan 2022-2032

**Table 5-27 Population and Population Density in the Wards crossed by the Project in the Central Province, 2010**

| Districts | Wards | Population | Population density (rounded figures per km²) |
|---|---|---|---|
| Serenje | Kabamba | 7,538 | 12 |
| Chitambo | Muchinka | 10,408 | 10 |
| | Chitambo | 9,843 | 11 |

Source: adapted from https://www.citypopulation.de data from the CSO 2010

### 5.4.2.2 POPULATION GROWTH

Zambia and the three (3) affected provinces show the typical demographic characteristics of sub-Saharan Africa countries: high fertility rate and population growth.

The fertility rate in Zambia has slightly decreased, from 6.2 births per woman at the time of the 2007 Census to 4.7 in 2018 according to the Zambia Demographic and Health survey (ZDHS, 2018). Nevertheless, it remains among the highest in sub-Saharan countries[4]. This high fertility results in a strong population increase rate and a large proportion of youth in the population.

Zambia's population grew at a rate of 3.4% per annum during the 2010-2022 intercensal period. This is an increase from the annual rate of 2.8% in the 1990-2000 intercensal period[5].

According to the ZDHS, 2018, the proportion of Zambians 24 years old or younger is 65.9%.

The national population has continued to grow over the past decades. The population grew at an average annual rate of 3.4% during the 2010-2022 period, an increase from 2.1% during the preceding intercensal period (2000-2010). Urban areas recorded a decline in the growth rate from 4.2% during the 2000-2010 intercensal period to 3.5% in the period 2010-2022.

#### MUCHINGA PROVINCE

Muchinga Province population grew at an average rate of 3.5% per annum during the period 2010-2022: a slightly higher rate than the national average.

Mpika District was the fastest-growing district with an annual rate of population growth of 5.3 % followed by Nakonde District with 3.4 %, Lavushimanda District with 2.7% and Kanchibiya with 1.0 % (Table 5-27)

**Table 5-28 Mean Population Growth Rates for Muchinga Province by Districts, 2022**

| District | Population (2010) | Population (2022) | Annual Growth Rate (%) |
|---|---|---|---|
| Kanchibiya | 82,151 | 93,052 | 1.0 |
| Lavushimanda | 40,677 | 55,755 | 2.7 |
| Mpika | 80,551 | 149,063 | 5.3 |
| Nakonde | 119,708 | 178,788 | 3.4 |
| **Muchinga Province** | **607,763** | **918,296** | **3.5** |

Source: Zambia Statistics Agency, 2022

According to the 2022 Census, in Muchinga Province 87.0% of the population resided in rural areas and 13.0% in the urban.

4 CSO, Zambia demographic and health survey, 2007, 2009.
5 CSO, 2010 Census of population and housing, National Analytical report, 2012.

Detailed census data from 2010 indicate that the province's population is young with a median age of 15.5 and 68.1% of its inhabitants being 24 years old or less. This population below 15 years old constituted 49.5% of the total population in rural areas and 44.3% in urban areas in 2010. The youth population, age group 15-24 years, made up 19.5% of the provincial population. This age group constituted 18.9% of the rural population and 22.7% of the urban population.

The population aged 15-64 years constituted 48.3% of the provincial population. This age group made up 47.2% of the rural population and 53.7% of the urban population. The elderly population (those aged 65 years and older) made up 3.0% of the provincial population. The age group constituted 3.3% of the rural population and 2.0% of the urban population.

## NORTHERN PROVINCE

The population of Northern Province grew at an average rate of 3.2% per annum during the period 2010-2022.

Most districts had high population growth rate, Kasama district have the highest with 3.5 %, slightly above the provincial average. Followed by Senga Hill and Mungwi District with 2.6 annual growth around (Table 5-28).

**Table 5-29 Mean Population Growth Rates for Northern Province by Districts, 2010-2022**

| District | Population (2010) | Population (2022) | Annual Growth Rate (%) |
|---|---|---|---|
| Kasama | 231,824 | 348,552 | 3.5 |
| Mungwi | 151,058 | 205,096 | 2.6 |
| Senga Hill | 92,391 | 126,308 | 2.6 |
| **Northern Province** | **1,105,824** | **1,618,412** | **3.2** |

Source: Zambia Statistics Agency, 2022

According to the 2022 Census, in Northern Province 77.7% of population resided in rural areas and 22.3% in the urban.

Detailed census data from 2010 indicate that the Northern Province's population is young: 67.9 % of the inhabitants are 24 years old or less (CSO, 2012). The median age is 15.5 years. Forty-nine (48.7) % of the population in the province was below the age of 15 years. This age group constituted 49.6% of the total population in rural areas and 44.5% of the total population in urban areas in 2010. The youth population, aged 15-24, comprised 19.2% of the provincial population. This age group constituted 18.4% of the rural population and 22.5% of the urban population. The population aged 15-64 constituted 48.5% of the provincial population, 47.4% of the rural population, and 53.3% of the urban population. Only 2.9% of the provincial population was elderly (those 65 years and older). This age group constituted 3.0% of the rural population and 2.2% of the urban population.

## CENTRAL PROVINCE

Central Province population grew at an average rate of 4.6% per annum during the period 2010-2022: a higher rate than the national average.

Central Province population had one of the highest population growth rates in Zambia. Most districts had a very high population growth rate; Chitambo shows a rate of 6.2%, Serenje has 2.5 (Table 5-29).

**Table 5-30 Mean Population Growth Rates for Central Province by Districts**

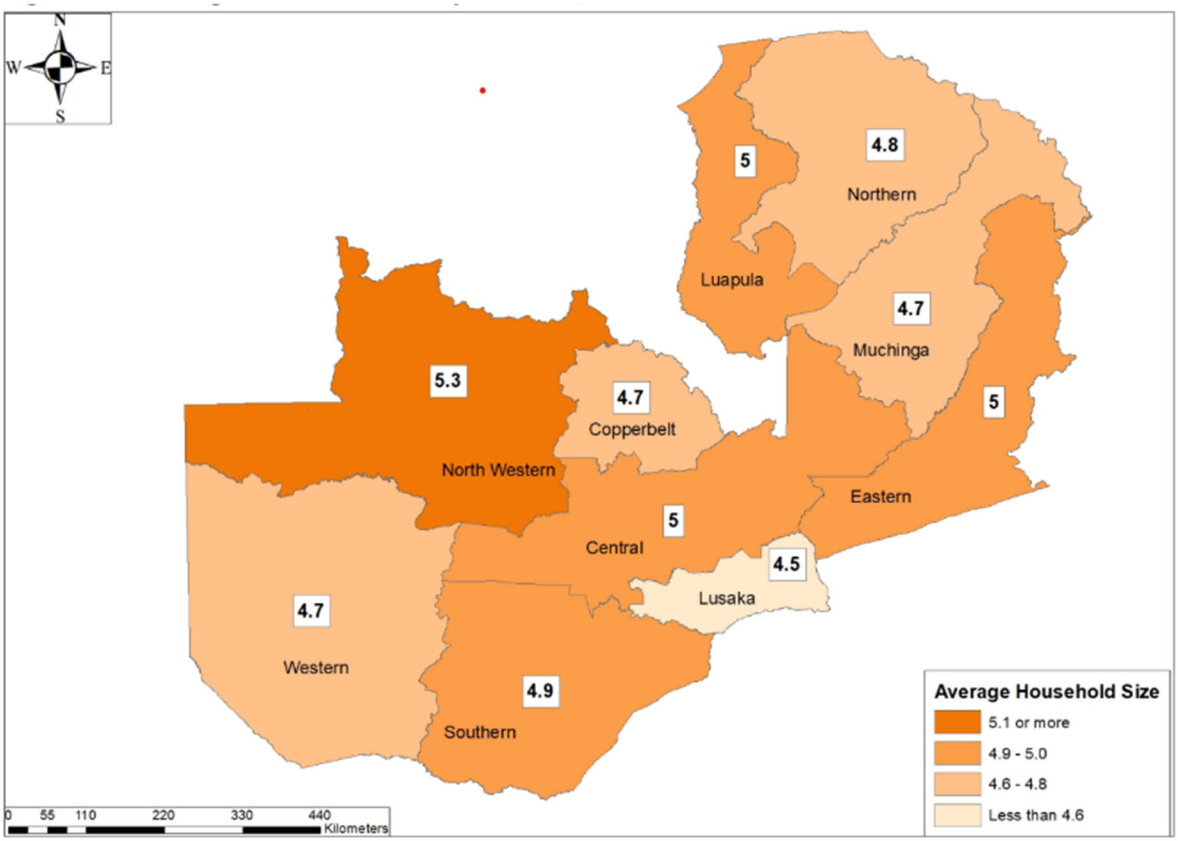
| District | 2010 Census | 2022 Census | Population Growth Rate 2010-2022 |
|---|---|---|---|
| Chitambo | 48,861 | 100,603 | 6.2 |
| Serenje | 117,880 | 158,192 | 2.5 |
| **Total** | **1,307,111** | **2,252,483** | **4.6** |

According to the 2022 Census, 76.6% of the population in Central Province resided in rural areas and 23.4% in the urban.

Detailed 2010 census data indicate that the province's population is young, with a median age of 16.3. The population below 15 years old constituted 48% of the total population in 2010. The youth population, aged 15-34 years, comprised 35.4% of the provincial population.

### 5.4.2.3 HOUSEHOLD TRENDS

According to the 2022 Census, the average household size at the national level was 4.8 persons per household. Rural areas had a higher average household size of 5.0 persons compared to urban areas, with 4.6 persons per household. Central province had a high average household size of 5.0 compared to Muchinga, with 4.7 and 4.8 for northern provinces. For household headship, Zambia DHS 2018 shows that males head 73.2% of households and 26.8 by females.




Source: Zambia Statistics Agency, 2022

**Figure 5-25 Average Household Size by province, Zambia 2022**

## MUCHINGA PROVINCE

The total number of households in Muchinga Province is 195,887, according to the 2022 census. This is an increase of 41.1% compared to the results of the 2010 census (138,783 households). As of 2022, the average household size for Muchinga Province is 4.7 persons, slightly lower than the Zambian average of 4.8 persons.

In 2010, male-headed households comprised 78.4% (108,853) of the total number of households. Household head data from the 2022 census are not yet available. The socioeconomic survey of 2017 shows that the percentage of males is also more significant (83.5%) among the affected heads of households in the Muchinga Province. Surprisingly, ZESCO's 2019 census of PAPs shows that 39% of heads of households of PAPs along the wayleave were women. The census did not highlight the reasons for a high percentage of female-headed households. However, this figure can be explained by the high percentage of widows amongst them (50%) and the absence of economic activities in the sector that may have driven men toward cities.

### NORTHERN PROVINCE

According to the 2022 census, the total number of households in the Northern Province is 333,874. This is an increase of 51.3% compared to the 2010 census results (220,561 households). As of 2022, the average household size for Northern Province was 4.8 persons, which is aligned with the Zambian average of 4.8 persons.

In 2010, male-headed households made up 79.4% (175,037) of the total number of households. Male-headed households had a larger average household size, 5.3 persons, compared to the 3.9 person's average for female-headed households.

### CENTRAL PROVINCE

According to the 2022 census, the total number of households in Central Province is 448,490. The average household size is 5 persons, which is higher than the Zambian average of 4.8 persons.

In 2010, male-headed households made up 78.7% (185,386) of the total number of households. Male-headed households had a larger average household size of 5.8 persons compared to 4.8 persons for female-headed households[6].

## 5.4.2.4 ETHNIC GROUPS AND LANGUAGES

Based on language of communication, the demographically most important ethnic groups in Zambia are the Bemba, the Nyanja, and the Tonga.

The ethnic division is somewhat different in the Muchinga, Northern and Central provinces. The main ethnic groups in Muchinga are the Bembas, Namwangas, Sengas, Tumbukas, and Bisas. In the Northern Province the main ethnic groups are the Bembas, Namwangas, Lungus, Mambwes, and Bisas, and in the Central Province the main ethic groups are Bembas, Lalas, Tongas and Lenjes. (Table 5-30). The most common language in the Project area is Bemba. However, other languages are commonly spoken in the Central province, such as Tonga, Lenje, and Nyanja. In the Muchinga province, Namwanga, Bisa and Senga are also commonly spoken. Bemba is largely predominant in the Northern province, but Mambwe and Bisa are also commonly spoken.

**Table 5-31 Languages (in %) in Zambia compared to Muchinga, Northern and Central Provinces, 2010**

| Language of Communication | Zambia | Muchinga Province | Northern Province | Central Province |
|---|---|---|---|---|
| Bemba | 33.5 | 46.9 | 69.2 | 31.8 |
| Lala | 1.8 | 0.4 | 0.0 | 17.3 |
| Bisa | 1.0 | 6.4 | 6.2 | 0.0 |
| Ushi | 0.9 | 0.0 | 0.0 | 0.0 |
| Lamba | 1.8 | 0.0 | 0.0 | 2.3 |
| Tonga | 11.4 | 0.1 | 0.0 | 15.5 |
| Lenje | 1.2 | 0.0 | 0.0 | 10.4 |
| Ila | 0.7 | 0.0 | 0.0 | 2.7 |
| Toka Leya | 0.5 | 0.0 | 0.0 | 0.0 |
| Luvale | 1.5 | 0.0 | 0.0 | 0.2 |
| Lunda (North Western) | 1.9 | 0.0 | 0.0 | 0.1 |
| Mbunda | 0.7 | 0.0 | 0.0 | 0.1 |
| Kaonde | 1.9 | 0.0 | 0.0 | 0.9 |
| Lozi | 5.5 | 0.0 | 0.0 | 1.0 |

6 CSO, 2012a.

| Language of Communication | Zambia | Muchinga Province | Northern Province | Central Province |
|---|---|---|---|---|
| Chewa | 4.5 | 0.0 | 0.0 | 0.4 |
| Nsenga | 3.0 | 0.0 | 0.0 | 0.4 |
| Ngoni | 0.7 | 0.0 | 0.0 | 0.3 |
| Nyanja | 14.8 | 0.3 | 0.1 | 8.9 |
| Tumbuka | 2.6 | 8.2 | 0.0 | 0.2 |
| Senga | 0.7 | 12.4 | 0.0 | 0.1 |
| Lungu | 0.6 | 0.0 | 6.9 | 0.0 |
| Mambwe | 1.3 | 0.5 | 14.0 | 0.2 |
| Namwanga | 1.2 | 20.7 | 0.3 | 0.2 |
| English | 1.7 | 0.1 | 0.1 | 0.7 |
| Other Language | 4.7 | 3.8 | 3.0 | 6.1 |
| % Total | 100.0 | 100.0 | 100.0 | 100.0 |

Note: The highlighted cells represent the three main languages in each administrative division.
Source: CSO, 2012a.

According to some informants, ethnic composition within the provinces varies depending on the districts. However, the distributions of these ethnic groups in the different districts are not known.

### 5.4.3 LAND TENURE

Under the 1995 Land Act and draft constitution, all land in Zambia vests in the President. Table 5-31 outlines the tenure types that are recognized legally.

**Table 5-32 Land Tenure Types**

| Type of Tenure | Characteristics | Legal Basis |
|---|---|---|
| Customary | Obtained through the permission of the local Chief. Most of the land in Zambia (about 90%) is held under customary tenure. Under customary law, the land is held by individuals, families, clans, or communities from generation to generation without temporal limitation. Customary tenure applies to individual plots, forest land, common land within a village, and communal grazing land. Most small-holder subsistence farmers cultivate customary land held in common ownership with the community, although farmers' rights are individualized. The land does not have formal documentation (e.g., certificates and titles) and the landholders do not pay land tax. | Governed by the customs and traditions of various ethnic groups. Sections 2 and 7 (ii) of the Lands Act. |
| Leaseholds of State land (statutory land) | Most urban areas, mining areas, protected areas, land along rail lines, and land that was free of the tsetse fly infestation during colonial times tend to be state land, much of which has been privatized through leaseholds. The state grants 99-year leasehold for surveyed land. The conversion of customary land to leaseholds requires approval of the Chief and any individual whose interests will be affected by the conversion. | Lands Act, 1995 (Cap. 184).<br>Lands (Amendment) Act, 1996 (No. 20 of 1996). 1996-06-28 |
| Unregistered lease or rental | Regulated by a tenancy contract signed and witnessed by both parties, which need not be a registered document. In practice, this form of agreement applies to dwelling houses. | Rent Act, 1972 |
| Informal rights in informal, illegal settlements | Informal renting and subletting based on unwritten (verbal) agreements. Illegal subdivision and occupation of land in expanding illegal settlement.<br>Most of the population in urban areas lives in informal settlements. In areas where settlements are built on primarily public land and the structures meet building standards, residents can regularize their rights with 30-year renewable Land Occupancy licenses. In other informal settlements, the residents do not have the right to their residential land under formal law. Customary law often recognizes the occupancy rights of residents, which may protect their interests against other potential occupants but offers no protection from eviction by government officials. | None |

Most land in Zambia (estimated at 90%) is held under customary tenure. Under customary law, land is held by individuals, families, or communities from generation to generation without temporal limitations. For the purposes of usufruct, the land is granted by Chiefs, who are the custodians of the land. Customary tenure applies to individual plots, forest land, common land within a village, and communal grazing land.

The land seldom has formal documentation (e.g., certificates, titles) and the landholders do not pay land taxes (USAID, n.d.). Some land has been ”converted” into exclusive use, and a document signed by the traditional authority that attests to this is created. However, these are seldom (in fact, virtually never) accompanied by a cadastral survey, and as such, the rights are recognised more as a social contract than as a legal transaction. However, the existence of these exclusive rights documents means that land is traded. Customary landowners are often considered land users since they do not pay any taxes and, in the case of government-led resettlement, they usually do not get compensated for land but only for lost crops. Traditional Authorities (TAs) allocate land to people and the Commissioner of lands has no powers under the Lands Act of 1995 to alienate land that is under customary tenure without consulting and obtaining the Chief’s consent as stipulated in the Lands (Customary Tenure) (Conversion) Regulations. The conversion is subject to the approval of the Commissioner of Lands. In doing so, however, the land is not legally transferred as it was state land to start with and remains state land. However, the rights to allocation of use transfer are with consent.

According to the 2017 socioeconomic surveys, the land-holding characteristics are constant among the PAPs, ranging from 1.3 to 1.6 parcels on average. The average land parcel areas vary from 4 hectares to 10 hectares.

Additionally, as it is usually the case with agrarian societies, according to 2017 surveys, 83.2% of cleared land parcels used by PAPs are, among other things, used for crop growing. An additional 29.1% is allocated to planted trees, 8.7% to pastures, and 1.4% to fallow. Only small portions of land parcels are usually left in their natural state.

### 5.4.4 REGIONAL ECONOMY

According to the 2019 RAP census, the livelihood of 69 % of affected households is solely based on agriculture and an additional 18 % rely on agriculture and other livelihoods, such as business, charcoal production or other informal employment.

Zambian agriculture has three broad categories of farmers: small-scale, medium and large-scale. Small-scale farmers are generally subsistence producers of staple foods with occasional marketable surplus. Medium-scale farmers produce maize and a few other cash crops for the market. Large-scale farmers produce various crops for the local and export markets. The size of holdings of each category of farmer is quite different. Small-scale farmers have holdings between 0.5 and 9 hectares, medium-scale farmers between 10 and 20 hectares, and large-scale farmers above 20 hectares. Medium and large farmers have land titles.

According to the Ministry of Agriculture, large-scale farmers make up approximately 2% of the farming population. They are generally characterized by high mechanization and benefit from a well-organized agricultural network that facilitates the acquisition of inputs. In 2010, Medium-scale farmers represented 13% of the farmer population, and small-scale farmers represented 85%.

The most prevalent agricultural practice is chitemene, or slash-and-burn. The household clears a parcel by cutting and burning trees and shrubs before planting. After a few years, the soil is exhausted, and a new one replaces the plot.

According to the Muchinga Province provincial administration, farming is the population's main livelihood source. The major crops cultivated are subsistence crops. The dominant farm produce includes palm oil, rice, vegetables, sugarcane, fruits, maize, cassava, sorghum, sweet potatoes, and millet.

According to the Northern Provincial Administration, the Province has no major industry, and its primary economic activity is agriculture. Farming, fishing, and trading are the mainstays of the majority of the population. The economy of this region is primarily driven by agriculture.

A similar situation is observed in the Central province, according to the Central province provincial administration, agriculture is the main economic activity. The province is home to most commercial farmers in Zambia and is one of the major producers of all country's major cash crops including wheat where more than 50% of the national produce comes from the region.

#### 5.4.4.1 CROPS

According to the 2019 socioeconomic surveys, the most common crops are maize, cassava, beans, groundnuts, millet, sorghum, sweet potatoes, cow peas and soya beans. Banana trees and mango trees are the main fruit trees, they also represent a source of income..

#### 5.4.4.2 LIVESTOCK

Of the Northern Province's agricultural households, 27% raise some livestock. Among the livestock owners, the most prevalent types of livestock are goats (70.3%), pigs (28.7%), and cattle (22.2%). In Zambia, the proportion of agricultural producers owning livestock is 36%. The corresponding proportion of livestock owners that have goats is 57.3%, pigs are 30.1%, and cattle are 56.1%.

Most of the Northern Province's agricultural producers (63.3%) own chickens, close to the Zambian figures (60.4%). The proportion of households raising other poultry species (e.g., duck, geese, guinea fowl, etc.) in either Zambia or Northern Province is marginal.

Among the Central Province's agricultural households, almost 43% raise some livestock, mainly goats (70.3%) and cattle (61.2%), but also pigs (9.0%) and sheep (2.5%).

In addition, most of the agricultural households of the Central Province (69.2%) keep poultry, mainly chickens (99.0%). Other poultry species (e.g., duck, geese, guinea fowl, etc.) in Central Province are marginal.

According to the 2017 socioeconomic surveys, animals owned by affected households include cattle (8.4%), pigs (13%), chicken (62.9%), goat (25.6%) and sheep (0.4%), among others.

#### 5.4.4.3 PLANTATIONS

Within the local study area, some extended tree plantations are visible. The plantations identified are mainly owned by the parastatal Zambia Forestry and Forest Industries Corporation (ZAFFICO). This company mainly operates plantations to meet the growing demand for timber in Zambia and to supplement supplies from overexploited indigenous forests (ZAFFICO, 2024). ZAFFICO operates two plantations in the Kasama district of Northern Province and the Nakonde district of Muchinga Province.

Kasama Plantation Group planted 1,000ha, of which 86,3% (863ha) is pine, while eucalyptus only accounts for 13.7% (137ha). Land preparation has commenced for 200 hectares that will be planted during the 2021/2022 planting season.

Aside from the large tree plantations, farmers also own various types of trees within the agricultural parcels. According to the 2019 census from ZESCO, the total number of fruit trees to be cut down within the wayleave is 2,085. Additionally, 172 tree owners will lose at least one fruit tree.

## 5.4.5 SOCIOECONOMIC FACTORS

### 5.4.5.1 AGRICULTURE AS THE MAIN SOURCE OF LIVELIHOOD

According to the 2010 census, Zambia labour force participation is higher in rural areas (66.1%) than in urban areas (33.9%). This is generally because more children go to school in urban areas than in rural areas. Furthermore, more women are considered active in rural areas because they work on the household farm, while in urban areas, women are considered "inactive" because they do not have an occupation aside from taking care of the children and household.

The most important groups in terms of employment categories are agriculture, forestry and fishing. This covers all small-scale farmers and their family workers. In Zambia, 53.8% of the working population are small-scale farmers. Among the active population, the proportion of workers in the primary sector (agriculture, forestry and fishing) is 71.3%[7]. The rural and urban averages are very different. The sector represents 92.3% of the active population in rural areas and only 7.7% in urban areas.

Elementary occupation (e.g., unskilled labourer, street vendors, etc.) represents the second most important occupation in Zambia, with a total of 12.3% of men and 13.5% of women in that group[8].

According to the 2017 socioeconomic surveys, the main occupation of the village's population involved in the Project is agriculture, representing about 86.5% of the total population. The proportion of agricultural workers in Central Province is slightly higher (92.3%) than in other regions. The results of the 2019 surveys support these data, indicating that most households practice agriculture. A few households also sell charcoal as a source of revenue (those living along roads). According to the 2019 surveys, maize, cassava, beans, groundnuts, millet, sorghum, sweet potatoes, cow peas and soybeans are the most common commodities. Banana trees and mango trees are the main fruit trees, which also represent a source of income.

According to the 2019 surveys, December and January are the most challenging months of the year for households because food stocks are depleting, crops are not ready to be harvested, and fees for school need to be paid. When people are faced with hardship, they either sell their garden products or their goats. Others mentioned receiving monetary support. Conversely, June and July are harvesting months, and households' situations during those months are better.

### 5.4.5.2 LIVESTOCK

According to ZESCO's census, the most common livestock owned by affected households are chickens, goats, and cattle. Some are used for consumption, while others are kept and sold during more challenging times. There are no herders in the Project area.

### 5.4.5.3 EDUCATION

One important measure of the education level is the literacy rate. In 2010, the literacy rate in Zambia was 70.2%.

There is still a gender gap in the literacy rate. Among females 5 years or older, 67.3% are considered literate, which is lower than the male rate (73.2%). However, the gender gap between the two inter-censal periods (2000-2010) has declined.

7 CSO, 2011a.

8 The economic activities are defined according to the International Standard for Industrial Classification of all economic activities (ISIC), Revision 4 (2008).

As for school attendance, the 2010 country-wide census shows that 74% of the population aged between 7 and 13 years attended school. Representing males (73%) and females (74.9%) is not large but demonstrates a slight advantage to females. However, there is still a large gap between the rural (67.5%) and the urban (83.5%) school attendance rate in that age group.

According to the 2017 socioeconomic surveys, the majority (55.5%) of affected household heads have attended primary school, while an additional 30.7% of them have also attended secondary school. Generally, about 11.8% of affected household heads attended an informal education program (adult education, vocation, etc.).

#### 5.4.5.4 HOUSEHOLD INCOME

The 2015 Living Conditions Survey revealed that the average monthly income for Zambian households was about 1,801.30 Kwacha.

There is a clear contrast between rural and urban households' average incomes. Urban households' average income was more than twice that of rural households. While the urban average monthly income was K 3,152.40, the rural average monthly income was only estimated at K 810. Whereas 15.4% of urban households had monthly incomes exceeding K 450, only 51,2% of rural households reached that income level.

Small-scale farmers constitute most rural households with an average monthly income of K 693.1.

In 2015, the average household monthly income in Northern Province was K 895.9. This average is lower than the Zambian average of K 3,152.40 but close to the rural Zambian average of K 810. For Central and Muchinga Provinces, the average is K 1530.80 and K 1201.00 for Muchinga Province.

The following table presents the distribution of household income according to the 2015 Living Conditions Monitoring Survey Report. In the Central province, 56.3% of households have income above K 601, compared to 39% for Muchinga province and 32.4 % for the Northern province.

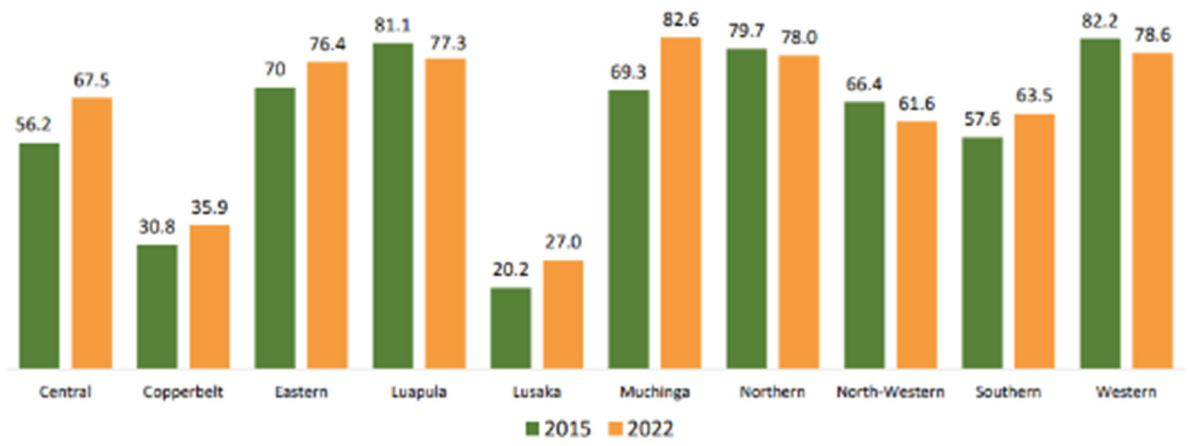
**Table 5-33 Distribution of Household Income according to 2015 Living Conditions Monitoring Survey Report**

| Average Monthly Income Range (in Kwacha) | Central Province | Muchinga Province | Northern Province |
|---|---|---|---|
| Less than 50 | 3.7% | 4.7% | 5.3% |
| 50 to 150 | 8.2% | 11.9% | 14.6% |
| 151 to 300 | 12.2% | 19.3% | 20% |
| 301 to 450 | 10,2% | 14.9% | 15.5% |
| 451 to 600 | 9.4% | 10.3% | 12.2% |
| Above 651 | 56.3% | 39% | 32.4% |

#### 5.4.5.5 POVERTY

According to the highlights of the 2022 Poverty Assessment in Zambia Report, most Zambians continue to live in poverty (Figure 5-26). Poverty trends by province show that poverty levels have gone slightly down between 2015 and 2022 in Northern Province (79.7 to 78.0%) while it has increased in Muchinga Province (69.3 to 82.6%) and Central Province (56.2 to 67.5%).

Muchinga Province has the highest proportion of the impoverished population, with 82.6%. Northern Province and Central Province have slightly lower proportions (respectively 78.0 and 67.5%).

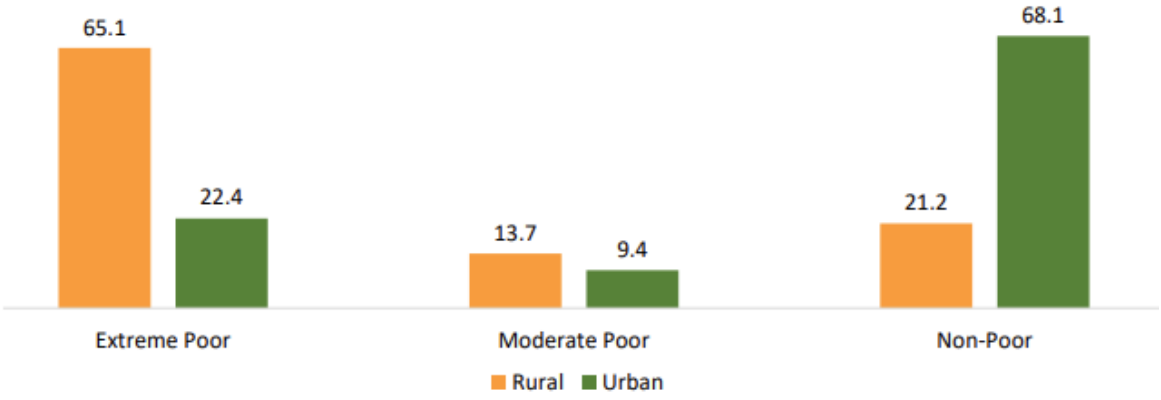



Source: Poverty Assessment in Zambia, 2022

**Figure 5-26 Poverty trends (percent) by Province, Zambia, 2015-2022**

The proportion of the population falling below the poverty line decreased from 62.8% in 2006 to 60.5% in 2010[9]. The percentage of extremely poor households marginally declined from 42.7% to 42.3% during the same period.

Poverty in Zambia has continued to be more of a rural than an urban phenomenon. The level of rural poverty is three times that of urban areas. In 2022, rural poverty was estimated at 65.1% compared to urban levels at 22.4%. Thus, 65.1% and 22.4% percent of the households in rural and urban areas, respectively, could not meet the cost of the basic food basket.




Source: CSO, 2016.

**Figure 5-27 Distribution of the Population by Poverty Level (%) Rural/Urban Poverty in Zambia**

[9] The food poverty line, which corresponds to the cost of the food basket, has been designated by the CSO as the extreme poverty line, while the basic needs basket (food + non-food items) has been designated as the moderate poverty line. Households whose per adult equivalent expenditure is less than the extreme poverty line are classified as extremely poor (or extreme % in Figure 5-27) while households whose per adult equivalent expenditure is equal to the food poverty line (extreme line) but falls below the moderate line are said to be moderately poor (overall percent in Figure 5-27). Non-poor households are those whose adult equivalent expenditure is greater or equal to the moderate line.

### 5.4.5.6 HEALTH AND LIFE EXPECTANCY

According to the world health organization statistics, in 2019, life expectancy in Zambia is 62.5. Women's life expectancy is higher (64.4 years) than males (59.5)

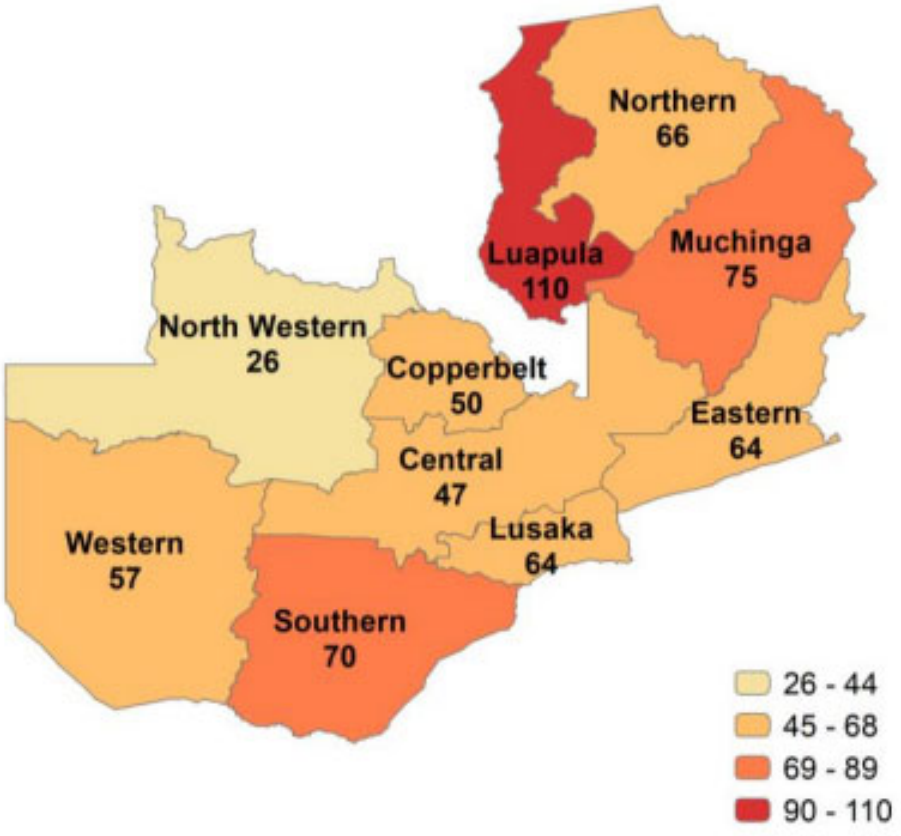
In 2019, transmissible, maternal, perinatal, and nutritional diseases accounted for 56.5% of the reported causes of death, followed by non-transmissible diseases at 34.8% and injuries at 8.7%. Malaria is the most prevalent reported disease.

As in many developing countries, maternal mortality and infant mortality are important and influence the overall life expectancy.

According to the 2010 census, in Zambia, in general, maternal deaths accounted for 9.3% of all adult (15-49 years) female deaths reported in 2010. This figure climbs to 11.8% in rural areas, compared to 6.7% in urban areas.

In 2018, the Zambian infant mortality rate (IMR) was 42 infant deaths per 1,000 live births. Again, there is a large discrepancy between the rural rate of 41 deaths per 1,000 live births and the urban one, 44 deaths per 1,000 live births. A similar pattern is observed for under-5 mortality (64 deaths per 1,000 live births in urban areas and 58 deaths per 1,000 live births in rural areas)

By province, under-5 mortality is highest in Muchinga province, with 75 deaths per 1,000 live births compared to 66 in Northern and 47 in Central. In terms of statistics, there is not much difference in health indicators between Muchinga and Northern Province. Central Province has better health indicators due to better economic conditions.



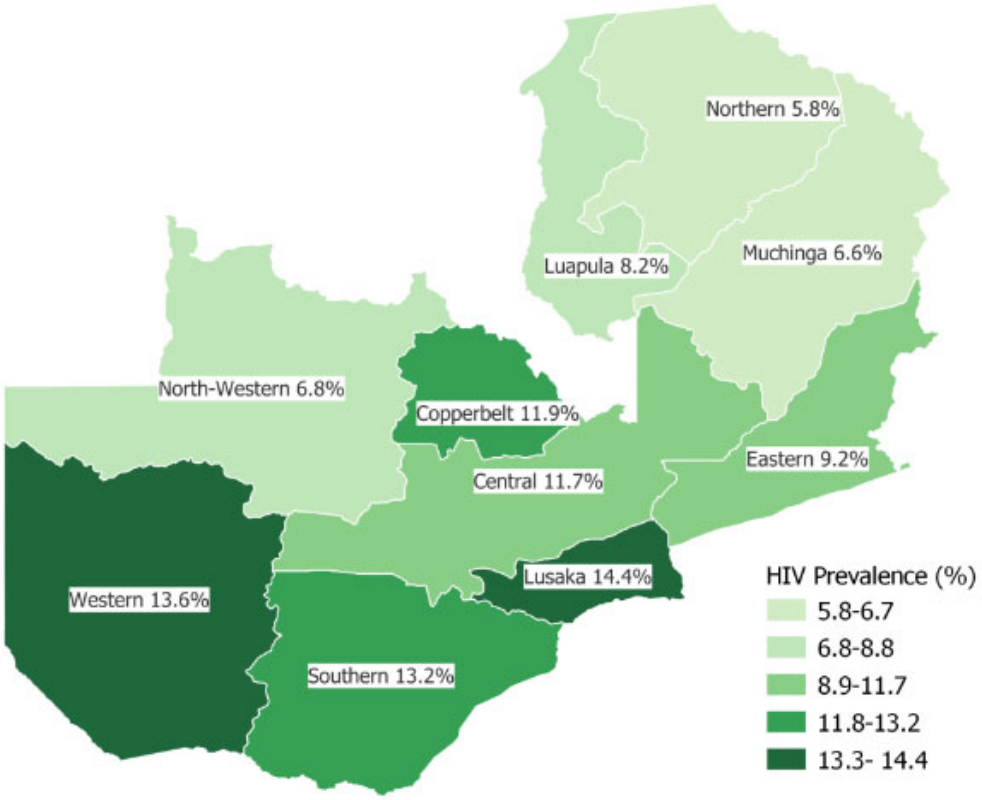

Source: Demographic and Health Survey, 2018

**Figure 5-28 Under-5 Mortality by Province (Deaths per 1,000 Live Births for the 10-year Period before the Survey)**

### 5.4.5.7 HIV

The Zambia population-based HIV Impact Assessment report, 2021 indicated that HIV prevalence among those aged 15 years and older ranged from 5.8% in Northern Province to 14.4% in Lusaka Province and was lower in rural areas, 9.2% than in urban areas, 13.5%. HIV prevalence was higher among women compared to men from the 20-24 age group to the 35-39 age group and the 45-49 age group. The largest difference was seen in the 30-34 age group, with a prevalence of 19.4% in women and 7.0% in men. By age group, HIV prevalence peaked at 29.1% among those aged 50-54 years.

The Northern and Muchinga Provinces had the lowest HIV prevalence rate at 5.8% and 6.6% in 2021, whilst Central Province had a higher rate at 11.7%.




Source: ZAMPHIA, 2021

**Figure 5-29 HIV Prevalence among Adults aged 15 years and older by Province, ZAMPHIA 2021GENDER ASPECT**

There are many socioeconomic differences between men and women in rural Zambia and in the geographical area of the Project. These differences are largely rooted in the traditional division of labour and status, or position of women relative to men in terms of opportunities and decision-making power. The sections below provide data and discussion of some important aspects that illustrate gender differences and highlight unequal power relations.

Gender-based Violence (GBV) is presented in section 5.4.7.

### 5.4.5.8 POPULATION AND HOUSEHOLD SIZE AND SEX COMPOSITION

In terms of population, and as mentioned previously, Zambia counted 19,610,769 individuals in 2022. The male population was 9,603,056 and the female population was 10,007,713. The Central Province counts 2,252,483 individuals (1,116,104 males and 1,136,379 females), the Muchinga Province with 918,296 individuals (452,600 males and 465,696 females), and the Northern Province with 1,618,412 individuals (62, 403 males and 63,905 females) (Zambia Statistics Agency, 2022). Specific population and sex composition by affected districts for 2022 are presented in the following table (Table 5-33).

**Table 5-34 Sex Composition of the Population within Affected Districts**

| District Name | Province | Male | Female | Total Population |
|---|---|---|---|---|
| Chitambo | Central | 49,393 | 51,210 | 100,603 |
| Serenje | Central | 79,075 | 79,117 | 158,192 |
| Kanchibiya | Muchinga | 46,225 | 46,827 | 93,052 |
| Mpika | Muchinga | 73,396 | 75,667 | 149,063 |
| Nakonde | Muchinga | 87,644 | 91,144 | 178,788 |
| Lavushimanda | Muchinga | 27,802 | 27,953 | 55,755 |
| Kasama | Northern | 170,168 | 178,384 | 348,552 |
| Mungwi | Northern | 101,928 | 103,168 | 205,096 |
| Senga Hill | Northern | 62,403 | 63,905 | 126,308 |

Source: Zambia Statistics Agency, 2022

The 2019 Labour Force Survey Report (LFSR) conducted by the Zambia Statistics Agency estimated that there were 3,614,037 households at the country level. The Central Province counts 359,814 households, the Muchinga Province 199, 723 households, and the Northern Province 276,023 households (Zambia Statistics Agency, 2019).The 2018 Zambia Demographic and Health Survey (ZDHS) conducted by the Zambia Statistics Agency found that 27% of households were headed by women. On average, the household size is 5 (Zambia Statistics Agency, 2018).

### 5.4.5.9 ECONOMIC ACTIVITIES AND EARNINGS

#### WORKING-AGE POPULATION

The 2019 LFSR estimated that the working-age population (15 years and older) was 9,706,101 at the country level, including 4,599,358 males and 5,106,743 females, representing a percentage distribution of 47% male and 53% female. As shown in Table 5-34 the Central, Muchinga and Northern provinces show similar sex distribution proportions in terms of the working-age population (Zambia Statistics Agency, 2020).

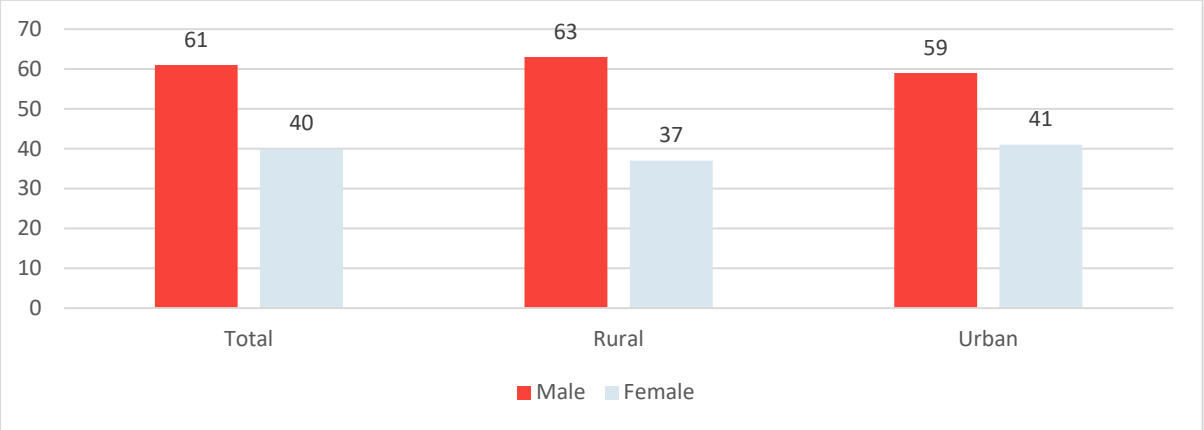
**Table 5-35 Number and Percentage Distribution of the Working-Age Population (15 years or older) by Province and Sex, 2019**

| Province | Total Population | Male (numbers) | Male (Percentage) | Female (numbers) | Female (percentage) |
|---|---|---|---|---|---|
| Central | 912, 765 | 450,498 | 49 | 462,267 | 51 |
| Muchinga | 553,307 | 264,988 | 48 | 288,319 | 52 |
| Northern | 742,339 | 353,908 | 48 | 388,431 | 52 |
| Country Level | 9,706,101 | 4,599,358 | 47 | 5,106,743 | 53 |

Source: Zambia Statistics Agency, 2019

## EMPLOYMENT

According to the 2019 LFSR, the employed population[10] was estimated at 2,995,103, of which 64% were living in urban areas and 36% were in rural areas (Zambia Statistics Agency, 2020). In terms of distribution between men and women, Figure 5-30 shows that there were more employed men than females in 2019, at 61% and 40%, respectively. A similar pattern is observed in both rural and urban areas. It is noteworthy that the LFSR found that 53% of the employed persons had completed secondary school as their highest educational level, and 29% completed primary school as their highest level of education achieved (Zambia Statistics Agency, 2020).




Source: Zambia Statistics Agency, 2019

**Figure 5-30 Percentage Distribution of Employed Persons by Rural/Urban and Sex, Zambia 2019**

In terms of occupation, the 2019 LFSR shows that except for services and sales workers, where the female proportion (57%) is higher than the male (43%), there were more males than females in all other types of main occupations, as shown on Figure 5-31. In addition to services and sales, women are mostly employed as professionals and in the category referred to as 'other'. Women account for almost half of all professionals and over a third of managers. As for men, most are employed in plant and machine operators, craft and related trade work, and the technicians and associate professionals categories (Zambia Statistics Agency, 2020).

[10] The employed population comprises all persons of working age (15 years and older) who in the short reference period were either in paid employment, self-employment or contributing family workers (Zambia Statistics Agency, 2020).

Source: Zambia Statistics Agency, 2019

**Figure 5-31 Number and Percentage Distribution of Employed Persons by Occupation, Rural/Urban and Sex, Zambia 2019**

Data displayed in the 2019 LFSR, shows employment to be either formal or informal[11]. In 2019, formal employment was estimated at 31% of all employment, while informal employment was 69% (Zambia Statistics Agency, 2020). Women are more typically employed in the informal sector, making it difficult for them to effectively compete with those who have employment experience in formal sector businesses. Moreover, persistent stereotyping of jobs that are traditionally male dominated raise barriers to entry for skilled and qualified women (World Bank, 2023). Women are also overrepresented among contributing family workers, which is 73% females and 27% males (Zamstats, 2020). The pattern of having more females than males among the contributing family workers was observed in both rural and urban areas (Zamstats, 2020). According to the 2018 DHS roughly one in three women (34%) and men (31%) aged 15-49 work in the agriculture sector (ZamStats, 2019)

## EARNINGS

Table 5-35 shows the monthly average earnings by type of employment and by sex. Across all types of employment, women earn less than men. On average, women earn 3,263 ZK per month, which equivalates to 121 US$ (roughly 4US$ per day). It is to be noted that for both men and women, working in the informal sector results in much lower earnings than in the formal sector. In the informal sector, women earn on average 1,010 ZK per month, which equivalates to 37US$ (roughly 1US$ per day). As highlighted earlier, it is important to note that most employed Zambians work in the informal sector (Zambia Statistics Agency, 2020).

[11] Formal employment is the type of employment in which employees are entitled to social security coverage and contract in addition to annual paid leave, or any such entitlement and any legal registration for own account workers/employers whereas informal employment relates to employment in which the job holders are not entitled to any social security (Zambia Statistics Agency, 2020).

**Table 5-36 Distribution of Average Monthly Earnings (in Zambian Kwacha ZK) by Type of Employment and by Sex, Zambia 2019**

| Type of Employment | Total Earnings (ZK) | Male Total Earnings (ZK) | Female Total Earnings (ZK) |
|---|---|---|---|
| Total Average | 4,010 | 4,342 | 3,263 |
| Formal | 6,025 | 6,350 | 5,241 |
| Informal | 1,468 | 1,689 | 1,010 |

Source: Zambia Statistics Agency, 2019

## POVERTY RATES

According to the 2022 Poverty Assessment in Zambia, conducted by Zambia Statistics Agency, at the country level, the incidence of poverty was estimated at 60% (60 out of every 100 persons in Zambia were poor at the time of the survey). A significant disparity is found between rural and urban areas, with respectively 79% and 32% of poverty rates in 2022. It was also found that female-headed households experience slightly higher poverty rates than male-headed households, with 63% and 59% respectively (Zambia Statistics Agency, 2023).

### 5.4.5.10 EDUCATION

Disparities are also found between men and women in the education sphere, although the 2018 ZDHS results show that most Zambians have either no formal education or only some primary education. Specifically, 60% of females and 54% of males aged 6 and over have no education or only some primary education. On average, women have completed a median of 4.6 years of schooling, while men have completed a median of 5.3 years. It was also found that men and women in the highest wealth quintile (18% and 14%, respectively) are more likely than their counterparts to have attained a higher education (Zambia Statistics Agency, 2019).

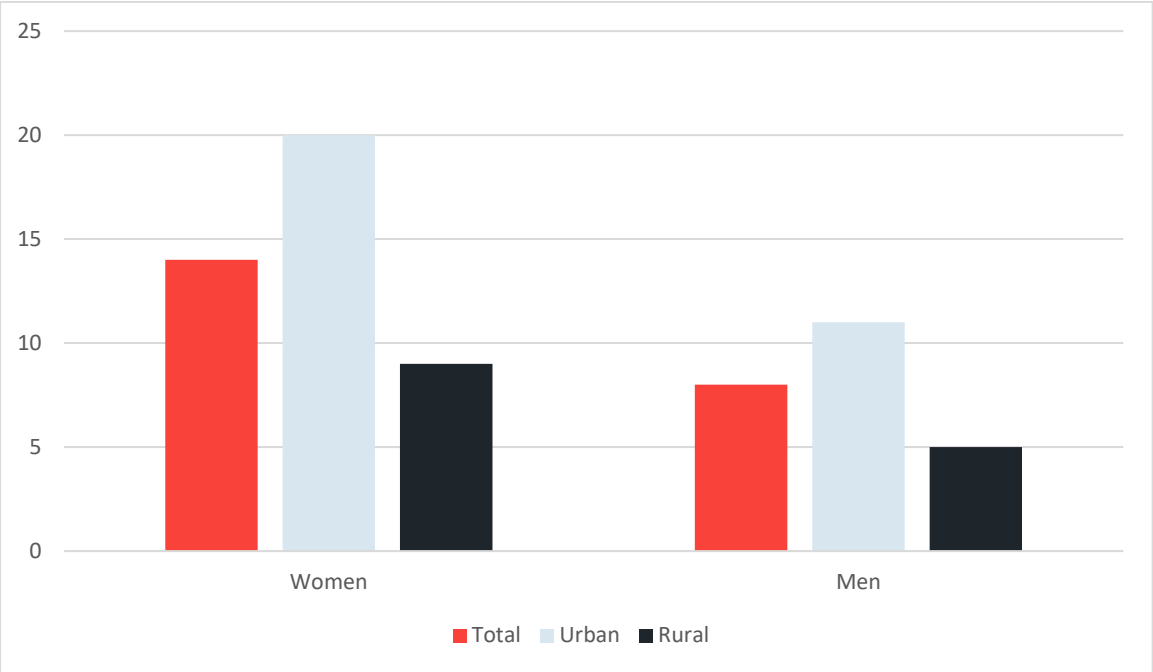
According to the World Bank 2023 Zambia Gender Assessment, gender parity has been attained at the primary school level (1.03). However, as children progress through the education system, the percentage of female students significantly drops. At the secondary level, in 2020, gender parity stood at 0.94, suggesting an average of 100 boys enrolled for every 94 girls. This situation reinforces the gender gap in education, where, because of gendered social norms and high teenage pregnancy rates, fewer girls are retained across the education system. Moreover, there remains a strong gender divide in literacy levels, with 66 percent of women being literate compared to 82 percent of men (World Bank, 2023).

### 5.4.5.11 WOMEN'S HEALTH STATUS

The maternal mortality ratio has dropped from 398 maternal deaths per 100,000 live births in 2013 to 252 maternal deaths in 2018; however, maternal deaths still account for 10% of all deaths among women aged 15-49 and close to 20% among women aged 20-24 (Zambia Statistics Agency, 2019). Drivers of maternal mortality are related to the difficulties in accessing prenatal health services, access to family planning, the lack of skilled birth attendants, and emergency obstetrics care (Zambia National Public Health Institute, 2018). The Zambian government estimates that unsafe abortion accounts for 30% of maternal mortality and 50% of gynaecologic hospital admissions (Freeman, 2017). Although the Termination of Pregnancy Act of 1972 gives women the right to safe and legal abortion services under certain circumstances, many women and girls turn to unsafe abortions due to a lack of awareness of the law, difficulty fulfilling termination conditions, predominance of Christianity and the amount of stigma associated with abortion (Population Council, 2017).

In addition, data on women's health shows that young women are four times more vulnerable to HIV/AIDS infection than their male counterparts. This gender disparity is maintained into adulthood but tends to be reduced. In Zambia, HIV prevalence is higher in urban areas in comparison to rural areas (Ministry of Health, 2023)). However, as recognised by the National Aids Council in Zambia, infrastructure Projects can lead to high risk of HIV in rural communities due to labour influx from the cities. The risk is particularly high in Projects where the workers move from site to site such as road Projects as well as transmission and grid extension Projects (National Aids Council, 2016). The driver of HIV vulnerability for women is related to the fact that they are exposed to Gender Based Violence (GBV), are often not in control of their sexual health, are less educated on sexual health and are likely to have older partners who may already be living with , 2019).

In terms of HIV prevalence, the following Figure (Figure 5-32) indicates that more women are HIV positive than men and that there is a higher prevalence in urban areas (Zambia Statistics Agency, 2019). The use of condoms is relatively low since only 50% of adults are using them when engaging in high-risk sexual intercourse (AVERT, 2019)




Source: Zambia Census of Population and Housing, 2019

**Figure 5-32 Percentage of Women and Men aged 15 to 49 who are HIV positive, Zambia 2018**

National AIDS Council (NAC) is the national body mandated to coordinate the national multi-sectoral HIV/AIDS response. It operates at the provincial and district levels through the Provincial HIV and AIDS Committee (PHAC) and District HIV and AIDS Committee (DHAC) (what used to be referred to as the Provincial AIDS Task Force and the District AIDS Task Force). The PHAC and DHAC are supported by the Provincial Aids Coordination Advisor (PACA) and District Aids Coordination Advisor (DACA) who sit under provincial and local government, respectively (National Aids Council, 2022),

### 5.4.5.12 GENDER DIVISION OF LABOUR, DECISION-MAKING PROCESS AND WOMEN'S EMPOWERMENT

#### GENDER DIMENSION OF HOUSEHOLD TASKS

In a typical small-scale agricultural Zambian household, women are generally responsible for more chores (weeding, harvesting, stocking, marketing and processing) than men (soil preparation and ridging) and perform them over a longer period of the year (ADB and ADF 2006; SIDA 2008). Additionally, women farmers are often responsible for cooking, heating, collecting firewood and taking care of children. Women in rural areas spend more than two hours daily collecting firewood and four more hours cooking (SIDA, 2008). Most Zambian girls are culturally expected to do more household chores than their brothers who go to school (SIDA, 2008).

The HIV/Aids pandemic brought an extra burden to many women as caring for sick relatives (husbands) is traditionally seen as a feminine task instead of working in the fields (SIDA 2008).

During 2019 focus group discussions with women, many highlighted the burden of having to deal with many chores while taking care of the children; in fact, women complained that they work more than men. Participants also mentioned having too many children early in life, suggesting that they may not have had a choice in the matter.

## GENDER DIMENSION OF AGRICULTURAL TASKS AND LAND TENURE

Generally, women in Zambia are the main producers, providers, and traditional managers of food production for household subsistence. However, they cannot access and control over land and productive resources (World Bank, 2023). A wide variety of crops such as maize, sorghum, millet, beans, groundnuts and cowpeas are grown and mostly sold in local markets (ADB and ADF 2006). Households headed by females are less prone to adopt farming cash/export-oriented crops, than households headed by males which grow, to a greater extent, cash generating crops (e.g., cotton, tobacco, horticulture, and sugar cane) (SIDA, 2008). Women farmers are most often engaged in small-scale subsistence farming with poor access to good land, seeds, technology, markets, and credit (SIDA, 2008).

Women's lack of access to market support services limits the amount of cash income they can earn for themselves and their families (ADB and ADF 2006). Due to their lower income, female-headed households own less equipment essential for developing farming and land titles (SIDA, 2008), and are often unable to buy livestock such as cattle, goats and pigs. This is also due to traditional management approaches in certain provinces, which do not allow women to herd cattle (SIDA, 2008).

Zambia has two land tenure or ownership systems: statutory land and customary land. Customary law follows a patriarchal structure and is the most common allocation system. The local chief may allocate a plot to a single woman, particularly if she has children, but not to a married woman. Women are often given land of lower quality (SIDA, 2008). Widows and female-headed households also raised this issue during the consultant's social survey of 2019.

## GENDER DIMENSION OF DECISION MAKING AND CONTROL OVER EARNINGS

At the country level, it has been highlighted by the World Bank's 2023 Zambia Gender Assessment that participation of women in decision-making positions remains very low, with the most recent parliament consisting of only 15 % of women in 2021 (World Bank, 2023).

In rural Zambia, women's ability to participate in decisions within households is influenced by several factors, such as their education level, income generation capabilities, income contribution to the household, and age (SIDA, 2008). Women's lack of access and control to education, markets and public life make them financially dependent and limit their control of resources and ability to make independent decisions (SIDA 2008). Indeed, the 2018 ZDHS collected data on women's participation in major household decisions (women's own health care, daily household purchases, major household purchases, and visits to the woman's family or relatives) and confirmed the persistence of those limiting factors. The results show that the higher their educational level, the more women tend to make decisions in all four areas of decision-making. Similarly, women in the highest wealth quintile are most likely to make decisions in all four areas (Zambia Statistics Agency, 2019).

At the country level, 57% of currently married women aged 15 to 49 years old make decisions either alone or jointly with their husband in all four specified areas. Women were most likely to report making decisions on daily household purchases (86%) and decisions concerning their own health care (81%). Seventy-seven percent of women indicated that they participated in making decisions about visiting their family or relatives, while 68% made decisions on major household purchases. Among currently married men aged 15 to 49 years old, 82% made decisions regarding their own health care and 87% made decisions concerning major household purchases. These findings show that while men and women have similar decision-making power in certain respects, women lag behind in terms of having control over making major household purchases (Zambia Statistics Agency, 2019). That women are responsible for household expenses paid from their own earnings could also be considered to be a burden, especially in poor households

Gender is also a factor affecting farming decisions in rural Zambia. The person managing the crop has generally a larger voice in how the resulting income will be spent (ADB and ADF 2006). Yet, as a result of male control over production resources, especially land, credit, and technology, men usually take control of the income resulting from sales of agricultural produce. However, women continuously contribute to this process (ADB and ADF 2006). A disparity is observed between rural and urban areas. The 2018 ZDHS decision-making results show that women in urban areas (68%) are more likely than those in rural areas (49%) to make decisions in all four areas.

Women's control over their earnings is a good indicator to observe disparities in this context. In Zambia, 31% of currently married women aged 15 to 49 reported that they mainly decide how to use their earnings, 51% reported that they make decisions jointly with their husband, and 18% indicated that their husband mainly decides how to use their earnings. The percentage of women indicating that their husband mainly makes decisions on their earnings decreases with increasing education, from 30% among those with no education to 7% among those with a higher education. A similar trend is observed with the women's position in the wealth quintile. The percentage of women indicating that their husband mainly makes decisions on their earnings decreases with increasing wealth quintile, from 29% in the lowest wealth quintile to 10% among those in the highest wealth quintile (Zambia Statistics Agency, 2019).

#### HOUSE, LAND, BANK ACCOUNT AND MOBILE PHONE OWNERSHIP

Ownership and control of assets such as land and housing provide multiple benefits to individuals and households, including a secure place to live, livelihoods, and collateral for loans. The ZDHS collected information on women's and men's ownership of assets, regardless of whether the assets were self-owned or jointly owned. Overall, women are more likely to share ownership of a house (22%) than men (14%). Conversely, men (17%) are more likely than women (8%) to own a house alone. Similarly, a higher percentage of women than men reported sharing ownership of land (18% versus 12%), while a higher percentage of men than women own land alone (15% versus 6%) (Zambia Statistics Agency, 2019).

Documentation of ownership of assets is important for security of tenure and to leverage or liquidate assets. Eight in 10 women (81%) and 9 in 10 men (91%) age 15-49 who own a house do not possess a title or deed for the house. Similarly, 9 in 10 women (89%) and men (94%) who own land do not have a title or deed for their land. (Zambia Statistics Agency, 2019).

It is to be noted that among ever-widowed women aged 15 to 49 years old, at the country level, nearly half (47%) were dispossessed of their husband's property (that is, after their late husband's death, none of his assets went to them). Land and house property grabbing is the practice of dispossessing surviving spouses of property after the death of their partner by family members of the deceased. This practice is likely to increase the victims' vulnerability to poverty.

The 2018 ZDHS estimates that among ever-widowed women aged between 15 and 49, nearly half (47%) were dispossessed of their husband's property (Zambia Statistics Agency, 2019). In 2019, during the consultant's survey, female participants reiterated their fear of property grabbing by family members.

Ownership of a bank account and a mobile phone are reflections of autonomy and financial independence. Women and men interviewed in the 2018 ZDHS were asked if they have an account in a bank or other financial institution that they use and if they own a mobile phone. More than half of women (53%) and men (66%) aged 15 to 49 years old owned mobile phones at the time of the survey, at the country level. In terms of bank account ownership, only 11% of women aged 15 to 49 years old at the country level declared to have one, compared to 18% of men aged 15 to 49 years old. The percentage of women owning a bank account increases with increasing wealth quintile, from 0.3% in the lowest wealth quintile to 34% among those in the highest wealth quintile. A similar trend is observed with men, from 0.5% in the lowest quintile to 46% in the highest quintile (Zambia Statistics Agency, 2019).

### *5.4.6 GENDER-BASED VIOLENCE (GBV)*

GBV is a growing concern for lenders and the Zambian government and is becoming the centre of attention of many policies and country wide strategies. Due to the presence of large workforces made of men with paid wages, many Projects represent a risk that prevailing GBV may worsen. It should be noted that Sexual exploitation and abuse (SEA) and Sexual harassment (SH) are specific forms of GBV that are common in infrastructure Projects. In this ESIA they are studied under the umbrella term GBV.

#### 5.4.6.1 GENDER-BASED VIOLENCE DEFINITION

According to the World Bank Guidance Good Practice Note on Sexual Exploitation and Abuse and Sexual Harassment in Investment Project Financing involving Major Civil Works (2022), 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, mental, sexual harm or suffering; threats of such acts; and 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:

- Defilement, child pregnancies and early marriages, trafficking and child labour;
- Workplace sexual harassment;
- Physical violence;
- Emotional abuse (such as humiliation, controlling behaviour, degrading treatment, insults, and threats);
- Economic abuse and the denial of resources, services, and opportunities (such as restricting access to financial, health, educational, or other resources with the purpose of controlling or subjugating a person);
- Sexual exploitation which is an actual or attempted abuse of a position of vulnerability for sexual purposes, including profiting monetarily, socially or politically from the sexual exploitation of another (UN Secretary-General's Bulletin on protection from sexual exploitation and abuse (PSEA) (ST/SGB/2003/13));
- Sexual abuse which is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions (UN Secretary-General's Bulletin on protection from sexual exploitation and abuse (PSEA) (ST/SGB/2003/13));
- Sexual harassment, which refers to any form of unwanted verbal, non-verbal or physical conduct of a sexual nature with the purpose or effect of violating the dignity of a person, in particular when creating an intimidating, hostile, degrading, humiliating or offensive environment. This may include unwelcome sexual advances requests for sexual favors and may take place through online activity or mobile communications as well as in person (WB, 2022).

#### 5.4.6.2 BASELINE SITUATION

##### METHODOLOGY

Establishing a baseline for GBV and sexual exploitation and abuse (SEA) is a delicate exercise and the World Bank does not recommend carrying out GBV surveys with individuals who suffered from GBV. Instead, baseline conditions should be based on consultation with a variety of stakeholders, such as political, cultural, or religious leaders, health teams, local councils, social workers, women's organizations, and groups working with children (World Bank, 2022). This exercise was initiated during the 2017 ESIA where rounds of consultation were carried out from 2013 to 2017 and a holistic approach was adopted during 2019 stakeholder meetings.

The rounds of consultations carried out in 2019 engaged in further communication with stakeholders and communities on GBV and gender aspects. Minutes of consultation conducted in 2019 are included in Appendix 7-8. During these consultations and social surveys, local organizations, NGOs and women from communities were met to:

- Understand the type of GBV present in the community and how the Project may exacerbate them;
- Identify groups of individuals that are the most vulnerable to be harmed and in which situation or location they feel most unsafe;
- Present the requirements from the WB regarding preventing and addressing GBV;

- Collect return of experience on how the community deals with GBV and how actual local support may be adapted to face the risks from the Project and to comply with the WB requirements;
- Collect perceived risks of GBV in the community;
- Identify and locate services available to GBV's victims from NGOs working on gender and GBV issues and local health centres and describe how easily women and victims have access to these services.

In addition, representatives of the Ministry of Gender were consulted to collect regulatory and institutional information, and collect and analyze country diagnostics, policies and strategies on gender and GBV. The consultant also collected information on gender-related Projects funded by international lenders.

The National Coordinator of the Victim Support Unit (VSU) from the Police in Lusaka was met to present the main concept of the GBV Action Plan and to validate the need to involve the VSU in this action plan (see ESMP for the action plan).

Locally, district-level agencies, such as health departments and social services, participated in meetings. The goal of these meetings was to gather information on experiences of how past infrastructure Projects performed in terms of women and child protection.

NGOs working as GBV service providers were met in the Project area (i.e., one-stop centres, shelters, NGOs). Lastly, during rapid surveys along the wayleaves, several informal discussions took place with women to collect their perceived risks related to the Project.

Tables showing the number of consultations and the number of focus group discussions that were held with women are presented in Appendix 7-8.

## SOCIAL, CULTURAL AND ECONOMIC FACTORS THAT MAY LEAD TO GBV AND SEA RISKS

### GENERALITIES ABOUT ZAMBIA

The Zambian government published several strategic and policy documents setting objectives to reduce gender inequality and GBV, and promote gender mainstreaming:

- Gender Division, National Gender Policy 2023;
- National Gender Monitoring & Evaluation Plan 2011-2015. In addition, the 2017-2019 Gender Status Report, a Baseline Review, provides sex-disaggregated statistics for indicators developed in this monitoring and evaluation plan;
- National Strategy on ending child marriage in Zambia 2016-2021.

In Zambia, there are a few generalities regarding gender; these are a selection of them (2017-2019 Gender Status Report, a Baseline Review):

- Most heads of households are men, nonetheless 27% of households are headed by women (Zambia Statistics Agency, 2018); Zambia ranks 124$^{th}$ in 137 countries on Gender Inequality Index, revealing large discrepancies between men and women;
- Literacy rates are lower for women (with 66 percent of women being literate, compared to 82 percent of men (World Bank, 2023); Women have higher HIV rates than men (Zambia Statistics Agency, 2019);
- Of the working population, 40% of women are employed, most of which are in the informal sector (Zambia Statistics Agency, 2019);
- Women marry earlier than men in Zambia; in 2018, the median age at first marriage was 19 years old, compared to 24 years old for men. It was found in 2018 that 9% of girls were first married by the age of 15 years old, compared to 1% for boys (Zambia Statistics Agency, 2019). This is the result of customary law, where the age of marriage for women coincides with puberty (National Strategy on ending child marriage in Zambia 2016-2021).;

- 11% of married women between the ages of 15 and 49 reported to be in a polygamous marriage. This rate has been in decline as it was 18% in 1992. Women with no education (18%) are more likely to have co-wives than women with higher education (2%) (Zambia Statistics Agency, 2019);
- Attitudes around wife beating: 46% of women aged 15 to 49 years old agree with at least one specified reason justifying wife beating. Reasons are: she burns the food, she argues with him, she goes out without telling him, she neglects the children, and she refuses to have sex with him (Zambia Statistics Agency, 2019).

## GBV CONTRIBUTING FACTORS

GBV is widespread in Zambia. Indeed, 36% of women aged between 15 and 49 years old have experienced physical violence since the age of 15, and 14% have experienced sexual violence. Of note, the Muchinga Province registers higher rates of the country in terms of physical violence, with 53% of women having experienced violence; as for sexual violence, 24% of Muchinga women have experienced it. In approximately 95% of the cases of both physical and sexual violence, the perpetrators are current or former husbands or partners. Additionally, 32% of ever-married women aged between 15 and 49 years old reported that their husband/partner demonstrates three or more specific behaviours such as jealousy, control, isolation. Women were most likely to report that their husband/partner is jealous or angry if they talk to other men (57%) and that they insist on knowing where they are at all times (52%) (Zambia Statistics Agency, 2019).

Factors contributing to GBV include cultural practices and the strong economic dependency of women. GBV often takes place within the family and is culturally tolerated, where women usually do not report spousal abuse due to their economic dependence on their husbands, social norms, and fear of stigma. Other contributing factors include alcohol and drug abuse, poverty, and the customary and statutory legal system, which does not always recognize violence within the marriage as a crime (USAID/Zambia Gender-Based Violence Programming Evaluation, 2010). However, there are signs of changes since some Chiefs are now also championing anti-GBV measures and working in close collaboration with GBV services providers (Chief Chikwanda (around Mpika District) and Chieftainess Nawaitwika (around Nakonde District)). During the 2019 round of consultation, NGOs mentioned that GBV cases are higher in areas where Chiefs do not adhere to the fight against GBV.

Recent efforts to strengthen the involvement of chiefs in GBV prevention and response include the establishment of four Village One Stop Centres (VLOSCs) at the chiefdom level by the National Legal Aid Clinic for Women (NLACW) under the GRZ-UN Joint Programme on GBV Phase II. The VLOSCs can be found in Chief Chamuka's chiefdom (Chibombo) and Chief Mumena's chiefdom (Solwezi). Other programs, such as the EU-funded Natwampane program, have worked with chiefs in Northern and Luapula Province to establish by-laws that prohibit acts of GBV, including child marriage. The nonrecognition of GBV leads to a situation where women do not seek help when they are experiencing violence. Overall, in 2018, it was highlighted that women aged between 15 and 49 years old who have experienced physical or sexual violence have a tendency not to seek help nor tell someone. Almost half (52%) did not seek help or tell anyone, while 13% told someone without seeking help, and only 35% sought help (Zambia Statistics Agency, 2019).

Another contributing factor highlighted during meetings with NGOs working on GBV in Mpika and with other NGOs in the Project area relates to sudden changes in the economic situation of households. Many poor households usually marry off their daughter to have fewer household fees or when they are faced with hard economic times. For example, periods of school fees and fish ban period are related to GBV. Many households do not have the means to pay for school fees in January because households are running short of food at that time of the year.

Participants also corroborated their difficulty paying school fees during the social surveys. An NGO is working on addressing this issue by giving goats to poor families that find it difficult to pay these fees (discussion with DOPE, 2019).

Two stakeholders that were consulted during 2019 meetings mentioned that the lack of social amenities in villages is also a contributing factor, as young girls are very interested in meeting outsiders to take them out of rural areas.

## PRE-EXISTING AND WELL-IDENTIFIED VULNERABILITIES AND SOCIAL CONTEXT IN THE STUDY AREA

Most forms of GBV are found in Zambia, including defilement, where there is a widespread perception that having unprotected sex with a minor or a child who is a virgin will cure the one who has HIV/AIDS. Most of the time, the defiler is a member of the family. Sexual cleansing is also practised in Zambia in which a widow is forced to have sex with the brothers of the deceased spouse (USAID/Zambia Gender-Based Violence Programming Evaluation, 2010). During 2019, consultation with stakeholders and NGOs, child marriage, unwanted pregnancies and defilement were mentioned as the most common forms of GBV.

The most common situations encountered in the Project area involve workers coming to a site, young girls being pushed from their families to meet the workers with the hope of having their daughter married, but after a short period of "consensual" relationship, the workers leave the site and the young girls are left alone, pregnant, so they drop out of school to take care of their children or resort to unsafe abortions which accounts for 30% or maternal deaths in Zambia (Freeman, 2017) despite abortion being legal during certain circumstances.

Given the pre-existing social issues, especially when some forms of GBV are culturally tolerated and widespread, women and children are at further risk of GBV by Project workers and economic migrants and the influx of labour can easily exacerbate their vulnerability. The lack of access to quality GBV response services for victims adds to the vulnerability. However, things are improving since most districts are actively addressing the GBV issue in the Project area (through a GBV task force), and according to many NGOs consulted in 2019, GBV services and awareness programs are now widespread and reach women even in rural areas. Further analysis of GBV service providers per district is provided in chapter 7 of the ESIA.

## CONCERNS RAISED BY WOMEN DURING THE FIRST ROUNDS OF PUBLIC CONSULTATIONS

During the four rounds of public consultation between 2013-2017, many participants discussed gender issues, mainly in the form of grievances related to the Project:

- Fear of HIV and other STD transmission and the need to have HIV awareness programs;
- Fear that women will be less considered than men in the resettlement and stakeholder engagement process;
- Women fear that cash compensation would be detrimental to them and the household since many men do not know how to manage money and will be tempted to abandon their families;
- Women wish to have equal chances of finding a job during construction and that specific measures be taken to ensure equal chance and equal salary;
- Selling food to Project staff should be reserved for local women with the help of local headmen;
- Women fear intimidation by men when they apply for a job;
- Women fear that men employed for the Project will spend their money drinking alcohol;
- There is a legacy of GBV from the existing Pensulo-Kasama 330kV line, where unwanted and unsupported pregnancies, HIV propagation and social disruption were reported by community members;
- There is a legacy of GBV from the Mungwi road construction, where unwanted and unsupported pregnancies and HIV propagation were reported by community members;
- Participants feel that previous contractors in the area did not collaborate with provincial authorities in the implementation of HIV prevention programs;
- Communities felt that there was a need to locate the workers camp as far from villages as possible to prevent interaction between workers and community members, and a need for workers to return every weekend to their families to reduce promiscuous behaviours;
- Communities fear that young girls will be vulnerable to sexual abuse due to the presence of workers with high salaries;
- Communities requested that a Code of Conduct (CoC) be imposed on workers and that this CoC includes sanctions;

- Communities requested that an emphasis be put on raising awareness of child abuse;
- Women requested that spouses be allowed to visit their husbands in the camp during weekends to reduce promiscuous behaviour with local women.

#### CONCERNS RAISED DURING THE 2019 ROUNDS OF PUBLIC CONSULTATION

According to 2019 meetings with stakeholders and focus groups with women, the main forms of GBV in the study area include defilement, child pregnancies, early marriages and physical violence. In addition, women have highlighted that Chiefs are not always addressing GBV or being helpful, especially when perpetrators are related to the Chief. Many stakeholders mentioned that poverty often leads to these forms of GBV and that GBV is deeply rooted in the culture, especially in rural areas where there is a culture of secrecy. In addition, increases of GBV during construction of infrastructure Projects were often mentioned by stakeholders.

Widows and female-headed households also mentioned land grabbing, or the fear of land grabbing, by family members during 2019 surveys as a form of GBV. They highlighted that resettlement could even be a good thing because it would give them the opportunity to move away from family members.

Participants proposed means to address GBV during the Project; most people highlighted the need to engage in continuous sensitization and awareness programs with the community prior to the Project. Other measures are developed in chapter 7 of the ESIA (Impact chapter). Minutes of meetings are found in Appendix 7-8.

### 5.4.7 VULNERABLE GROUPS

Vulnerable groups are usually more adversely affected by project impacts and/or more limited than others in their ability to take advantage of a project's benefits than others on the basis of their socioeconomic characteristics, such as sex, disability, ethnic/tribe, social origin, age, religion, language, marital status, migrant status or economic status. The government of Zambia has specifically identified women, youth and persons with disabilities as targeted citizens (similar to vulnerable groups), which is reflected in the national Social Safeguard Standards for the energy sector. These are groups that have been marginalized or disadvantaged and whose access to economic resources and development capacity has been constrained. Important to note is that although women, youth and persons with disabilities (PWD) are subjected to certain vulnerabilities, they are not homogenous categories. Overlapping identities may cause additional vulnerability.

#### VULNERABLE HOUSEHOLDS

According to the socioeconomic survey of 2017[12], the factors making some households more vulnerable than others include disability or illness of the head of households or of a household's member, households headed by a woman or child, and households that own only one land parcel that is likely to be impacted by the Project.

About 27% of households in Zambia are headed by women. In 2018, the average income among female-headed households was only 70% of the average income among male-headed households (Zambia Statistics Agency, 2016). As a result of lower income levels, female-headed households are slightly poorer than male-headed households and this difference is more pronounced in urban areas where close to 30% of female-headed are poor (moderate or extreme) compared to male-headed households at 22% (Zambia Statistics Agency, 2016).

#### WOMEN AND GIRLS

Cultural practices around land may disadvantage women during resettlement. Although woman usually have access to land through men (fathers, husbands, brothers, or sons) the male head of household typically exercises primary control over the land (FAO, 2018), which often disadvantage women from benefitting from compensation or livelihood restoration support. This is likely to be exacerbated in polygamous households, where junior wives may experience additional vulnerabilities due to their lower status in the marriage (FIG Congress, 2006).

12 Note that socioeconomic surveys were completed for the first RAP in 2017. In 2019, more surveys were conducted for the first RAP update.

Women in polygamous marriages are most frequent in Muchinga (14%) and Northern Province (13%) and less prevalent in Central Province (8%) (Zambia Statistics Agency, 2019)

Women may also be limited in taking advantage of employment opportunities with the project. Out of the working-age population in Zambia, more than two-thirds of men (71%) are in formal employment compared to women at 29% (Zambia Statistics Agency, 2019). In large infrastructure projects, creating thousands of job opportunities, women are often discriminated against due to gender stereotypes that construction work is too physically demanding and not appropriate for women. This is despite women performing a number of tasks that requires physical strength such as collection of firewood, fetching water, and work in the field.

Women and girls are also vulnerable to Sexual Exploitation, Abuse and Harassment (SEAH) as a negative project impact. In 2018, 36% of Zambian women reported to have experienced physical violence at least once since the age of fifteen. There is a high acceptance towards violence, as 46% of women and 26% of men agree that a husband is justified in beating his wife under certain circumstances. Higher disposable incomes among male workers of the project may lead to higher level of SEAH due to increased alcohol consumption. There is a strong relationship between alcohol and SEAH, as women whose husband/partner is often drunk are much more likely (84%) to experience violence than women whose husband/partner does not drink alcohol (34%). Poverty and unemployment can also lead to sexual exploitation where women are offered jobs in the project in exchange for sex as well as young girls dropping out of school, sometimes encouraged by their families to start relationships with the workers.

## CHILDREN AND YOUTH

In 2018, youths aged 15–34 accounted for 77% of unemployed persons in Zambia (Zambia Statistics Agency 2019). Further, close to half (45%) of youths in Zambia are not in employment, education or training (NEET). Young women are overrepresented among the youth NEET at 53% compared to young men at 36% (Zambia Statistics Agencys, 2019).

Young women, especially NEET, are likely to be more vulnerable to sexual exploitation and abuse from project workers, especially when combined with high poverty levels, leading to negative impacts in terms HIV/AIDS as well as unwanted/unsupported pregnancies or unsafe abortions. The high level of unemployment among youth also makes them more likely to accept exploitative working conditions if offered employment. According to the 2018 Labour Survey, youth make up 64% of the total persons in precarious employment (ZamStats, 2019).

According to the 2014 Zambia Violence against Children Survey (VACS), violence against children is rife in Zambia. One in three females and two in five males aged 18–24 years experienced physical violence prior to age18. A quarter of male and female respondents aged 13–17 years experienced physical violence 12 months prior to the survey The most frequent perpetrators of the first incident of sexual abuse prior to age 18 for females and males were spouses, boyfriends/girlfriends, romantic partners and friends (Ministry of Youth, Sport and Child Development, and al., 2018)

## PERSONS WITH DISABILITIES (PWD)

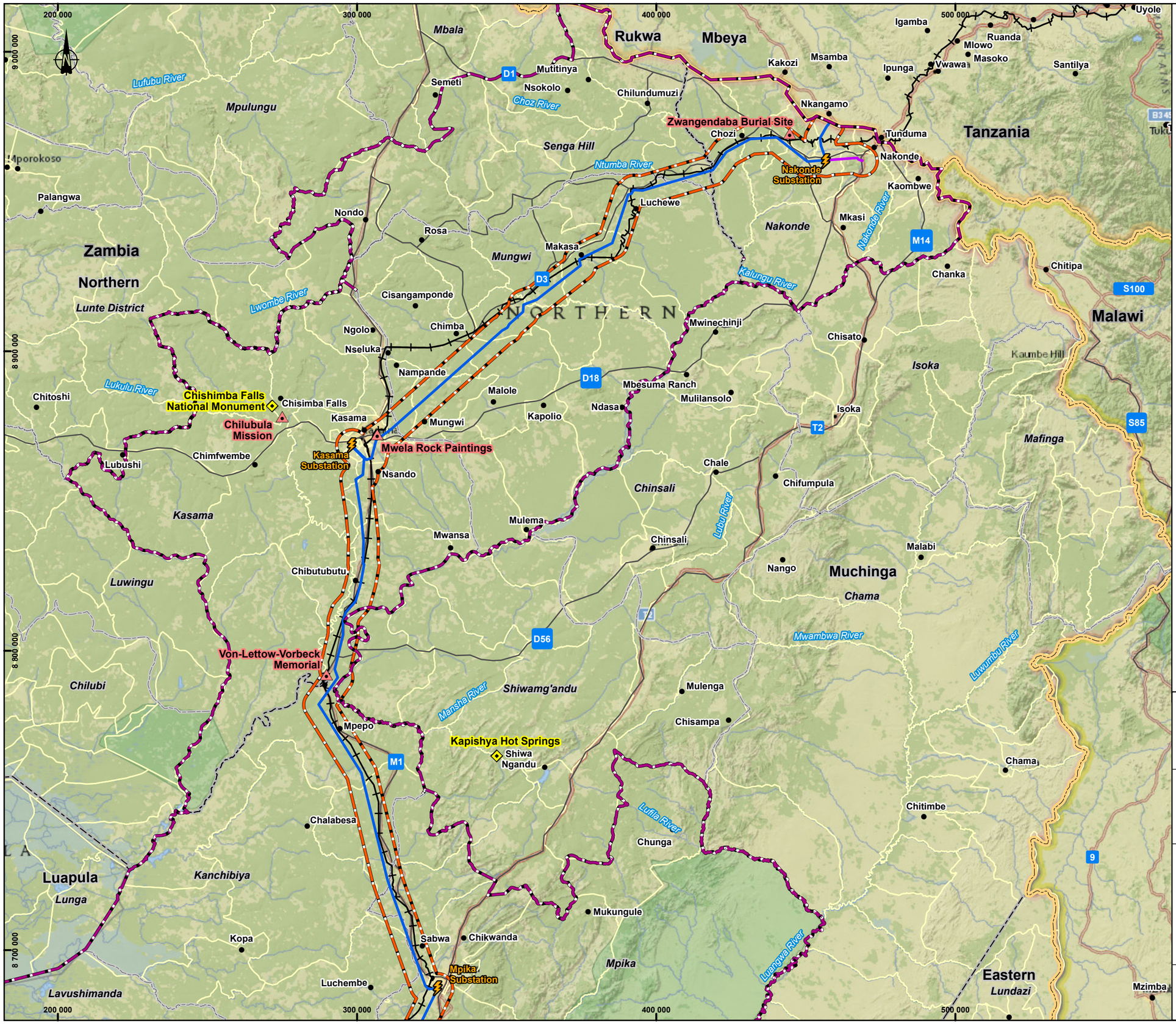
The Government of Zambia recognises disability as a human rights and developmental issue, in line with the United Nations Convention on the Rights of Persons with Disabilities. Based on the this, The Persons with Disabilities Act No. 6 of 2012 defines a person with disability as “a person with a permanent physical, mental, intellectual or sensory impairment which, in interaction with various barriers, may hinder that person to fully and effectively participate in society on an equal basis with others”. According to the Zambia National Disability Survey in 2015, disability prevalence among adults above 18 years is estimated to be around 11% in both urban and rural areas (Zambia Statistics Agency, 2018). The most common activity limitation among PWD is seeing (50%). This is followed by problems with walking (26%), remembering (15%), hearing (14%), self-care (6%), and communication (5%). A large majority (58 %) reported mild disability for these activities. Moderate and severe disability were highest for sight and mobility difficulties (Zambia Statistics Agency, 2018). Persons with disabilities are more likely to be excluded from or unable to participate fully in the mainstream consultation process as well as benefitting from employment opportunities and other project benefits.

### OTHER VULNERABLE GROUPS

As mentioned earlier, overlapping identities may cause additional vulnerability. In that sense other vulnerable groups are identified, which may include the elderly (especially widows), chronically ill, orphans and single mothers.

## 5.4.8 ARCHAEOLOGICAL AND CULTURAL RESOURCES

Several archaeological and cultural resources sites have been inventoried in the extended study area (see Map 5-25 and Map 5-26).




**Human Environment**

- Nakonde — City / Village
- Zambia — International Boundary
- Northern — Province Limit
- Nakonde — District Limit
- Ward Limit
- Road
- Railroad

**Cultural Heritage Sites**

- Cultural or Archaeological Site
- Touristic Site

**Project Components**

- Local Study Area
- Social Extended Study Area
- Proposed 330 kV Transmission Line
- Proposed 132 kV Transmission Line
- Substation

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*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-25**
**Cultural Heritage**
**Nakonde - Mpika Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

0 12,5 25 km
UTM 36S, WGS84

**21 juin 2024**

*Preparation: H. Chouinard*
*Drawing: F. St-Hilaire-Dorion*
*Validation: M. Brennan Jacot*

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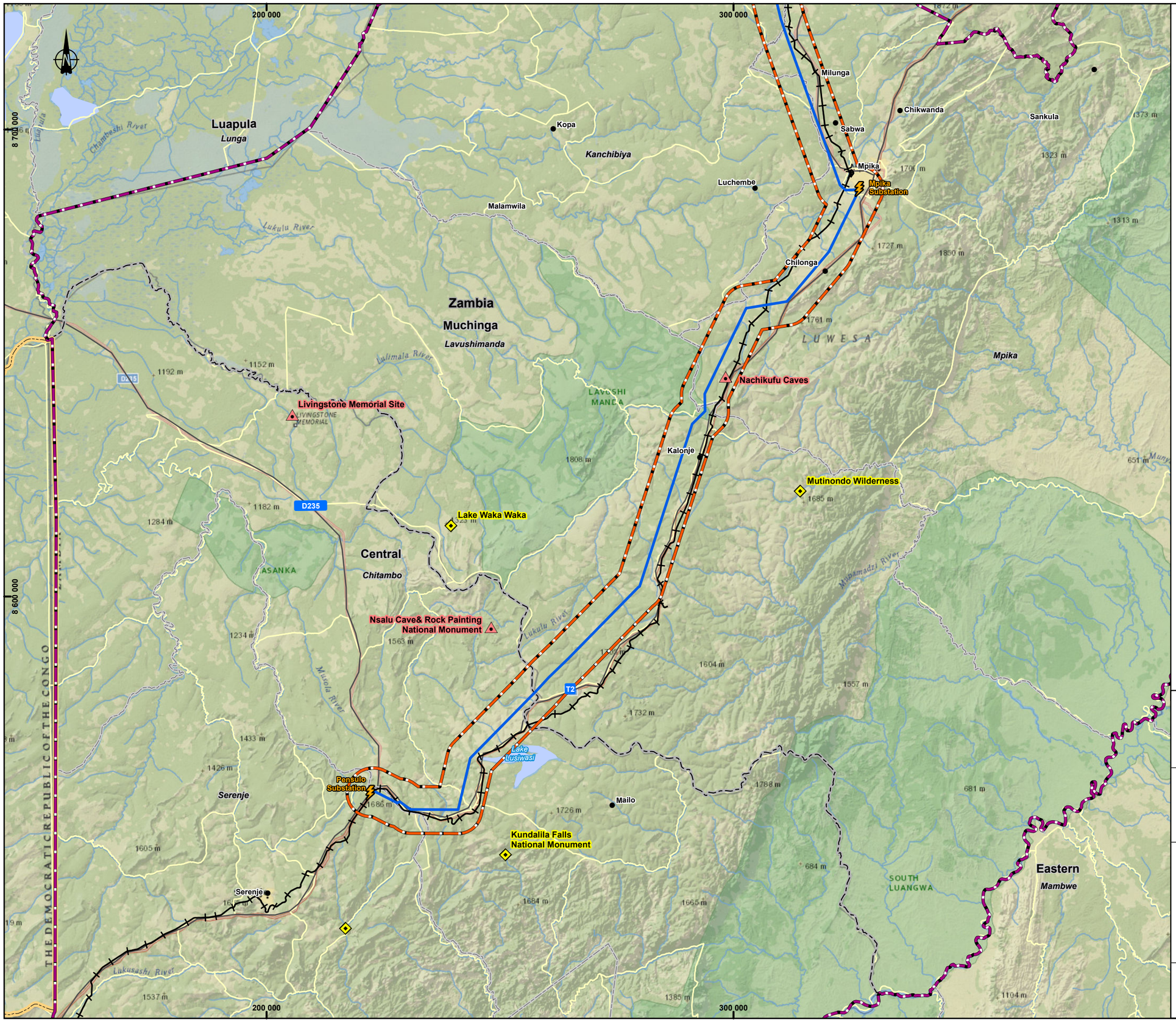
*Boundaries and measurements shown on this document must not be used for engineering or land survey delineation. A land register analysis conducted by a land surveyor was not undertaken.*

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ZESCO Powering the Nation

*Zambia-Tanzania Interconnector Project*

*Environmental and Social Impact Assessment (ESIA) Update*

**Map 5-26**
**Cultural Heritage**
**Mpika - Pensulo Segment**

***Sources :***
*ESRI, National Geographic and World Hillshade*
*MapLibrary, Africa World*
*Protected Planet and Birdlife International*
*Open Street Map, 2019, roads, railways, rivers*
*Zambia Ministry of Land, districts*

0 8 16 km
UTM 36S, WGS84

**19 juin 2024**

*Preparation: H. Chouinard*
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*CA0027197_7329_EIC5_25_26_CulturalHeritage_031_032_240619*

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*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.*

### 5.4.8.1 ARCHAEOLOGICAL SITES

#### MWELA ROCK PAINTINGS

Mwela Rock paintings are located about 5 km from Kasama town, encompassing eastwards rock outcrops of Mwankole, Sumina, Mulundu, Fwambo, Changa Mwibwe, and westwards, 10 km from the town of Lwimbo rock outcrops. The paintings are associated with the Later Stone Age and are remnants of the Twa people (sometimes referred to as "Bushmen"), who were the early inhabitants of Zambia before the arrival of the Bantu and other people. These rock paintings date back 3,000 years or more.

The site's topography is generally fairly undulating, and deeper soils are more frequent, whereas the central part is generally flat. The outcrops form part of the boundary of the extension of the main plateau areas. The site is also incised by abundant streams and extends over 100 $km^2$. More than 1,000 paintings have been recorded in the rock outcrops, making Mwela Rock Paintings National Monument one of Africa's densest concentrations of rock art sites.

The site is protected under the National Heritage Conservation Commission (NHCC) Act, Cap 173 of the laws of Zambia and was declared collectively as a National Monument under Government notice no. 255 of 1964, bearing the name of Mwela. Part of the area is further protected under the Forestry Act as it falls within the Kasama Forestry Reserve area under the traditional leadership of Senior Chief Mwamba of the Bemba people of northern Zambia (UNESCO, 2015). The site is of international importance, considering its rich features and the fact that it was submitted to UNESCO for classification as a world heritage site. The proposed line route passes within the Heritage site. Consultation with the NHCC in Kasama indicated that a Heritage Impact Assessment within the wayleave was required before the Project can be implemented so that appropriate mitigation measures can be identified. The NHCC study of the Mwela Heritage Site has been undertaken in 2020 (NHCC, 2020).

Source: Norway, 2012.

**Photo 5-18 Mwela Rock Paintings – Sample**

During the fieldwork for this HIA, a number of Physical Cultural Resources (PCRs) were identified in the study area in the vicinity of the proposed wayleave for the ZTIP. These resources and their locations are summarized in the table below. The study led by NHCC did not find any heritage resource within the wayleave.

However, there are several heritage resources in the vicinity of the wayleave which are likely to be directly impacted by the project.

**Table 5-37 Physical Cultural Resources identified in the vicinity of the ZTIP**

| S/N | Physical Heritage Resource | PCR/ID | Description | Longitude/Latitude |
|---|---|---|---|---|
| 1 | Red Geometric Tradition | PCR 1 | Fading rows of finger dots and arcs. | UTM 307877 E; 8871 233 N 10,12.389 S; 31 14.772E |
| 2 | Red Geometric Tradition | PCR 2 | Multiple finger dots. | UTM 307830 E; 8871226 N 10,12.393 S; 31 14.740E |
| 3 | Unique Feature / Red Geometric Tradition | PCR 3 | Rock feature "Noah's Ark" and with multiple rows of finger dots going round and some inside. | UTM 308848 E; 8871288 N 10,12.357 S; 031,14.864 E |
| 4 | Red Animal Tradition | PCR 4 | Apron like structure with rows of finger dots. | UTM 308358 E; 8871105 N 10,12.462 S; 031,15.031 E |
| 5 | Red Animal Tradition | PCR 5 | Two scoping animals with distorted bellies and small legs. | UTM 308589 E; 8871220 N 10,12.403S; 031,15.152 E |
| 6 | Red Geometric | PCR 6 | Finger lines. | UTM 308601 E; 8871230 N 10,12.393 S; 031,15.164 E |
| 7 | Red Geometric | PCR 7 | Multiple finger lines with full concentric circles. | UTM 308649 E; 8871254 N 10,12.380 S; 031,15.189E |
| 8 | Red Geometric | PCR 8 | Multiple lines of finger dots. | UTM 308675 E; 8871246 N 10,12.387 S; 031,15.202 E |
| 9 | Red Animal Tradition | PCR 9 | Elephant like style with multiple rows of finger dots. | UTM 308896 E; 8871287 N 10 12.356 S; 31 14.864E |
| 10 | Red Animal Tradition | PCR 10 | Lion killing an animal. | UTM 306940 E; 8870386 N 10,12.870 S; 032,14.244 E |
| 11 | Unique Rock Outcrop | GEO 1 | Rock outcrop with overhang. | 10, 12.403 S; 31 15.152E |
| 12 | Unique Rock Outcrop | GEO 2 | Rock outcrop with overhang. | 308675 E; 8871246 N 10, 12.387S; 31 15.202E |
| 13 | Cave | GEO 3 | Open cave about 2m high by 4m long. | UTM 368893 E; 8871289 N 10,12.367 S; 031,15.327 E |
| 14 | Red Geometric Tradition | PCR 11 | Surface finds of pot sherds. | 10 12 31.85 S; 31 14 39.18E |
| 15 | Red Geometric Tradition | PCR 12 | Finger lines. | 10 12 29.78S; 31 14 57.34E |
| 16 | Red Geometric Tradition | PCR 13 | Finger lines. | 10 12 29.73S; 31 14 59.70E |
| 17 | Unique Rock Outcrop | PCR 14 | Rock outcrop has paintings on all sides of the rock that include red animal tradition, multiple rolls of finger dots and finger lines. | 10 12 29.98S; 31 14 59.77E |

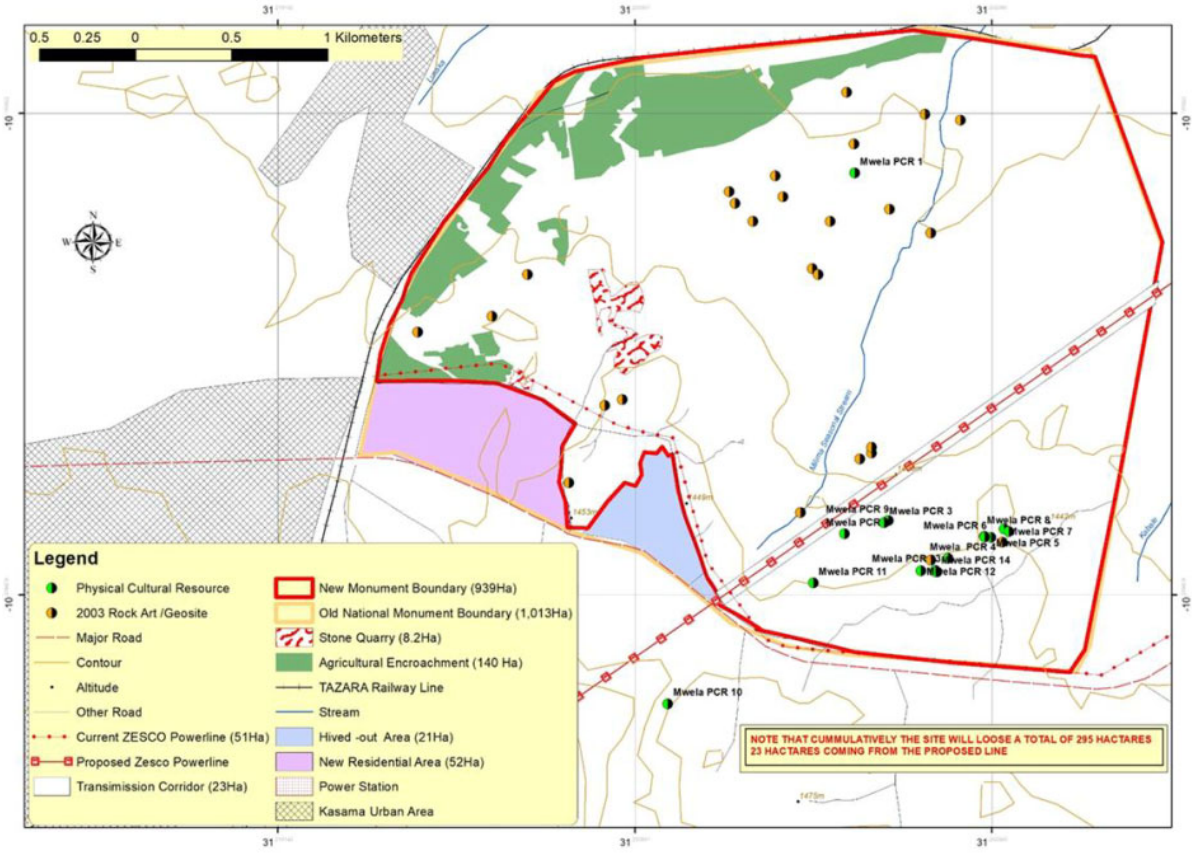
Source: NHCC, 2020

Figure 5-33 shows the location of the identified PCR in proximity to the ZTIP and Table 5-37 identifies the distance between the PCR and the line route. They include sites identified from previous studies within the Mwela Art site.

**Table 5-38 Physical Cultural Resources in the vicinity of the ZTIP**

| Physical Cultural Resources Feature ID | Distance from Centre of Transmission Line | Nature of Cultural Resource |
|---|---|---|
| PCR 1 | 125m | Rock Art Site |
| PCR 2 | 100m | Rock Art Site |
| PCR 3 | 165m | Rock Art Site |
| PCR 4 | 515m | Rock Art Site |
| PCR 5 | 544m | Rock Art Site |
| PCR 6 | 518m | Rock Art Site |
| PCR 7 | 547m | Rock Art Site |
| PCR 8 | 572m | Rock Art Site |
| PCR 9 | 160m | Rock Art Site |
| PCR 10 | 295m | Rock Art Site |
| PCR 11 | 221m | Rock Art Site |
| PCR 12 | 468m | Rock Art Site |
| PCR 13 | 519m | Rock Art Site |
| Mwela-East Geosite 1 | 124m | Rock Art Site 77 in Old Inventory |
| Mwela-East Geosite 2 | 165m | Rock Art Site 77 in Old Inventory |
| Mwela-East Geosite 3 | 176m | Rock Art Site 77 in Old Inventory |
| Mwela-East Geosite 4 | 167m | Rock Art Site 78 in Old Inventory |
| Mwela-East Geosite 5 | 191m | Rock Art Site 80 in Old Inventory |
| Mwela-East 6 | 459m | Rock Art Site 24-26 |
| Mwela-East Geosite 7 | 518m | Rock Art Site 13 (Coincides with PCR 6) |
| Mwela-East Geosite 8 | 597m | Rock Art Sites 6-9 |
| Mwela-West Geosite | 934m | Rock Art Site |

Source: NHCC, 2020




Source: NHCC, 2020

**Figure 5-33 Location of identified Physical Cultural Resources**

## NACHIKUFU CAVES

Like the Mwela rock paintings, the Nachikufu caves are remnants of the Twa people, who were the early inhabitants of Zambia before the arrival of the Bantu and other people.

The paintings here were discovered in 1948 and are estimated to be up to 15,000 years old. They are located some 50 km south of Mpika, near road T2. Access is regulated.

Due to their historical significance, the caves are of national/international importance. They are located approximately 2 km away from the Project line route (as opposed to 900m from the T2 road). The Project will not impact them.

**Photo 5-19 Rock Painting in Nachikufu Caves**

## NSALU CAVES AND ROCK PAINTINGS

Nsalu Caves are protected as a National Monument. This huge semicircular cave, cut into Nsalu Hill, stands about 50m above the level of the surrounding plateau, and contains some excellent San/Bushmen rock paintings. The caves have been vandalized, but most of the paintings can still be seen.

Archaeological investigations have demonstrated occupation for at least 20,000 years, firstly by Middle and Late Stone Age people and later by Iron Age settlers. The oldest paintings are in yellow and include parallel lines, circles and loops. Later drawings were executed in rust-coloured paint, and even later ones in red and white paints used together. The last paints applied appear as grey-white pigments and have been applied rather clumsily. They contain animal fats and are thought to have been the work of Iron Age settlers within the last 2,000 years. Due to their historical significance, the caves are of national/international importance. They are located approximately 32 km away from the Project line route. The Project will not impact them.

**Photo 5-20 Rock Paintings in Nsalu Caves**

### 5.4.8.2 HISTORICAL CULTURAL SITES

#### ZWANGENDABA BURIAL SITE

Zwangendaba (c. 1785 – 1848) was the king of the Ngoni people for more than thirty years, from approximately 1815 to his death in 1848. After being driven from the eastern region of what is now South Africa, near modern Swaziland, by the Zulus during the Mfecane, Zwangendaba led his people, then called the "Jere", on a migration of more than 1,000 miles lasting more than twenty years. Their journey took them through the areas now known as Mozambique, Zimbabwe and Malawi to the western part of Tanzania, where Zwangendaba set up a base at Mapupo. The Ngoni, once a small tribe, extended their dominion even further through present-day Tanzania, Malawi, and Zambia when they fragmented into five separate groups following his death (Wikipedia, 2024a). The Zwangendaba burial site is located some 40 km West of Nakonde town. The burial site is in a place called Mititi in Kapwila village. The site is of regional importance due to the importance of Chief Zwangendaba. It is located more than 3 km away from the Project line route and will, therefore, not be affected by the Project.

#### VON LETTOW-VORBECK MEMORIAL NATIONAL MONUMENT

This memorial is located near the north end of Chambeshi Bridge at the spot where German East African forces agreed a cease-fire on 14 November 1918. That is where the German General Paul Von-Lettow-Vorbeck received the message that World War I was lost for the Germans and he had to lay down his arms before British General Edwards (CommonWealth war graves, 2023). It is of national significance considering its classification as a National Monument. It will not be impacted because it is located 2.4 km away from the Project.

**Photo 5-21 Von Lettow Vorbeck Memorial National Monument**

### CHILUBULA MISSION NATIONAL MONUMENT

Chilubula Mission is the first mission of the White Fathers in the territory built in 1895 by Father Joseph Dupont, known as 'Moto Moto'. It features a large church and well-preserved buildings (Zambia Tourism, 2015). It has national importance due to its classification as a National monument. It is located approximately 25 km away from the Kasama substation and the Project line route and will not be affected by the Project.

## 5.4.8.3 NATURAL FEATURES CULTURAL SITES

### CHISHIMBA FALLS NATIONAL MONUMENT

Located on the Luombe River, Chishimba Falls are a combination of three successive falls, incorporating Mutumena Falls, Kaela Rapids, and Chishimba itself. The spot is situated about 33 km from the town of Kasama in the Northern Province. The impressive main part of the falls is around 20 m high. Chishimba Falls are of national importance, considering their classification as a National Monument. The site is located approximately 30 km away from Kasama substation and the Project line route and will not be affected by the Project.

The Bemba people regard the Chishimba Falls as one of the most sacred places of power. The nature spirit Chishimba resides in the cave below the falls, which is a place of prayer and honour. A hydroelectric diversion canal at the falls helps provide power to Kasama and other neighbouring villages (Zambia Tourism, 2015).

**Photo 5-22 Chishimba Falls**

#### KUNDALILA FALLS NATIONAL MONUMENT

The Kaombe River in Zambia falls over the lip of the Muchinga escarpment and makes a waterfall near the small town of Kanona in the Serenje District. The waterfall is called Kundalila Falls, meaning “crying dove” in the local Bemba language. Kundalila Falls belongs to the list of official Zambian Natural Monuments (Wikipedia, 2024b). Due to this classification, they are of national importance but will not be impacted by the Project since they are located approximately 11 km to the south of the Project alignment.

### 5.4.8.4 TOURISM SITES

#### MUTINONDO WILDERNESS

Mutinondo Wilderness lies within Chief Mpumba's area on the plateau 30 km west of the Luangwa Valley in the Northern Province of Zambia. The area consists of 10,000 hectares of privately owned land encompassing pristine Miombo woodland, large chunks of granite inselbergs, rivers, as well as waterfalls and glades (dambos) (Mutinondo Wilderness, 2024). It is located 22 km to the East of the Project alignment and, therefore, will not be affected by it.

### 5.4.8.5 PRIVATE SACRED ASSETS

According to the 2017 RAP, two (2) households in the Northern Region had a grave located within the wayleave. Neither the 2021 RAP nor the 2017 RCAP for the Kasama-Nakonde section have reported any private sacred assets located within the wayleave. However, during the field works activities and consultation activities associated with the RCAP audit, a shrine in form of a big tree located within the wayleave was identified in Mpasuka Village, in Mungwi district.

More private sacred assets may be recorded during the RAP update.

## *5.4.9 SOCIAL INFRASTRUCTURE*

### 5.4.9.1 EDUCATION

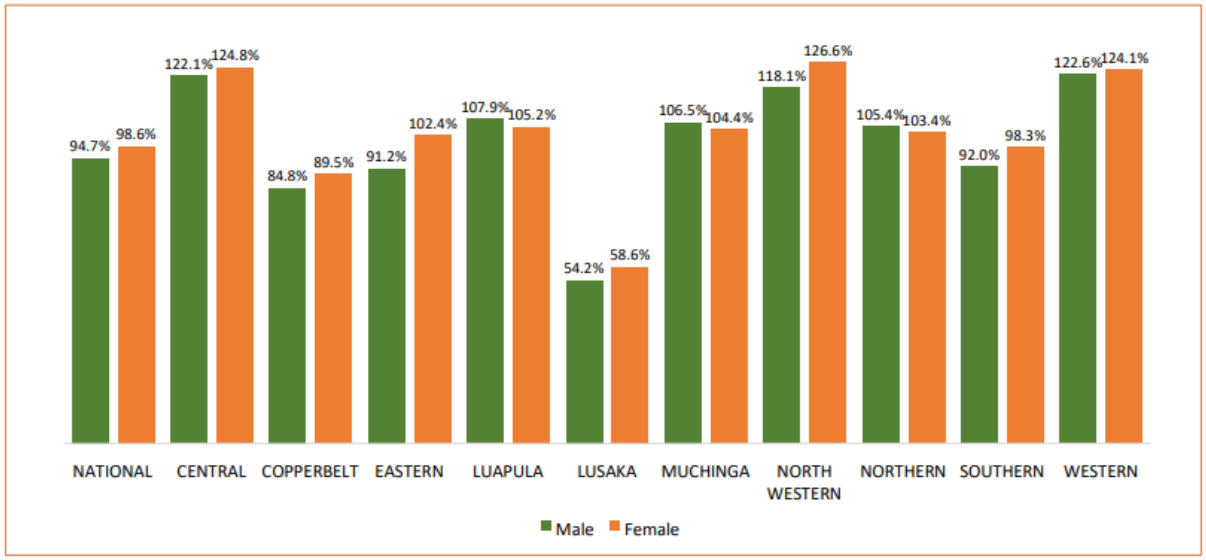
According to the education statistics bulletin 2020, 7760 (82.2%) and 880 (68.2%) of all primary and secondary schools are located in rural areas. Most are run by the Ministry of Education.

In the Northern Province, there were 1,091 primary and secondary schools. Primary schools accounted 941 and 150 for secondary schools. Most of them are in rural areas, with 92.10% for primary schools and 81.30% for secondary schools.

When comparing provinces, Muchinga Province recorded the highest number of schools located in rural areas (94% and 83.3%), respectively, at both primary and secondary levels, while Lusaka and Copperbelt recorded most of the schools being predominantly urban. In fact, Muchinga Province had 786 schools, including 684 primary schools and 102 secondary schools.

Central Province recorded 1292 schools, 1114 primary and 178 secondary. 92.10% of primary schools and 72.50% of secondary schools are in rural areas.

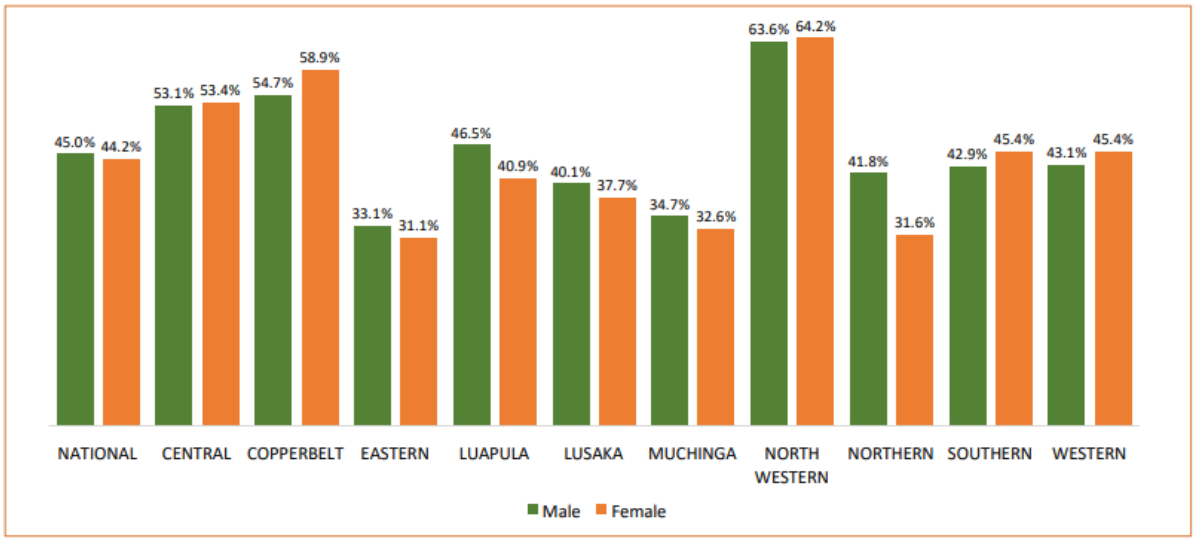
In 2020, the gross enrolment rate by sex and Province showed that the Project's three provinces had a rate higher than the national one in grades 1-7 (male 94.7% and female 98.6%). Central Province shows a rate of 122.1% for males and 124.8% for females, Muchinga Province had 106.5% for males and 104.4% for females and Northern province had 105.4% for males and 103.4% for females (Figure 5-34).




Source: Zambia Education Statistics Bulletin, 2020

**Figure 5-34 Gross Enrolment in Grades 1 to 7 by Sex and Provinces**

These statistics show that the enrolment rate fell in grades 8 to 12 to 45.0% for males and 44.2% for females at the national level (Figure 5-35). The three-Project provinces follow the same trend: Central Province (53.1% for male and 53.2% for female), Muchinga Province (34.7% for male and 32.6% for female) and Northern Province (41.8% for male and 31.6% for female).




Source: Zambia Education Statistics Bulletin, 2020

**Figure 5-35 Gross Enrolment in Grades 8 to 12 by Sex and Provinces**

For higher education, the region offers courses at two institutions: Kasama College and the Zambia College of Agriculture in Mpika.

The Zambian government owns the Kasama College of Education through the Ministry of Education, Science, Vocational Training and Early Education. The college was opened in 1966. The college has been offering certificate courses for primary school teachers, such as the Primary Teachers' Certificate (PTC), the Zambia Basic Education Course (ZBEC), and the Zambia Teacher Education Course (ZATEC).

The Zambia College of Agriculture – Mpika was established in 1976 by statutory instrument. The college is located on a 2 808.77 hectares farm and it is 20 km away from the Government department's headquarters along the T2 Road. The College offers a two-year certificate course in General Agriculture, (Boarding and Day Schooling), a three-year Diploma in Sustainable Agriculture (Boarding) and a four-year Diploma in Sustainable Agriculture (Distant Learning). The day schooling program is conducted at the Mpika Farmers Training Centre.

**Photo 5-23 Zambia College of Agriculture**

#### 5.4.9.2 HEALTH FACILITIES

In Zambia health services are classified as follows:

- Level 3 hospitals: are the highest referral hospital. These hospitals cater for a catchment population of approximately 800,000 and above, and have subspecializations in internal medicine, surgery, pediatrics, obstetrics, gynaecology, intensive care, psychiatry, training and research. All complicated cases not attended to at second level hospitals are referred to third level hospitals (MOH, 2012).
- Level 2 hospitals: are provincial hostipals. They are intended to cater for a catchment area of between 200,000 and 800,000 people, with services in internal medicine, general surgery, pediatrics, obstetrics and gynaecology, dental, psychiatry and intensive care services (MOH, 2012).
- Level 1 hospitals: are district level hospital. These serve a population of between 80,000 and 20,000 and provide services such as medical, surgical, obstetric and diagnostic services (MOH, 2012).
- Urban health centres (UHC) and Rural health centres (RHC): They catch a population of about 10,000 people in rural areas and 30,000 to 50,000 people in urban areas (MOH, 2012).
- Health posts: are the lowest levels of health care and built in communities. They cater for a catchment population of approximately 3,500 in rural areas and 1,000 to 7,000 in the urban settings and are set up within 5 km radius for sparsely populated areas. The types of health services offered at this level are basic first aid rather than curative (MOH, 2012).

The following table shows health facilities in Muchinga Province, in the study area districts.

**Table 5-39 Health Facilities in Muchinga Province, in the Study Area Districts**

| Districts | Wards | Level 3 Hospital | Level 2 Hospital | Level 1 Hospital | General clinic | Urban Health Centre | Rural Health Centre | Health Post | First-aid Stations |
|---|---|---|---|---|---|---|---|---|---|
| Mpika | Nachikufu | 0 | 1 | 0 | 0 | 0 | 1 | 2 | 0 |
| | Lubambala | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| | Mukungwa | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lavushimanda | Chikanda | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 1 |
| Kanchibiya | Mumbubu | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| | Chambeshi | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 0 |
| Nakonde | Mulalo | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | Popomozi | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | Ngumba | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | Isunda | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | Musyani | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 |

Source: Zambia Master Health Facility List (ZMHFL), 2024

The following table shows health facilities in Northern Province, in the study area Districts.

**Table 5-40 Health Facilities in Northern Province, in the Study Area Districts**

| Districts | Wards | Level 3 Hospital | Level 2 Hospital | Level 1 Hospital | General clinic | Urban Health Centre | Rural Health Centre | Health Post | First-aid Stations |
|---|---|---|---|---|---|---|---|---|---|
| Kasama | Chibundu | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 |
| | Kapongolo | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| | Lualuo | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| | Chiba | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| | Mulilansolo | 0 | 1 | 1 | 1 | 0 | 2 | 0 | 0 |
| Mungwi | Ngulula | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| | Mungwi | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| | Chamfubu | 0 | 0 | 0 | 0 | 0 | 3 | 1 | 0 |
| | Fube | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 |
| | Iyaya | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| | Kabisha | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| | Mpanda | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| | Lubala | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| Senga Hill | Chozi | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |

Source: Zambia Master Health Facility List (ZMHFL), 2024

The following table shows health facilities in Central Province, in the Study area Districts (Chitambo was not a separate district at time of statistics).

**Table 5-41 Health facilities in Central Province, in the Study Area Districts**

| Districts | Wards | Level 3 Hospital | Level 2 Hospital | Level 1 Hospital | General clinic | Urban Health Centre | Rural Health Centre | Health Post | First-aid Stations |
|---|---|---|---|---|---|---|---|---|---|
| Chitambo | Muchinka | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| | Chitambo | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 |
| Serenje | Kabamba | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |

Source: Zambia Master Health Facility List (ZMHFL), 2024

**Photo 5-24 Basic Health Post in the Study Area**

### 5.4.9.3 INFRASTRUCTURES TO ASSIST VICTIMS OF GBV

In Zambia, there are several facilities to assist victims of GBV, these are called One-Stop Centres.

One Stop Centres (OSC) refers to organisations that provide GBV survivors with all key services (health, psychosocial, police and legal) under one roof. There are currently 69 OSCs operating in Zambia. By turning GBV help desks into OSCs, an additional 31 OSCs are expected by December 2023

The following table shows the distribution of OSC's and Help Desks across the affected districts of the Project. It is to be noted that the Zambian Government, through it's Gender Division keeps an online mapping of all service providers in terms of GBV "GBV Referral Pathway"[13]. Results are shown in the ESMP.

[13] The GBV Referral Pathway can be accessed online : GBV REFERAL PATHWAY – Gender Division

**Table 5-42 One Stop Centers and Gender-Based Violence Help Desks Distribution and Affected Districts**

| District | OSC and Help Desks |
|---|---|
| **Muchinga Province** | |
| Kanchibiya | GBV Help Desk (in the process of transitioning to a OSC) |
| Mpika | OSC |
| Lavushimanda | GBV Help Desk (in the process of transitioning to a OSC) |
| **Northern Province** | |
| Kasama | OSC |
| Mungwi | OSC |
| Senga | OSC |
| **Central Province** | |
| Chitambo | GBV Help Desk (in the process of transitioning to a OSC) |
| Serenje | GBV Help Desk (in the process of transitioning to a OSC) |
| Nakonde | OSC |

An assessment of the capacity and needs of GBV service providers is presented in the Impact Chapter.

### 5.4.9.4 HOUSEHOLD INFRASTRUCTURE

Asset ownership is a useful measure when considering households' socioeconomic situation. Households' socioeconomic level in Zambia can be estimated from housing standards and the extent to which the population has access to safe water sources, energy and other socioeconomic infrastructure. HOUSING ASSETS

The table below shows household distribution by dwelling types, at the national level as well as for the Northern Central and Muchinga provinces.

The traditional hut is significantly more prevalent in the Northern and Central provinces than in Zambia in general. The relative importance of the rural population in the Project area explains this difference.

**Table 5-43 Type of Dwellings Occupied by Households, 2015**

| Area | Traditional Hut (%) | Detached House (%) | Flat/ Apartment (%) | Semi-Detached House (%) | Servant Quarters (%) | Other (%) |
|---|---|---|---|---|---|---|
| Zambia | 32.0 | 28.5 | 10.4 | 5.5 | 1.3 | 0.8 |
| Northern Province | 65.1 | 14.3 | 1.1 | 0.5 | 0.2 | 0.3 |
| Central Province | 36.6 | 27.4 | 4.5 | 2.8 | 0.2 | 0.5 |
| Muchinga Province | 48.3 | 19.8 | 4.9 | 3.4 | 0.1 | 0.0 |

Source: Living Conditions Monitoring Survey Report, 2015

As for ownership, the vast majority of Northern (88.4%), Central (74.8%) and Muchinga (82.0%) households, own their dwelling. The Northern Province figures are higher than the Zambian average of 69.5% but close to the rural score of 90.8%, while the Central Province figure is closer to the Zambian average. These varying results reflect the slightly different urban/rural population compositions in the respective provinces.

More figures on housing and specific to PAPs are presented in the RAP.

**Photo 5-25 Example of a Typical House Between Kasama and Nakonde**

## WATER ACCESS

Among the different water sources, protected wells, boreholes and taps are seen as safe water supply sources, whereas unprotected wells, rivers and lakes/streams springs are considered unsafe water supply sources.

As can be seen in Table 5-41 Safe water access is somewhat problematic in the Northern Province, where only 26.9% of households have access to a safe water source (protected wells, boreholes, or taps), compared to 61.6% in Zambia (83.6% urban, 54.7% rural). The situation is different in the Central Province, where more than half of households (53.3%) have access to a safe water source.

**Table 5-44 Households Type of Water Sources**

| Area | Protected Well (%) | Borehole (%) | Tap (%) | Rivers and Other Open Waters Directly from river/ lake/ stream/ dam (%) | Unprotected Well (%) | Unprotected Spring (%) | Other (%) |
|---|---|---|---|---|---|---|---|
| Zambia | 10.4 | 23.5 | 30.2 | 10.7 | 19.6 | 1.2 | 0.7 |
| Urban | 10.5 | 8 | 63.6 | 0.7 | 8.6 | 0.3 | 1.2 |
| Rural | 10.5 | 35.2 | 5 | 18.3 | 27.9 | 1.9 | 0.4 |
| Northern Province | 4.9 | 13.7 | 9.9 | 36.2 | 31.9 | 1.2 | 0 |
| Central Province | 25.5 | 18.2 | 20.7 | 12.6 | 20.8 | 0 | 0 |
| Muchinga Province | 12.1 | 15.1 | 12 | 20.3 | 34.5 | 4.8 | 0 |

Source: Living Conditions Monitoring Survey Report, 2015

According to the Living Conditions Monitoring Survey of 2015, at the national level, the results show that 67.7 % of households had access to improved drinking water sources. About 89.2 percent of urban households had access to improved drinking water sources, while 51.6 percent of households in rural areas accessed improved drinking water sources. Analysis by province shows that Central Province had the highest proportion of households with access to safe water at about 64.4%, and Northern Province had the lowest percentage of households with access to water at 28.5%.

## ENERGY ACCESS

Energy access and usage indicators in Zambia vary significantly between rural and urban areas. In the rural areas, very few (4.4%) Zambian households enjoy electricity. In the urban areas, an average of 67.3% of the households are connected.

In that context, it is not surprising to see that the main cooking fuel used by Zambian households is collected wood (48%) and purchased charcoal (30%). However, in rural areas, collected wood is used by 84.5% of households, and charcoal is used by 13.2% of them. In urban areas, most households used charcoal for cooking at 59.1%, followed by electricity at 34.5%and firewood at 6 %.

These urban/rural differences are reflected in energy indicators of the Northern, Muchinga and Central provinces. In the Northern Province, only 2.0% of the households are connected to the electricity grid, while that proportion reaches 6.6 % in the Muchinga Province and 11.4% in the Central Province, which is more urbanized. Similarly, in the Northern Province, the proportion of households using collected wood as cooking fuel is 68.9% and charcoal 20.6%. In Muchinga and Central Provinces, collected wood is used by 62.1 and 64.4%% and charcoal is purchased by 3.0% and 1.2%.

## LIGHTING ENERGY

In urban areas, households use electricity (67.6%) or candles (16.3%) as lighting energy, while in rural areas, the two most prevalent lighting energy forms are torches (70.6%), solar panels (7.4%), candles (6.2%) or open fire (4.3%)

The statistics for Project three provinces are similar to the rural Zambian rate. The proportion of households that use torches is 68.3% for Northern Province, 60.2 for Muchinga Province, and 58.9% for Central Province; candles are 8.5%, 8.2%, and 8.4%, and electricity is 8.3%, 16.4%, and 18.4%. As for Central Province, which is more urbanized, 18.4% of households use electricity, torch, 58.9% and candles, 8.4 %.

According to the Living Conditions Monitoring Survey, solar energy is an important source of lighting (7.4% of affected households).

## TOILET FACILITIES

The toilet facilities are listed in Table 5 42.

**Table 5-45 Households Type of Toilet Facility, 2015**

| Area | Flush Toilet (%) | Pit Latrine with Slab (%) | Pit Latrine without Slab (%) | Other (%) | None (%) |
|---|---|---|---|---|---|
| Zambia | 15.6 | 24.1 | 13.8 | 3.2 | 4.1 |
| Urban | 34.2 | 38.6 | 26.3 | 0.4 | 0.4 |
| Rural | 1.5 | 13.2 | 72.9 | 5.2 | 6.9 |
| Northern Province | 3.7 | 16.1 | 80.9 | 0.3 | 1.9 |
| Central Province | 11 | 20.8 | 61.6 | 1.5 | 4.9 |
| Muchinga Province | 7.6 | 16.1 | 73.8 | 1.6 | 0.7 |

Source: Living Conditions Monitoring Survey Report, 2015

In urban areas, households use flush toilets (34.2%) or pit toilets with slabs (38.6%) as toilet facilities. The two most prevalent forms in rural areas are pit latrines without slabs (72.9%) and pit latrines with slabs (13.2%).

The statistics for Project three Provinces are similar to the rural Zambian rate. The proportion of households that use pit latrines without slabs is 72.9%, with slabs 13.2%. As for households living in the Northern Province, 80.9% of households use pit latrines without slabs and 16.1% with slabs.

#### 5.4.9.5 ECONOMIC INFRASTRUCTURE

Many important linear infrastructures (roads, trains, etc.) cross one or both provinces covered by the Project study area. Airport and telecommunications services are also present. Other than these types of social infrastructure, schools and health centres are distributed in the different districts of the area.

##### ROADS

The main road connection in the area is the Great North Road (T2), connecting Lusaka and the Copperbelt Province to Mpika, Serenje, Kapiri, Mposhi, Kabwe, etc., up to Nakonde at the border. This main road is paved (bituminous standard) and is in good condition.

The different districts also have many “regional” roads, most of which are in poor condition. However, some improvement efforts are already in place.gu For example, the Nseluka Nakonde (D3) Road was upgraded to a bituminous standard to connect Kasama and Nakonde.

##### TRAINS

The region is connected to Tanzania and the rest of Zambia via Lusaka by the TAZARA (Tanzania Zambia Railways) railway. The regional headquarters are in Mpika.

The line stretches from new Kapiri Mposhi in Zambia to Dar-es-salam in Tanzania.

The 1860 km stretch provides passenger and freight trains with an annual capacity of 250,000 passengers and 350,000 metric tons of freight.

The line route roughly follows the TAZARA railway in its Zambian portion.

**Photo 5-26 Nakonde TAZARA Station**

**Photo 5-27 TAZARA Rail Line near Kasama**

## PIPELINE

The TAZAMA (Tanzania Zambia Mafuta) Pipeline, used for the transportation of crude oil, extends from the port of Dar es Salaam to Ndola in Zambia. It passes through the extended study area via Nakonde, Chinsali, Mpika, Kanona, Serenje, and Mkushi before veering North towards Ndola. TAZAMA also operates three oil pumping and storage facilities South of Chinsali, near Mpika and North of Chimutanda.

The transmission line route remains far from the TAZAMA pipeline between the Tanzanian border and Mpika. The line inserts into a corridor used by many other linear infrastructures between Mpika and Pensulo. Two crossings are accounted for, one just South of Mpika and the second one approximately 22k before reaching Pensulo.

## AIRPORTS AND AIRSTRIPS

Kasama has the only tarmac standard airport in the extended study area. The other airstrips in the area are located at Mpika and Serenje.

Nakonde has one air field off Mbala, running from Mwenzo to Musanza. Due to its extremely poor condition, the airfield is used for non-commercial landings. TELECOMMUNICATIONS

Most of the districts in the area are covered by at least one of 3 main telecommunication providers: Airtel, MTN and Zamtel (including fixed landlines from Zamtel).[14]

[14] All the providers provide both telephone services and internet.

**Photo 5-28 Airtel Communication Tower in Rural Mungwi**

## 5.4.10 LANDSCAPE

Between Nakonde and Kasama, the landscape is quite uniform, defined by a gently undulating plateau, with scattered land use in woodland vegetation. Sparse villages and clusters of houses are usually located close to roads. Photos 5-29 and 5-30 provide examples of typical landscapes in this area.

**Photo 5-29 Landscape after Border**

One exception is shortly after the Nakonde substation; the line route goes through the fringes of the Chambeshi River floodplain. In that area, the landscape alternates between the same type of scattered rural complex seen elsewhere on the line route and the characteristic floodplain landscape, which is very flat grassland interspersed with termite mounds where larger vegetation can grow. Photo 5-30 is representative of the landscape within the Chambeshi floodplain.

**Photo 5-30 Chambeshi Floodplain Landscape**

The landscape between Kasama and Mpika is also quite uniform and flat. Aside from the more urbanized areas of Kasama and Mpika, the area is characteristic of a rural complex with scattered human occupation. The Pensulo-Kasama 330 kV line is a prominent feature within the landscape of this area. The higher land is covered in degraded miombo woodland. There are also a few wetland areas and watercourses. Photo 5-31 is representative of landscapes encountered along that stretch of the Project.

**Photo 5-31 Kasama-Mpika Landscape**

Landscape is also very uniform between Mpika and Pensulo. Except for some scattered hills, topography remains that of a gently rolling plateau and land occupation remains relatively scattered rural complex. As illustrated in Photo 5-32 the Pensulo-Kasama 330 kV line mentioned above is also a prominent feature within the landscape in this area. Some zones are still mostly covered in more remote areas with degraded miombo.

**Photo 5-32 Mpika-Pensulo Landscape**

# 6 IMPACT ASSESSMENT

The following sections present the impacts that can be anticipated at the construction, operation, and decommissioning phases of the Project. Section 6.1 presents the method used for impact identification and assessment, section 6.2 discusses the assessment of potential impacts identified, as well as proposed mitigation or enhancement measures, and section 6.3 presents an analysis of cumulative impacts.

## 6.1 METHOD FOR IMPACT IDENTIFICATION AND ASSESSMENT

The method used to identify and assess the Project impacts relies 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 impacts associated with this type of Project, as well as on the real effectiveness of mitigation and compensation measures generally applied.

The method for impact identification and assessment is based particularly on the three following elements:

- The Project description from the Feasibility Study, which enables the identification of potential sources of impact based on the technical characteristics of the infrastructure to be built, as well as construction activities, methods, and schedule. The Project is described in detail in Chapter 3.
- The description of the existing environment, which allows the ecological and social contexts in which the Project is implemented to be understood and to identify, if applicable, issues that should be considered. The environmental components are described in Chapter 5.
- The issues and concerns raised by the PAPs and other stakeholders, which allow for the main issues related to the Project to be identified. Public issues and concerns are discussed in Chapter 7.

### *6.1.1 KEY ELEMENTS FOR IMPACT ANALYSIS*

#### 6.1.1.1 SOURCES OF IMPACT

The sources of impact can be defined as all the activities linked to the Project, including associated facilities, that are likely to have an impact on the environment. The sources of impact are grouped by Project phase: pre-construction, construction, operation (including maintenance), and decommissioning. The following table details these sources of impact (Table 6-1).

It should be noted that impacts resulting from the Project's decommissioning phase were assessed based on the current understanding of decommissioning activities. The powerline and associated substations are anticipated to be continuously maintained and operated for several decades. Given the project's long life, it is likely that methods and conditions under which decommissioning will take place will be markedly different when decommissioning does occur. It is recommended that the impact assessment of the decommissioning phase and environmental and social management be updated prior to commencing decommissioning.

**Table 6-1 Sources of Impact**

| Sources of Impact | Description |
|---|---|
| **Pre-Construction** | |
| Bidding process | The bidding process from the preparation of the Terms of References, evaluating proposals, selecting contractors, and contract signatures. |
| Land acquisition | Procedures relating to agreements with landowners. |
| Resettlement | Resettlement process of Persons Affected by the Project (PAPs). |
| Displacement of economic activities | Resettlement of economic activities affected by the Project. |
| Site preparation | Site preparation activities include establishing equipment storage yards and worker camps, clearing vegetation, removal of topsoil, excavation, earthworks, and construction of access roads. |
| **Construction** | |
| Transportation and traffic | Road transportation of materials, equipment, and workers to and from the site, including fueling and maintenance of vehicles and machinery. |
| Construction activities | Construction of the power transmission line and substations, including temporary facilities used during the work phase, such as borrow pits, as well as the erection of towers and stringing of conductors. |
| Waste and hazardous materials management | Management and storage of waste, hazardous substances, and other materials to be removed, including hydrocarbons. |
| Purchase of materials, goods, and services | Purchases required for the construction of the power transmission line and substations. |
| Presence of workers | Workers present along the wayleave and substation sites. |
| Worksite restoration | Rehabilitation to their initial state conditions (topography, runoff, physico-chemical properties of soils and water, vegetation cover, etc.) of the working areas and access roads. |
| **Operation** | |
| Presence and operation of line, substations, and access roads | Presence and operation of facilities. |
| Transportation and circulation | Road transportation of materials and equipment, including vehicle fueling and maintenance. |
| Maintenance and repairs | Inspection, maintenance, and repair of conductors, towers, and structures in substations, as well as wayleave maintenance and vegetation control. |
| Waste and hazardous materials management | Handling operations and storage of hazardous waste used during the operation, including oil used in transformers at substations. |
| Purchase of materials, goods, and services | Purchases required for the operation of the substations and the transmission line. |
| Presence of workers | Employees operating substations and during maintenance along the line. |
| **Decommissioning** | |
| Site preparation | Site preparation activities include establishing equipment storage yards and worker camps, clearing vegetation, removal of topsoil, excavation, earthworks, and construction of access roads. |
| Transportation and circulation | Road transportation of dismantled Project components, materials, equipment, and workers to and from the site, including fueling and maintenance of vehicles and machinery. |
| Decommissioning activities | Decommissioning activities include dismantling conductors, towers, structures, and substations, as well as foundation removal, excavation, earthworks, and revegetation of areas disturbed by the Project. |

| Sources of Impact | Description |
|---|---|
| Waste and hazardous materials management | Management and storage of waste, hazardous substances, and other materials to be removed, including hydrocarbons. |
| Purchase of materials, goods, and services | Materials, goods, and services purchased to support the decommissioning of the Project. |
| Presence of workers | Presence of workers involved in decommissioning activities. |

### 6.1.1.2 ENVIRONMENTAL AND SOCIAL COMPONENTS

Determining Valorized Environmental and Social Components (VESCs) consists of identifying, based on available data, all elements of the physical, biological, and socioeconomic environments that are likely to be affected by the Project. The VESCs identified for the Project are listed in Table 6-2. The ESIA process will focus only on these VESCs.

**Table 6-2 Valorized Environmental and Social Components**

| Component | | Description |
|---|---|---|
| Physical Environment | Soils | Physicochemical characteristics of the surface deposits, including vulnerability to erosion. |
| | Hydrography and water resources | Physicochemical characteristics of the surface water, sediments, and groundwater. |
| | Air quality | Physicochemical characteristics of the air. |
| | Climate change | Greenhouse gas emissions, as well as climate change-related impacts. |
| | Noise, vibrations, and electromagnetic fields | Noise, vibrations, and EMF levels. |
| Biological Environment | Terrestrial flora | Terrestrial plant communities, including special-status species. |
| | Avifauna | All bird species and their habitats, including special-status species. |
| | Terrestrial fauna | All terrestrial and semi-aquatic animal species and their habitats, including special-status species. |
| | Aquatic habitats and associated fauna | Riparian and aquatic plant communities and wetlands, with associated species, including special-status species. |
| Socioeconomic Environment | Employment and economic development | Local and regional economic development and employment. |
| | Land use | Land uses: agricultural, livestock rearing, fishing, tourism, mining, forestry, urban, etc. |
| | Built environment | Impacts on existing buildings present in the work area (commercial, residential, industrial, institutional, etc.). |
| | Infrastructure | Electricity and telecommunication networks, public services (health, education), regional and local road networks, railroads, etc. |
| | Gender aspects | Women's living conditions, including women's economic opportunities and gender equity within the communities. |
| | Communities and social cohesion | Traditional knowledge, social cohesion, and vulnerable groups (poor, youth, women, elderly, and indigenous people), as well as post-conflict issues. |
| | Cultural and archaeological heritage | Religious, cultural, or historical sites and structures. |
| | Landscape | Integrity of landscape features (landmarks, etc.). |
| | Safety and public health | Population's well-being and health, including HIV/AIDS issues. |
| | Occupational health and safety | Well-being of workers and their safety. |

### 6.1.1.3 ENVIRONMENTAL AND SOCIAL CONCERNS RAISED DURING STAKEHOLDER CONSULTATIONS

The main environmental and social issues and concerns associated with the Project, raised during consultations with PAPs and relevant stakeholders, are summarized in Table 6-3 and will be considered for impact assessment as they represent the most sensitive and the most valued components according to stakeholders.

**Table 6-3 Main Environmental and Social Concerns**

| | |
|---|---|
| **Biological Environment** | |
| Ecosystems and Fauna | Presence of sensitive and fragile ecosystems, such as national parks and game reserves that, should not be impacted by the Project. |
| Terrestrial Flora | Reforestation efforts should be integrated into the Project's environmental and social management measures. |
| **Human Environment** | |
| Employment and economic development | Need for local benefits, including rural electrification, for the Project to be seen as acceptable by the local population and authorities.<br>Access to jobs during construction. |
| Land use | Expectations for fair compensation and resettlement assistance.<br>Expectations for fair livelihood restoration assistance.<br>In-kind compensations for lost structures and other assets are seen as a better option than cash compensations. |
| Built environment | Resettlement seen as an opportunity to improve people's houses. |
| Infrastructure | Construction of new access roads seen as an opportunity to develop more remote areas. |
| Gender aspects and Gender-Based Violence (GBV) | Measures should be planned to ensure women fully participate in stakeholder engagement and resettlement processes and compensation negotiations.<br>Special attention shall be paid to the risk of GBV, including child marriage, unplanned pregnancies, and spread of sexually transmitted diseases (STDs). |
| Communities and social cohesion | Importance of engaging with Traditional Authorities (TAs) during the resettlement process.<br>Importance of engaging with civic society during Project implementation. |
| Cultural and archaeological heritage | It is important to protect buried artefacts, fossils, or graves that could be affected during excavation works for pylons. The potential for chance findings is considered high throughout Northern and Muchinga provinces.<br>National Heritage Conservation Commission (NHCC) wishes to assist in the excavation works, at different places along the line, during construction works. |

## *6.1.2 IDENTIFICATION OF POTENTIAL IMPACTS*

As mentioned previously, the identification of the direct/indirect, positive/negative, trans-regional, social/economic, and physical/ecological impacts is established by an "environmental matrix". One axis, the matrix, identifies Project related sources of impact, and the other lists biophysical and social/economic components of the Project. Table 6-4 presents these interactions, which form the basis for the impact evaluation.

**Table 6-4 Impact Identification Matrix**

| Environmental Component / Sources of Impact by Phase | Physical Environment | | | | Biological Environment | | | | Socioeconomic Environment | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Soils | Hydrography and Water Resources | Air Quality | Noise, Vibrations and EMFs | Terrestrial Flora | Avifauna | Terrestrial Fauna | Aquatic Habitats and Associated Fauna | Employment and Economic Development | Land Use | Built Environment | Infrastructure | Gender Aspects and GBV | Communities and Social Cohesion | Cultural and Archaeological Heritage | Landscape | Safety and Public Health | Workers' Health and Safety |
| **Pre-construction** | | | | | | | | | | | | | | | | | | |
| Bidding process | | | | | | | | | | | | | N | | | | | |
| Land acquisition | | | | | | | | | | N | N | | N | N | | | | |
| Resettlement | | | | | | | | | | | N | | N | N | | | | |
| Displacement of economic activities | | | | | | | | | N | | | | | N | | | | |
| **Construction** | | | | | | | | | | | | | | | | | | |
| Site preparation | N | N | N | N | N | N | N | N | P | | | N | | | N | N | N | N |
| Transportation and circulation | N | N | N | N | N | | | N | N/P | N | | N | | | | | N | N |
| Construction activities | N | N | N | N | | N | N | N | P | | | N | N | | N | N | N | N |
| Waste and hazardous materials management | N | N | | | | | | N | | | | | | | | | N | N |
| Purchase of materials, goods, and services | | | | | | | | | P | | | | | | | | | N |
| Presence of workers | N | | | | N | N | N | N | N/P | | | | N | N | | | N | N |
| **Operation** | | | | | | | | | | | | | | | | | | |
| Presence and operation of line, substations, and access roads | | | | | | N | N | | | | | N/P | | | | N | N | |
| Transportation and circulation | | N | N | | N | | | | | | | | | | | | N | N |
| Maintenance and repairs | | | N | N | N | N | N | N | P | N | | | N | | | | | N |
| Waste and hazardous materials management | N | N | | | | | | N | | | | | | | | | | N |
| Purchase of materials, goods, and services | | | | | | | | | P | | | | | | | | | N |
| Presence of workers | | | | | | | | | | | | | N | N | | | N | N |
| **Decommissioning** | | | | | | | | | | | | | | | | | | |
| Site preparation | N | N | N | N | N | N | N | N | | N | | N | | N | | N | N | N |
| Transportation and circulation | N | N | N | N | N | N | N | N | | | | N | | | | | N | N |
| Decommissioning activities | N | N | N | N | N/P | N/P | N/P | N/P | | N/P | | N | N | N | | P | N | N |
| Waste and hazardous materials management | N | N | | | | | | N | | | | | | | | | N | N |
| Purchase of materials, goods, and services | | | | | | | | | N/P | | | | | | | | | N |
| Presence of workers | N | | | | N | N | N | N | N/P | | | | N | N | | | N | N |

Note: N = negative impact P = positive impact N/P = both negative and positive impacts.

## 6.1.3 METHOD FOR IMPACT ASSESSMENT

Following the identification of the potential and significant interactions, the positive and negative impacts of each Project activity on each environmental and social component will be qualitatively or quantitatively assessed.

The magnitude of the impact will be determined by completing an overall assessment of how one or several sources of impact affect an environmental component. This assessment considers the measures applied during the design phase of the Project to optimize the alignment of the transmission line and evaluates the importance of the impact based on three criteria (intensity, extent, and duration) considering the implementation of the proposed mitigation measures (i.e., residual impacts). As outlined in Table 6-5, impact importance is characterized as major, moderate, or minor in nature.

The assessment criteria are hereafter defined, while the proposed mitigation measures are listed in Tables 3-1 and 3-2 of the ESMP report.

### 6.1.3.1 IMPORTANCE OF IMPACTS

#### INTENSITY

The intensity of the impact on environmental and human receptors indicates the degree to which the assessed component is disturbed.

The analysis considers the receptor's properties, particularly its sensitivity and capacity to accommodate changes, as well as its estimated value. Impact intensity is divided into three levels:

- **High**: the impact damages the concerned receptor permanently, jeopardizes significantly its integrity, or changes substantially or irreversibly its environmental distribution or role.
- **Medium**: the impact alters the receptor's quality and its environmental distribution or role without damaging its integrity.
- **Low**: the impact slightly alters the concerned receptor without substantially changing its quality, environmental distribution, or role.

#### EXTENT

The extent of the impact refers to the range of the modified natural and human environments. The extent is a function of the Project's footprint, area of influence, or portion of the population affected by it. It could be regional, local, or limited:

- **Regional**: the impact has regional effects (or an area wider than the study area) or affects most of the population in surrounding districts.
- **Local**: the impact mainly affects the direct area of influence or bordering population groups.
- **Limited**: the impact affects only a limited area or some individuals in the direct area of influence.

### DURATION

The impact duration refers to the period during which the effects of the Project will be felt. This parameter reflects the intermittent nature of the impact. An impact could be long-term, medium-term, or short-term:

- **Long-term**: the impact is felt continuously or intermittently throughout the Project's lifetime. The impact is often permanent or irreversible.
- **Medium-term**: the impact is felt temporarily, continuously, or intermittently during the construction or decommissioning phase.
- **Short term**: the impact is felt temporarily, continuously, or intermittently for a limited period during the Project's construction or decommissioning phase.

Public consultation activities will help in identifying and confirming the impact assessments on given components representing issues of the affected communities.

### PROBABILITY OF OCCURRENCE

The impact assessment also examines the probability of occurrence, i.e., the likelihood that an impact will affect a component. The probability may be:

- **High probability**: the impact will certainly manifest itself.
- **Moderate probability**: the impact might occur without any certainty.
- **Low probability**: it is unlikely that the impact will occur, or it could occur only in the event of an accident.

Note that the analysis of the impact's probability of occurrence is conducted separately from that of the importance since they are two independent criteria that do not influence each other. Thus, this criterion is not included in the impact assessment matrix. However, the evaluation of these two criteria is presented together in the following sections.

## 6.1.3.2 ASSESSING THE IMPORTANCE OF IMPACTS

The importance of an impact results from an overall judgement on the effect of a source of impact on an environmental or social component after the application of mitigation or enhancement measures.

An impact is either positive or negative. However, only the importance of negative impacts is assessed in this study. The impact assessment is based on the three criteria discussed in section 6.1.3.1: intensity, extent, and duration of the impact. The correlation between these criteria, as shown in Table 6-5, allows making an overall judgement on the importance of the residual impact at each phase of the Project based on the following scale: minor, moderate, or major importance.

The impact assessment matrix presented in Table 6-5 is meant to be symmetric since there are seven (7) possibilities for the impact to be of major importance, thirteen (13) possibilities for the impact to be of moderate importance, and seven (7) possibilities for the impact to be of minor importance.

The occurrence of incidences related to GBV, safety and public health, and occupational health are discussed in terms of risk rather than the importance of impact.

**Table 6-5 Residual Impact Assessment Matrix**

| Impact Assessment Criteria | | | Importance |
|---|---|---|---|
| **Intensity** | **Extent** | **Duration** | |
| High | Regional | Long | Major |
| | | Medium | Major |
| | | Short | Major |
| | Local | Long | Major |
| | | Medium | Major |
| | | Short | Moderate |
| | Limited | Long | Major |
| | | Medium | Moderate |
| | | Short | Moderate |
| Medium | Regional | Long | Major |
| | | Medium | Moderate |
| | | Short | Moderate |
| | Local | Long | Moderate |
| | | Medium | Moderate |
| | | Short | Moderate |
| | Limited | Long | Moderate |
| | | Medium | Moderate |
| | | Short | Minor |
| Low | Regional | Long | Moderate |
| | | Medium | Moderate |
| | | Short | Minor |
| | Local | Long | Moderate |
| | | Medium | Minor |
| | | Short | Minor |
| | Limited | Long | Minor |
| | | Medium | Minor |
| | | Short | Minor |

# 6.2 IMPACTS ASSOCIATED WITH THE PROJECT

## *6.2.1 POSITIVE IMPACTS*

### 6.2.1.1 BIRDS AND WILDIFE

Power line ROWs when properly managed can be beneficial to wildlife, providing them with feeding and nesting sites for birds and mammals.

#### 6.2.1.2 EMPLOYMENT AND ECONOMIC DEVELOPMENT

Economic opportunities for PAPs and communities can be in the form of temporary employment and business opportunities during the construction and operation phases, including revenues from the sale of food and other consumable goods to workers. This positive outcome will particularly benefit women since many of them derive income from this type of economic activity.

Some jobs are expected to be available during the construction of the transmission line for the local population, mainly as casual workers. However, these employment opportunities are expected to be temporary and benefit the community in the short-term only. This would result in a limited positive impact on employment, since few local people are likely to be employed. To maximize the Project's positive impacts on the creation of jobs, the following mitigation measures will be implemented:

- Apply human resource policies favoring local labor (local content plan) during construction and maintenance, including subcontracting wayleave vegetation management to local communities;
- Implement training programs to build local capacity;
- Disclose information on newly created business opportunities;
- Encourage the recruitment of female workers, with equal payment for male and female workers, for equivalent jobs.

#### 6.2.1.3 INFRASTRUCTURE

##### REGIONAL ECONOMIC DEVELOPMENT

One of the most important anticipated benefits to the population is increased electricity supply to communities and households. There is currently a lack of electricity in areas crossed by the Project. Many significant long-term indirect impacts could arise with the electrification of the region and increased electricity availability, provided the Project is properly optimized and integrated to its environment. With the additional energy supply, community institutions and trading centers could improve services, increase economic activity, and accelerate their development in their areas of expertise. Furthermore, the existing electricity grid is likely to become more stable with the interconnection. Although rural electrification is not part of the current Project, it could improve opportunities for rural electrification that would be coordinated by the Rural Electrification Authority. The following section provides Project integration recommendations that could be considered to enhance positive impacts.

##### AGRICULTURAL INFRASTRUCTURE

Improved availability and reliability of energy in the region, resulting in improved access to electricity for households and communities, can also improve storage and processing of agricultural products, increasing their market value and/or extending their preservation periods. Storage with refrigerators can preserve dairy products, fruits, and vegetables that can be sold or consumed during the following days. Grain mills can be built in the villages of producers instead of bringing products to "mill towns", thereby reducing transportation costs and time losses. These improvements could result in higher values for agricultural products and better incomes for farmers, in the long term.

##### DEVELOPMENT AND HEALTH

Electrification could support investments in education and strengthen capacity-building efforts to overcome critical constraints in implementing development programs. Furthermore, power supply to health facilities, cold storage for transport, and storage of vaccines and other essential medicines could significantly improve health services in the Project area.

Improvements in the education and health systems will contribute to the enhancement of girls' and women's literacy rates and well-being. Ultimately, it could improve their access to current or future wage employment and decrease discrimination against women and girls (Jayachandran, 2014).

#### 6.2.1.4 POSITIVE IMPACTS OF DECOMMISSIONING

Decommissioning the Project at the end of its life is also likely to result in positive impacts, including but not limited to:

- reduced habitat fragmentation by revegetation of the wayleave;
- reduced risk of bat and bird collisions;
- possible reversal of land use restrictions within the wayleave, creating opportunities for agricultural or other economic activities;
- reduced radio and television signal interruptions;
- improved landscape and visual quality due to removal of towers, lines, substations, and access roads;
- reduced risk of electrocution;
- economic and employment opportunities from temporary work associated with decommissioning activities.

## 6.2.2 NEGATIVE IMPACTS TO THE PHYSICAL ENVIRONMENT

### 6.2.2.1 SOILS

#### CONSTRUCTION PHASE

##### POTENTIAL IMPACTS

- Soil erosion in erosion-prone areas;
- Soil compaction in work areas;
- Loss of organic layer in areas where excavation and backfilling activities are held;
- Changes in soil's chemical properties and risk of soil contamination.

##### SOURCES OF IMPACT

- Site preparation;
- Construction activities;
- Waste and hazardous materials management;
- Transportation and circulation;
- Presence of workers.

## MITIGATION MEASURES

Mitigation measures aimed at controlling soil erosion, compaction, organic layer losses, and contamination should be applied to reduce impacts. A complete list of mitigation measures is provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Develop and implement a Residual Material and Hazardous Products Management Plan in compliance with WB EHS Guidelines on waste management;
- Develop and implement an Emergency Preparedness and Response Plan, which should minimally consider the following:
  - 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 that the 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;
- Prepare and implement of erosion and sediment control plans, particularly in areas identified as having high erosion potential;
- Reduce the construction of new access roads, where possible. Promoting the use of existing access roads for machinery and vehicle movement, increasing their width as necessary;
- Avoid vehicle or machinery traffic in areas where soils are highly saturated, such as dambos.
- Preserve organic soil during construction so that it can be reused for restoration purposes at the end of the work.

## DETAILED IMPACT DESCRIPTION

Even prior to the construction phase, one of the Contractor's main obligations will be to translate the ESMP into a detailed Construction ESMP. This Construction ESMP will consider detailed specifications of construction activities (such as workers' camp/ equipment yard/workshop, borrow pits, presence of workers, etc.) and indicate how and when the ESMP's mitigation measures and monitoring requirements will be implemented.

The Construction ESMP is not limited to impacts on soils and will cover all environmental and social components analysed here. This obligation will ensure that environmental and social impact mitigations are fully adapted to detailed construction activities and equipment specifications that are currently unknown.

During the construction phase, construction of access roads, digging of foundation pits for the towers, and removing vegetation (for foundation purposes) are the main activities likely to affect soil structure and quality. Foundations will be dug up to variable depths, depending upon the tower type and soil characteristics. At the tower sites, all vegetation within the footprint of the tower base, and for a distance still to be determined beyond the base in all directions, will be cleared to ground level.

Excavation works and vegetation removal, especially on steep slopes, will render soils unstable and more vulnerable to erosion. As vegetation cover stabilises the soils and ensures resistance to erosion, vegetation removal will be restricted to a minimum. The herbaceous and ligneous species that do not represent a risk for the powerline will be maintained in place and will contribute to maintaining natural soil stabilization.

The construction of access roads and vehicle movement along the Project area can lead to soil compaction in areas where soils are clayey or highly saturated. Mitigation measures such as de-compaction of soils following construction and postponing construction activities during times when soils are saturated will help reduce associated adverse effects.

Excavation and backfilling work associated with the construction of the towers and access roads could result in the loss of the organic layer of the soils by mixing it with other layers. The agricultural potential in the study area is generally recognized as being rich and the region therefore supports an important population. Therefore, any existing layer of organic soil should be preserved. By initially removing the first inches of soil (exact depth to be determined on site) and storing those separately from the rest of the excavated soil, it will allow for their reuse.

In addition, soil contamination may also result from unsound waste management practices. Hazardous waste can be easily ignited, corrosive, reactive, or toxic. They can also have other physical, chemical, or biological characteristics that pose a potential risk to human health or the environment if improperly managed. Contractors and Subcontractors will be required to develop and implement waste management plans that comply with relevant WB waste management guidelines to ensure various types of waste produced during the construction phase (sanitary, non-hazardous, and hazardous) are adequately recovered, stored, and disposed of.

Finally, soils can be contaminated during the construction phase by soil mixing during the excavation of foundation pits or by accidental oil/fuel spills from heavy machinery, either at storage yards or worksites. With respect to soil mixing, excavated soils will be segregated and stockpiled in authorised sites during the construction phase to prevent soil mixing. In the case of accidental spills from heavy machinery, the extent of soil contamination will depend on the magnitude of these accidental events. However, the establishment of equipment storage yards and maintenance areas on adapted surfaces and the implementation of an Emergency Response Plan will help manage accidental spills correctly.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since the potential for soil erosion in the study area is low and the application of general mitigation measures will reduce erosion or compaction soil vulnerability, loss of organic layers, as well as possible soil contamination from soil mixing or accidental spills. The extent of the impact is local since soil erosion, compaction, organic layer losses, or contamination is likely to occur in a well-defined area within the ROW. The duration of the impact is medium since soil erosion, compaction, organic layer losses, and contamination could occur throughout the entire construction phase. The residual impact on soils during the construction phase is thus considered of minor importance. The probability of occurrence is low after the application of mitigation measures.

| **Residual Impact on Soil during the Construction Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: Low | |

## OPERATION PHASE

### POTENTIAL IMPACT

– Changes in soil's chemical properties and risk of soil contamination.

### SOURCE OF IMPACT

- Waste and hazardous materials management.

### MITIGATION MEASURES

Mitigation measures aimed at controlling contamination during the operation phase should be applied to reduce impacts. A complete list of mitigation measures is provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Develop and implement an Emergency Preparedness and Response Plan that includes spill response procedures;
- Develop and implement a Residual Material and Hazardous Products Management Plan
- Regularly inspect all equipment at substations that may contain contaminants, such as transformers;
- Store all ignitable, reactive, flammable, corrosive, and toxic materials in clearly labelled containers;
- Store hazardous materials in a manner that includes secondary containment and prevents interaction with other materials, the environment, and accidental tampering.

### DETAILED IMPACT DESCRIPTION

During the operation phase, oil spills could result from equipment breaking down at the substation sites, maintenance and replacement of transformers, and this could lead to soil contamination in proportion to the magnitude of these accidental events. During the construction phase, the risk of soil contamination from accidental oil spills, maintenance vehicles, and machinery cannot be discarded entirely. Moreover, specific attention must be given to the proper management of hazardous waste, particularly waste oil and substation equipment such as transformers. However, applying general mitigation measures and implementing a waste management plan will help reduce this risk significantly.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since immediate response to accidental spills and decontamination would be possible. The extent of the impact is limited since any spill or inappropriate management is likely to occur in a well-defined area within the ROW and substation site. Moreover, the impact duration is short, given that any accidental spill will be contained and cleaned up immediately. The residual impact on soils during the operation phase is thus considered of minor importance. The probability of occurrence is low after the application of mitigation measures.

| **Residual Impact on Soils during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Short | |
| Probability of occurrence: Low | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Soil erosion in erosion-prone areas;
- Soil compaction in work areas;

- Loss of organic layer in areas where excavation and backfilling activities take place;
- Changes in soil's chemical properties and risk of soil contamination.

## SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Decommissioning activities;
- Waste and hazardous materials management;
- Presence of workers.

## MITIGATION MEASURES

To reduce impacts, mitigation measures should be applied to control soil erosion, compaction, organic layer losses, and contamination. These measures are listed for construction and within the ESMP's Chapter 3.

## DETAILED IMPACT DESCRIPTION

Before the decommissioning phase, the Contractor will be responsible for preparing a detailed Construction ESMP for the decommissioning. This Construction ESMP will consider detailed specifications of decommissioning activities (such as workers' camp/ equipment yard/workshop, borrow pits, presence of workers, etc.) and indicate how and when the ESMP's mitigation measures and monitoring requirements will be implemented.

The ConstructionESMP is not limited to impacts on soils and will cover all environmental and social components analysed herewith. This obligation will ensure that environmental and social impact mitigations are fully adapted to detailed decommissioning activities and equipment specifications, which are currently unknown.

Decommissioning activities such as clearing vegetation from the ROW and access roads, backfilling tower foundations, filling depressions, and recontouring the terrain are the main activities likely to affect soil structure and quality.

Excavation works and vegetation removal, especially on steep slopes, will render soils unstable and more vulnerable to erosion. Vegetation cover stabilises the soil and ensures resistance to erosion, so the removal of vegetation will be reduced where possible. Revegetation of the ROW and access roads will be encouraged.

Excavation and backfilling work associated with filling the tower foundations or landscape recontouring could result in the loss of the soil's organic layer by mixing it with other layers. The agricultural potential in the study area is generally recognized as rich, and the region, therefore, supports an important population. Organic soil conserved during construction should be redistributed to decommissioned areas.

In addition, soil contamination may also result from poor waste management practices or through accidental spills. However, the establishment of equipment storage yards and maintenance areas on adapted surfaces and the implementation of a Waste Management Plan and Emergency Response Plan, as completed for the construction phase, will help manage accidental spills.

## IMPACT ASSESSMENT

The intensity of the residual impact is low since the potential for soil erosion in the study area is low and the application of general mitigation measures will reduce erosion or compaction soil vulnerability, loss of organic layers, as well as possible soil contamination from soil mixing or accidental spills. The extent of the impact is local since soil erosion, compaction, organic layer losses, or contamination is likely to occur in a well-defined area within the ROW. The impact duration is medium since soil erosion, compaction, organic layer losses, and contamination could occur throughout the decommissioning phase. The residual impact on soil during the decommissioning phase is thus considered of minor importance. The probability of occurrence is low after the application of mitigation measures.

| Residual Impact on Soils during the Decommissioning Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: Low | |

### 6.2.2.2 HYDROGRAPHY AND WATER RESOURCES

#### DESIGN MEASURE

As a general measure, existing access roads, including those opened for the construction of the 330kV Pensulo - Nakonde electricity transmission line, will be used whenever possible to minimize the need for new ones. This will help reduce the number of waterbody crossings. Additionally, the watercourses crossing will be perpendicular to the line, therefore reducing the length of said crossing.

When possible, the crossings will be in the narrowest sections of waterbodies. The positioning of the towers will be done at least 50 m from waterbodies.

#### CONSTRUCTION PHASE

##### POTENTIAL IMPACTS

- Changes in hydrology;
- Modifications of surface water quality with a risk of contamination;
- Modifications of groundwater quality with a risk of contamination.

##### SOURCES OF IMPACT

- Site preparation;
- Construction activities;
- Waste and hazardous materials management;
- Transportation and circulation.

##### MITIGATION MEASURES

A complete list of mitigation measures for reducing impacts on hydrography and water resources is provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Prepare and implement erosion and sediment control plans, particularly in areas identified as having high erosion potential;
- Develop and implement an Emergency Preparedness and Response Plan, including a spill response plan;
- Develop and implement a Residual Material and Hazardous Products Management Plan;
- Always maintain hydrological connectivity upstream/downstream in work areas. When stream crossings are unavoidable, construct suitable culverts or temporary bridges to ensure sufficient water supply to maintain a viable fish habitat. Ensure the temporary structures are removed at the end of construction and that the watercourse is restored to its original condition;

- Install silt barriers (e.g., fencing) when working in steep riparian areas and along wetlands to minimize potential sediments being transported to aquatic habitats;
- As much as possible, conduct work that may impact local hydrology during the dry seasons (from June to September) to minimize the risks associated with watercourse obstruction or encroachment;
- Operate machinery on land in a way that minimizes disturbance to the banks of watercourses;
- Construct a designated, signposted, concrete wash down bay that is fully contained for all excess concrete and concrete wash down (e.g., plastic lined);
- 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.
- Store hazardous materials at least 60 m away from any watercourse or wetland) in a manner that includes secondary containment and prevents interaction with other materials, the environment, and accidental tampering.

## DETAILED IMPACT DESCRIPTION

The proposed transmission line route crosses several watercourses over its length, including the Chambeshi River, as well as areas of seasonal wetlands. Sources of impact to watercourses and wetlands are the removal of vegetation, construction of access roads, vehicle movement along the ROW and construction sites, and excavation/piling for tower installations.

Vegetation removal in riparian areas can increase soil erosion, causing sediments to be deposited into the waterbodies, especially during rain events. Ultimately, this could lead to the deterioration of the water quality as well as a modification in the natural hydrology of these watercourses.

Construction of access roads, as well as vehicle movement along the construction sites, can result in changes pertaining to run-off, as well as hydrology, by modifying the water flow dynamics.

This impact will be minimized by prohibiting permanent access roads in wetland areas, minimizing construction of access roads in such areas to what is strictly essential to the Project's construction, and decommissioning all construction access roads in wetland areas as soon as they have fulfilled their purpose.

Moreover, the excavation of pits for the towers' foundations could expose groundwater. This groundwater will consequently be more exposed to contamination by spills or leaks of contaminants. Thus, any contaminated groundwater observed during excavation should be pumped out of the pits.

In addition, the development and implementation of both a waste management plan and an emergency measures plan by the Contractor and Subcontractors will mitigate the risks occurring from unsound waste management practices and potential spills that could result in both surface water and groundwater contamination.

## IMPACT ASSESSMENT

The intensity of the residual impact is low since all impacts can be efficiently mitigated or eliminated through the application of proposed mitigation measures. The extent is limited since any modification or disruption will be experienced in a specific area and will be controlled with the application of specific management measures. The duration is medium since contamination of water resources will be addressed immediately with the Emergency Measures Plan and changes in hydrology will be mitigated.

Thus, the residual impact on water resources during the construction phase is considered of minor importance. After the application of mitigation measures, the probability of occurrence is low.

| Residual Impact on Hydrography and Water Resources during the Construction Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Medium | |
| Probability of occurrence: Low | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Modifications of surface water quality with a risk of contamination;
- Modifications of groundwater quality with a risk of contamination.

### SOURCES OF IMPACT

- Waste and hazardous materials management;
- Transportation and circulation.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on hydrography and water resources during operations are provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Develop and implement an Emergency Preparedness and Response Plan, including a spill response plan;
- Develop and implement a Residual Material and Hazardous Products Management Plan;
- Conduct regular inspection of all equipment at substations that may contain contaminants, such as transformers;
- Ensure storage of all ignitable, reactive, flammable, corrosive, and toxic materials in clearly labelled containers;
- Ensure storage of hazardous materials in a manner that includes secondary containment and prevents interaction with other materials, the environment, and accidental tampering.

Mitigation measures aimed at reducing impacts on hydrography and water resources during the operation phase are listed in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

During the operation phase, oil spills could result from equipment breaking down at the substation sites and leading to ground and surface water contamination in proportion to the magnitude of these accidental events. Moreover, specific attention must be given to the proper management of hazardous waste and products and of substation equipment such as transformers. However, the application of general mitigation measures and the waste management plan will help reduce this risk significantly.

Additionally, the movement of machinery required for maintenance works near wetland areas could cause water quality alterations through contaminants leaking into the water. These impacts will be mitigated by applying proposed mitigation measures and favoring manual maintenance in their vicinity.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since an immediate response to accidental spills would be possible, and circulation in existing wetlands could be avoided. The extent of the impact is limited since any spill or inappropriate management is likely to occur in a well-defined area within the ROW and substation site. Moreover, the impact duration is short, given that any accidental spill will be contained and cleaned-up immediately. The residual impact on water resources during the operation phase is thus considered of minor importance. The probability of occurrence is low after the application of mitigation measures.

| **Residual Impact on Hydrography and Water resources during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Short | |
| Probability of occurrence: Low | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Changes in hydrology;
- Modifications of surface water quality with a risk of contamination;
- Modifications of groundwater quality with a risk of contamination.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Decommissioning activities;
- Waste and hazardous materials management.

### MITIGATION MEASURES

Mitigation measures to reduce impacts on hydrography and water resources are listed in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

The proposed transmission line crosses several watercourses, including the Chambeshi River, as well as areas of seasonal wetlands. Sources of impact to watercourses and wetlands include the removal of vegetation (i.e., on access roads and work laydown areas), transportation of equipment, materials and workers, excavation, and backfilling associated with filling tower foundations, recontouring, and landscaping activities. There is also a possibility that decommissioning activities can result in the exposure of surface water to contamination related to accidental spills.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since all impacts can be efficiently mitigated or eliminated through the application of proposed mitigation measures. The extent is limited since any modification or disruption will be experienced in a specific area and will be controlled with the application of specific management measures. The duration is medium since contamination of water resources will be addressed immediately with the emergency measures plan and mitigation measures will be implemented to reduce impacts on hydrology. The residual impact of decommissioning on water resources is thus considered of minor importance. The probability of occurrence is low after the application of mitigation measures.

| Residual Impact on Hydrography and Water Resources during the Decommissioning Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Medium | |
| Probability of occurrence: Low | |

### 6.2.2.3 AIR QUALITY

## CONSTRUCTION PHASE

### POTENTIAL IMPACTS

- Temporary air quality deterioration.

### SOURCES OF IMPACT

- Site preparation;
- Construction activities;
- Waste and hazardous materials management;
- Transportation and circulation;
- Worksite restoration.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on air quality during construction are provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Develop and implement a Pollution Prevention Management Plan
- Maintain equipment and machinery in good running condition;
- Prohibit idling of vehicles on-site; shut down generators and machinery when not in use;
- 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;Cover stockpiles of fine materials during periods of high winds;
- Cover excavated materials with erosion control blankets and loads of brittle material during transport;
- Use water for dust suppression on stockpiles, exposed soils, and roads if dust generation is observed;
- Prohibit any burning of wastes.

### DETAILED IMPACT DESCRIPTION

During the construction phase, several construction activities will be conducted at separate locations around the worksites (e.g., excavations, off-road equipment operation, traffic along the ROW and on unpaved roads, etc.). These activities generate dust and exhaust emissions, leading to temporary deterioration of air quality and disturbances to neighboring populations. Additionally, clearing activities could contribute to the local reduction of air quality, considering the emissions of organic matter, such as pollen, and the exposition of bare soil. However, with the application of general management measures, potential air quality deterioration during the construction phase is not expected to affect neighbouring populations significantly.

### IMPACT ASSESSMENT

The residual impact's intensity is low since applying mitigation measures will help reduce particulate matter significantly. The extent is local since particulate matter will likely be generated along the local road network and within the ROW and construction sites. The impact duration is medium since air quality deterioration will occur throughout the construction phase. The residual impact on air quality during the construction phase is thus considered of minor importance. The probability of occurrence is high since particulate matter emissions are commonly associated with construction activities.

| Residual Impact on Air Quality during the Construction Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

## CONSTRUCTION PHASE

### POTENTIAL IMPACTS

- Temporary air quality deterioration.

### SOURCES OF IMPACT

- Transportation and circulation;
- Maintenance and repairs.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on air quality during operation are provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Develop and implement a Pollution Prevention Management Plan
- Maintain equipment and machinery in good running condition;
- Prohibit idling of vehicles on-site; shut down generators and machinery when not in use;
- 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.

### DETAILED IMPACT DESCRIPTION

During the operations phase, maintenance activities, particularly ROW maintenance and related vegetation clearing activities, could have a negative impact on air quality. Degradation of air quality is expected to occur locally. Air quality may also be altered by fossil fuel-powered vehicles and machinery used for maintenance activities. Vehicles and traffic associated with maintenance activities are also likely to generate dust, especially during dry periods. However, with the application of general management measures, potential air quality deterioration during the construction phase is not expected to affect neighbouring populations significantly.

### IMPACT ASSESSMENT

The residual impact's intensity is low since applying mitigation measures will help reduce particulate matter significantly. The extent is local since particulate matter will likely be generated along the ROW. The duration of the impact is long since air quality deterioration will occur throughout the entire construction phase. The residual impact on air quality during the construction phase is thus considered of minor importance. The probability of occurrence is high since particulate matter emissions are commonly associated with construction activities.

| Residual Impact on Air Quality during the Operation Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: High | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Temporary air quality deterioration.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Decommissioning activities.

### MITIGATION MEASURES

Mitigation measures to reduce impacts on air quality are outlined in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

During the decommissioning phase, several activities will generate dust and exhaust emissions, which will lead to temporary air quality deterioration and possible disturbance to neighbouring populations. The application of general management measures is expected to reduce dust impacts during decommissioning effectively.

### IMPACT ASSESSMENT

The residual impact's intensity is low since applying mitigation measures will reduce particulate matter. The extent of the impact is local since particulate matter is not likely to be generated along the local road network and within the ROW and construction sites. The impact duration is medium since air quality deterioration will occur throughout the decommissioning phase. The residual impact on air quality during the decommissioning phase is thus considered of minor importance. The probability of occurrence is high since particulate matter emissions are commonly associated with construction activities.

| Residual Impact on Air Quality during the Decommissioning Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

### 6.2.2.4 CLIMATE CHANGE

#### RISK ASSESSMENT

Climate change-related hazards represent a risk for the Project as some critical Project component may be vulnerable to extreme rainfall and flooding, extreme temperatures, extreme weather events as well as wildfires and flooding. The following recommendations have been developed to improve climate change resilience throughout Project design, construction, and operations. As climate change risk is continually evolving, climate risks should be reassessed on an ongoing basis throughout Project operations to determine if additional resilience measures are necessary.

**Table 6-6 Climate Resilience Recommendations**

| Climate Hazard | Vulnerable Project Components | Recommendation |
|---|---|---|
| Extreme rainfall/flooding | Substations | Assess local flood risk for substations and determine if flood monitoring and/or flood proofing is required. |
| | Pylons and substations | Consider impacts of extreme rainfall and flooding as well as drought impacts on soil stability for pylon and substation foundation design. |
| | Pylons and substations | During operations, assess and monitor foundation stability after extreme rainfall and flood events. Inspect substations for damage following extreme rainfall events. |
| Extreme temperatures | Transmission lines and substations | Consider future temperature Projections in transmission line and substation design. |
| Extreme weather events | Pylons | Consider future wind Projections in pylon design. |
| Wildfire & flooding | Substations | Consider storage and containment if hazardous substances are stored at substations to protect from environmental releases in wildfire or flood events. |
| | All Project infrastructure | Develop emergency response plans, including early warning and alert system, for wildfire and flood events for construction as well as operations |

#### CONSTRUCTION PHASE

##### POTENTIAL IMPACTS

- Greenhouse gas emissions.

##### SOURCES OF IMPACT

- Site preparation;
- Construction activities;
- Waste management;
- Transportation and circulation;
- Worksite restoration.

##### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on climate change during construction are provided in the ESMP's Chapter 3, however, key mitigation measures are as follows:

- Develop and implement a Residual Material and Hazardous Products Management Plan;
- Develop and implement a Pollution Prevention Management Plan;

- Proceed to selective clearing within the wayleave, maintaining vegetation below 2 m when possible;
- Prohibit idling of vehicles on-site; shut down generators and machinery when not in use;
- Prohibit any burning of wastes.

## DETAILED IMPACT DESCRIPTION

Some greenhouse gas (GHG) emissions will occur during the construction phase. These will mostly derive from:

- Use of fossil fuels to power construction equipment and vehicles; and
- Land-use changes caused by the clearance of vegetation in the ROW.

Emissions could also result from management of hazardous products and residual materials, especially if waste is burned. However, this will be prohibited to avoid such air pollution.

Emissions from use of fossil fuels during construction cannot be avoided, as machinery and vehicles will be required to build the line. Generators will also probably be needed at worker camps. However, those emissions are not expected to be significant on a national scale, considering that construction work will have a limited intensity and duration. It is not possible to estimate those emissions at this time due to limited knowledge regarding the construction methods and calendar that will be developed by the contractor.

GHG emissions related to land-use changes caused by the clearance of woody, shrubby, and crop biomass in the wayleave were estimated based on the International Panel on Climate Change (IPCC) methodology for GHG inventories related to agriculture, forestry, and other land uses. Some land use classes were excluded as it is estimated that their disruption will not lead to major GHG emissions. Those include built environment, open area/rock outcrop, and water. Wetlands were also excluded as they will be avoided and will not be destroyed during construction activities. Additionally, agricultural land will only be affected at the base of pylons as crops below 2 m will be maintained within the wayleave, and construction activities will be done after the harvesting season. Lastly, calculations did not consider land use conversion that may occur outside of the wayleave resulting from people losing their land or having limited access to land and resources within the wayleave.

As shown in Table 6-7, GHG emissions for land clearing are estimated at 42,066 tonnes $CO_2$ eq. The results present a worst-case scenario for GHG emissions, as selected vegetation clearing will be done, keeping trees and shrubs under 2 m in height. However, calculations were made based on a complete clearance of woodland, fallow land, plantations, forests, and savannas.

**Table 6-7 Estimated GHG Emissions associated with Land Use Change**

| Land Use Class | Affected Area (ha) | Estimated GHG Emissions (tonnes $CO_2$ eq.) | Reference |
|---|---|---|---|
| Agricultural | 0.01 | 93.62 | Ogle et al., 2019 |
| Riverine forest | 0.18 | 1,657.43 | Domke et al., 2019; Aalde et al., 2006 |
| Fallow land | 1.60 | 4,901.76 | Ogle et al., 2019 |
| Plantation, orchard | 0.02 | 150.09 | Ogle et al., 2019 |
| Grassland | 0.88 | 1,352.29 | Domke et al., 2019; Aalde et al., 2006 |
| Woodland | 3.89 | 33,909.93 | Domke et al., 2019; Aalde et al., 2006 |
| **Total** | | **42, 065.93** | |

It should be noted that, after construction, some vegetation will return to the ROW as crops and trees smaller than 2 m will be tolerated by ZESCO. Aside from the area of Nakonde substation and the pylons' base, vegetation will be restored within the ROW, allowing to capture carbon. Due to limits in tree heights in the wayleave, it is considered that all land use classes will return as shrubland. According to the IPCC methodology, it is estimated that 2, 760.01 tonnes $CO_2$ eq. per year could be captured, mitigating the emissions associated with ROW clearance.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since the application of mitigation measures will help reduce significantly particulate matter. The extent is regional since climate change-related impacts may be felt throughout the region. The duration of the impact is medium since emissions will occur throughout the entire construction phase. The residual impact on climate change during the construction phase is thus considered of moderate importance. The probability of occurrence is high since emissions are commonly associated to construction activities.

| Residual Impact on Climate Change during the Construction Phase | |
|---|---|
| Intensity: Low | Importance: Moderate |
| Extent: Regional | |
| Duration: Medium | |
| Probability of occurrence: High | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Increased climate change vulnerability due to loss of vegetation cover;
- Potential emissions of greenhouse gases.

### SOURCES OF IMPACT

- Presence and operation of line, substations, and access roads;
- Maintenance and repairs;
- Waste and hazardous materials management.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on climate change during operations are provided in the ESMP's Chapter 3, however, key mitigation measures are as follows:

- Allow vegetation below 2 m to grow within the wayleave to increase vegetation cover.

### DETAILED IMPACT DESCRIPTION

Loss of vegetation cover due to land clearing in the wayleave may lead to increased vulnerability to flood, especially in low-lying areas. Landslide may also be more frequent in areas with important slopes.

Emissions from machinery could include greenhouse gases, but quantities are expected to be limited and emissions should only occur over short periods of time when maintenance activities are ongoing. Greenhouse gas emissions associated to the operation and maintenance of the powerline and substations are not expected to be significant on a national scale. Poor management of hazardous products and residual materials could generate small amounts of GHG.

### IMPACT ASSESSMENT

The intensity of the residual impact is minor since the application of mitigation measures will reduce emissions and climate change vulnerability. The extent of the impact is local since impacts should mostly be felt along the line route, especially in low-lying or erosion-prone areas and near-maintenance work. The duration of the impact is medium since it is likely to occur throughout the operation phase, but not continuously. The residual impact on climate change during the operation phase is thus considered of minor importance. The probability of occurrence is moderate since extreme climatic events are difficult to predict.

| **Residual Impact on Climate Change during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: Moderate | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Greenhouse gas emissions.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Decommissioning activities.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on climate change during decommissioning are provided in the ESMP's Chapter 3, however, key mitigation measures are as follows:

- Prohibit idling of vehicles on-site; shut down generators and machinery when not in use;
- Prohibit any burning of wastes.

### DETAILED IMPACT DESCRIPTION

Greenhouse gas (GHG) will be emitted during the decommissioning phase. Emissions during the decommissioning phase will be mainly related to the use of fossil fuels to power construction equipment and transport vehicles, however, it is possible that at the time of decommissioning the use of electronic construction and transport vehicles will have increased, resulting in fewer GHG emissions.

Based on current conditions, emissions from the use of fossil fuels during decommissioning is likely as machinery and transport vehicles will be required to dismantle Project infrastructure, clear vegetation, recontour the terrain, and transport materials, equipment, and workers. It is also possible that generators will be needed at worker construction camps, however, it is likely that access to electricity will have improved at the time of decommissioning. Regardless, decommissioning works will have a limited intensity and duration.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since the application of mitigation measures will reduce emissions. The extent of the impact is local since emissions are expected to be generated along the local road network and within the wayleave and decommissioning sites. The duration of the impact is medium since emissions will occur throughout the decommissioning phase. The residual impact on climate during the decommissioning phase is thus considered of minor importance. The probability of occurrence is high since GHG emissions are commonly associated to construction activities.

| Residual Impact on Climate Change during the Decommissioning Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

## 6.2.2.5 NOISE AND VIBRATIONS

## CONSTRUCTION PHASE

### POTENTIAL IMPACT

- Increase in noise and vibration levels.

### SOURCES OF IMPACT

- Site preparation;
- Construction activities;
- Transportation and circulation;
- Worksite restoration.

### MITIGATION MEASURES

Mitigation measures for controlling noise and vibration during construction are provided in the ESMP's Chapter 3, however, key mitigation measures are as follows:

- Develop and implement a Pollution Prevention Management Plan;
- Set up a noise monitoring program for the construction phase to ensure compliance with the IFC's EHS Guidelines regarding noise levels.
- Maintain equipment and machinery in good running condition;
- Prohibit idling of vehicles on-site; shut down generators and machinery when not in use;
- Restrict noise and vibration-generating activities near residential or institutional sensitive receptors between 7 a.m. and 7 p.m.

### DETAILED IMPACT DESCRIPTION

Noise and vibrations will occur during site preparation and construction activities. In some locations, work will be done close to residences, farms, or businesses located along the ROW or near substations. Traffic, as well as the use of construction equipment and machinery, will lead to temporary noise that may disturb the neighbouring communities and the local fauna.

Noise and nuisance levels resulting from the construction works will be limited in time and will be significantly reduced with the implementation of the mitigation measures outlined in Chapter 3 of the ESMP. These measures include maintaining machinery and equipment in good running conditions and restricting noise-generating activities to daytime hours. Additionally, a grievance redress mechanism will be established, providing a means for residents to make noise complaints, if necessary.

### IMPACT ASSESSMENT

The application of the proposed mitigation measures will help keep a low intensity for the residual impact. The extent of the impact is local since noise and vibration levels will most likely increase in the worksites and the immediately surrounding areas. The impact duration is considered medium since it will occur during the entire construction phase. The residual impact of noise and vibrations during the construction phase is thus considered of minor importance. The probability of occurrence is high because noise and vibrations are part of construction activities.

| **Residual Impact of Noise and Vibrations during the Construction Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

## OPERATION PHASE

### POTENTIAL IMPACT

- Increase in noise and vibration levels.

### SOURCES OF IMPACT

- Maintenance and repairs;
- Transportation and circulation.

### MITIGATION MEASURES

Mitigation measures for controlling noise and vibration during operations are provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Maintain equipment and machinery in good running condition, including brakes, mufflers, silencers, catalyzers, etc.;
- Restrict noise and vibration-generating activities near residential or institutional sensitive receptors between 7 a.m. and 7 p.m.

### DETAILED IMPACT DESCRIPTION

During the operation phase, maintenance activities conducted near pylons, substations, transmission lines, or ROWs could increase noise levels, which may disturb neighbouring communities. However, these disturbances will be temporary since they are only felt during maintenance activities. Management measures proposed to reduce noise impacts during the construction phase will also help reduce noise impacts through the operation phase.

During the operation phase, two main sources of noise are expected to result from the powerline and substations: noise associated with the corona effect caused by discharge of energy and noise emitted by the equipment. These can be heard in proximity to the transmission line and the vicinity of substations. In general, noise produced by substations is higher than that produced by transmission lines. A study analysing noise levels around different 330kV substations shows that noise levels at the boundary of substations vary between 35 and 62 dBA (Chen, Gao, and Liu, 2014). With the distance, noise should not reach higher than accepted national standards.

Background noise emitted by the powerline and substations is affected by air conditions, including humidity, density, wind, and water. Thus, nearby residents are more likely to be affected by noise levels when the weather is rainy or foggy. The nearest residences to the substations are approximately 350 m, 450 m, and 500 m for Pensulo, Nakonde, and Mpika substations, respectively. From these distances, it is possible that the humming from transformers at the substations may still be audible if background levels of noise are below 30 dBA at night (Gange, 2011). If operational noise from substations results in exceedances of the World Bank Group noise level guidelines, the installation of noise barriers around substations should be considered. Overall, noise-related impacts during the operation phase are expected to be low.

Several decades of EMF research have failed to identify major public health risks, but some uncertainties do remain. Therefore, evaluating exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines are recommended by the Word Bank Group (World Bank, 2007).

The electric field produced by high-voltage lines is usually greatest directly beneath the transmission line but quickly reduces as distance from the centreline increases. For example, the electrical field from a 315-kV line generally returns to background levels within 40 m of the centreline (Hydro-Québec, 2019). The electric field is further reduced by the presence of trees, fences, and buildings (Hydro-Québec, 2019). Similarly, the magnetic field of transmission lines also reduces with distance from the transmission line, generally returning to background levels at ground level within 40 m and to levels below those emitted by a straight tube florescent light (at 15 cm distance) within 20 m of the centreline (Hydro-Québec, 2019). Additionally, given that the route alignment and substation locations were selected in part to avoid human development and urban areas, the overall impact of EMF is expected to be low.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since the application of the mitigation measures will significantly reduce noise and vibration levels. The extent of the impact is local, as noise and vibrations will be generated all along the transmission line and at the substation. Even if the noisier impacts will be felt during maintenance which will occur only for a short period of time, background noise from the powerline and the substation will be produced during the entire operation phase. The duration of the impact is then considered long. The residual impact during the operation phase is thus considered of moderate importance. The probability of occurrence is high since maintenance work will be needed to ensure the transmission line's operation.

| **Residual Impact of Noise and Vibrations during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Moderate |
| Extent: Local | |
| Duration: Long | |
| Probability of occurrence: High | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACT

- Increase in noise and vibration levels.

### SOURCES OF IMPACT

- Site preparation;

- Transportation and circulation;
- Decommissioning activities.

#### MITIGATION MEASURES

Mitigation measures to reduce noise and vibration impacts are identified in Chapter 3 of the ESMP.

#### DETAILED IMPACT DESCRIPTION

Noise and vibrations will occur as part of decommissioning. In some locations, work will be done near residences, farms, or businesses located along the ROW or substations. Traffic, as well as the use of equipment and machinery, will lead to temporary noise that may disturb neighbouring communities and nearby fauna.

Noise and nuisance levels resulting from the decommissioning works will be limited in duration and it is anticipated that mitigation measures to reduce noise and vibration impacts will be effective. These measures include maintaining machinery and equipment in good running order and restricting noise-generating activities to daytime hours.

#### IMPACT ASSESSMENT

The application of proposed mitigation measures will help keep a low intensity for the residual impact. The extent of the impact is local since noise and vibration levels most likely will increase in the worksites and the immediately surrounding areas. The duration of the impact is considered medium since it will occur during the decommissioning phase. The residual impact of noise and vibrations during the decommissioning phase is thus considered of minor importance. The probability of occurrence is high because noise and vibrations will be emitted from decommissioning activities.

| **Residual Impact of Noise and Vibrations during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

## *6.2.3 NEGATIVE IMPACTS TO THE BIOLOGICAL ENVIRONMENT*

### 6.2.3.1 TERRESTRIAL FLORA

#### DESIGN MEASURE

The study area comprises an important number of nationally and internationally designated areas, including forest reserves and a national park. The Lavushi Manda National Park, as well as most forest reserves, is avoided by the Project line route. The passage of the line route inside high integrity forests, with higher tree density, was also considered in the comparative analysis to reduce impacts.

#### CONSTRUCTION PHASE

#### POTENTIAL IMPACTS

- Permanent loss of natural habitat and critical habitat areas and associated flora;
- Modification of species composition in flora communities present in the LSA;

- Potential impacts on flora species of conservation concern;
- Supply reduction in ecosystem services for local communities and increased pressure on natural resources;
- Potential introduction of invasive alien species (IAS).

## SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Presence of workers.

## MITIGATION MEASURES

A complete list of mitigation measures for minimizing impacts on terrestrial flora is provided in the ESMP's Chapter 3. However, key mitigation measures are as follows:

- Clearly mark the extent of the ROW and temporary construction areas with stakes at intervals of 50 m or less. Identify and mark the vegetation to be preserved along sections of the ROW;
- Undertake ROW vegetation cutting with the supervision of a botanist or a technician from the Department of Forestry to identify and relocate, if possible, species of conservation concern;
- Implement the Compensation Plan for the loss of natural habitats, including plantation and restoration of natural miombo woodlands affected Forest Reserve (See BMP);
- Contribute to the development of management plans for the affected forest reserves;
- Undertake selective cutting of the vegetation in dambos and riparian habitat to keep low shrubby and herbaceous species that do not represent a risk for the powerline, including the Mungwi Forest Reserve;
- Implement the Biodiversity Management Plan (BMP) for mitigation and compensation of impacts on natural and critical habitat, as well as protected areas

## DETAILED IMPACT DESCRIPTION

During the construction phase, local vegetation will be cleared under the wayleave. According to the wayleave code of practice, developed by the local Energy Regulation Body in conjunction with the other local regulators, the maximum vegetation height allowed within the wayleave is 0.5 m. Vegetation clearing will lead to a permanent loss of terrestrial habitats within the ROW along the entire length of the transmission, for a width varying between 32 m, for the 132kV line between Nakonde substation and the Isoka-Nakonde line, 35 m, where the line follows the existing 330kV transmission line from Pensulo to Kasama, 50 m, where the proposed 330kV line stands alone and 60 m, for the double-circuit 400kV line between Nakonde and the Tanzanian border.

A large portion of the proposed transmission line runs parallel to existing or planned linear infrastructure. In fact, 321 km of the 625 km of planned powerlines is paired with another line or will be mounted on double circuit pylons, reducing additional habitat fragmentation and loss.

A proportion of these habitats is already used for agriculture or is composed of fallow land, reducing the loss and fragmentation of natural habitats. However, some forested areas, associated with the Miombo woodland, are crossed along the transmission line and will be subjected to the most vegetation loss. Affected areas for each habitat type are provided in Table 6-8 for the different line sections.

**Table 6-8 Habitat Types within the ROW per line section**

| Habitat type /landuses | Area (ha) | | | | | |
|---|---|---|---|---|---|---|
| | Pensulo - Mpika | Mpika - Kasama | Kasama - Nakonde | Nakonde - Tanzania /Zambia Border | Nakonde-Isoka | Total |
| Agriculture | 127,04 | 171,5 | 272,9 | 45,6 | 15,2 | **632,3** |
| Built-environment | 1,46 | 4,4 | 1,7 | 0,2 | 0,1 | **8,0** |
| Fallow land | 88,21 | 120,3 | 194,9 | 26,8 | 11,4 | **441,6** |
| Grassland - Open area | 185,01 | 31,1 | 24,9 | 0,0 | 0,0 | **241,0** |
| Riverine forest | 8,07 | 14,6 | 25,1 | 0,5 | 0,4 | **48,5** |
| Rock outcrop | 0,00 | 0,0 | 4,8 | 0,0 | 0,0 | **4,8** |
| Wetland | 60,65 | 63,4 | 194,8 | 2,2 | 1,1 | **322,1** |
| Degraded Woodland | 185,54 | 323,5 | 288,3 | 7,8 | 7,9 | **813,0** |
| Woodland-Mature | 20,46 | 4,7 | 0,0 | 0,0 | 0,0 | **25,2** |
| Woodland-Secondary | 121,74 | 56,8 | 54,7 | 0,0 | 0,0 | **233,3** |
| Plantation | 0,00 | 0,0 | 0,0 | 0,0 | 4,2 | **4,2** |
| **TOTAL** | **798,2** | **790,4** | **1062,1** | **83,1** | **40,4** | **2774,1** |

A large proportion of powerline right-of-way consists of agricultural areas and fallow land (39%). In the case of these land uses, vegetation clearing has limited impacts.

Vegetation loss will mostly affect woodland, riverine forests, as well as plantations.

A total of 307,5 ha of what can be considered as natural habitat, which secondary and mature woodland, as well as riverine forest, are found in the ROW and will need to be cut. Although considered natural habitat, it is important to note that most riverine forests are degraded and that the integrity of the secondary woodland in the Project area is low due to clearing for fuelwood, charcoal, and building materials and annual wildfires.

It is proposed to compensate for the habitat losses generated by the Project, by implementing a reforestation scheme to help restore the natural forest habitats. To appropriately mitigate residual impacts on natural habitats and achieve no net loss, it is estimated that a minimum of 361ha of natural miombo woodland (considering 85% plantation success) be replanted or restored elsewhere. ZESCO shall examine the possibility and may provide financial and logistical support to an existing reforestation scheme in the Study Area. This will include planting of areas affected by erosion and restoration of degraded forests in the Study Area. Support provided by ZESCO may include the procurement and distribution of native trees for planting, maintenance, and monitoring of the planted areas, etc. Further details on the reforestation scheme for compensation of natural habitat loss is provided in the BMP

Seven forest reserves are crossed by the transmission line; they include Kasama (2.9 km), Amenshi (0.3 km), Chitimukulu (3.2 km), Mungwi (0.4 km), Nkole Mfumu (4.4 km), and Kanona (30.7 km). However, these forest reserves have been degraded from human activities and infrastructure to varying degrees, as stated in Section 5.3.3.1 of the baseline chapter, where the habitats within the forest reserves, and more specifically within the wayleave of the proposed transmission line, are described.

As per the ERB Wayleave Code of Practice, wayleave width in Forestry Areas should be wider (78 m for a 330kV line) to prevent any danger to the line. However, to reduce impacts on habitats found within forest reserves and considering tree height in typical miombo woodland is not high, it was decided to maintain the 50 m ROW. The habitat types within the affected areas inside these forest reserves are presented in Table 6-9. Kanona FR and Nkole Mfumu FR are the forest reserves with the more natural habitats affected, i.e., riverine forest and mature and secondary woodland. The passage of the line inside the Kanona FR will lead to the clearing of 62.1 ha of mature and secondary miombo woodland. These more natural forests constitute disjunct patches interlaced with agricultural areas and other degraded woodland. In the Nkole Mfumu FR, although mature stands of forest are present in the Project's wayleave, these are relic patches within an area of disturbed forest. Furthermore, this section of the FR is already fragmented by another transmission line, as well as by the TAZARA railway.

The Nkole Mfumu FR comprises some vast unfragmented mature forests to the east, which will not be affected by the Project. As presented in Table 6-9. The clearing of the will lead to the loss of 20.4 ha of mature and secondary woodland, which represents a loss of 0.01% of the total mature woodland within the FR.

In Mungwi FR the Project's ROW is composed of herbaceous wetlands (dambo) and riverine forests. The dambo area should not suffer any vegetation loss during construction because the vegetation height is below 0.5 m. However, the proposed transmission line will require the clearing of 0.7 ha of riverine forest. Mitigation measures to ensure maximum vegetation cover is preserved during construction work and restoration works required to ensure the area maintains its ecological functions will reduce the impacts on vegetation in the Mungwi FR. Where possible, the sitting of pylons within the wetlands should be avoided.

Specific measures for the impacts on forest reserves are developed in the BMP.

**Table 6-9 Habitat types in the ROW in the different forest reserves affected**

| Habitat type/ Landuse | Kasama Forest Reserve | Amenshi Forest Reserve | Chitimukulu Forest Reserve | Mungwi Forest Reserve | Nkole Mfumu Forest Reserve | Kanona Forest Reserve | Nakonde Forest Reserve |
|---|---|---|---|---|---|---|---|
| Agriculture | 0.06 | 1.08 | 2.29 | | 1.13 | 20.91 | - |
| Build-environment | 0.01 | - | - | - | - | 0.26 | - |
| Fallow land | - | - | 7.12 | - | 0.64 | 10.53 | - |
| Grassland - Open area | 0.11 | - | | - | - | 5.46 | - |
| Rock Outcrop | 4.78 | - | - | - | - | - | - |
| Riverine forest | - | - | | 0.74 | | 1.81 | - |
| Wetland | 0.24 | - | - | 1.41 | - | 6.41 | - |
| Plantation | - | - | - | - | - | - | 4.18 |
| Degraded Woodland | - | - | - | - | - | - | 0.34 |
| Woodland-Mature | - | - | - | - | 4.72 | 20.46 | |
| Woodland-Secondary | 9.08 | - | 6.75 | - | 15.64 | 41.64 | - |
| Total | 14.28 | 1.08 | 16.16 | 2.15 | 22.13 | 107.48 | 4.52 |
| Total natural habitat | 9..08 | 0 | 6..75 | 0.74 | 20.36 | 63.91 | 0 |

Several species of conservation concern are present or potentially present within the BESA: these included critical habitat trigerring *Disa aequiloba* (En), *Encephalartos schmitzii* (VU and RR) *Euphorbia perplexa var. kasamana* (RR) and *Gladiolus serenjensis* (RR) (see Critical Habitat Assessment in Appendix 5-14). Impacts on critical habitat of these species is anticipated for *Disa aequiloba* and *Euphorbia perplexa var kasamasa*, whereas critical habitat for the *Encephalartos schmitzii* (VU and RR) and *Gladiolus serenjensis* (RR), although present in the BESA, should not be impacted by the Project.

*Disa aequiloba* could potentially be found in natural undisturbed wet grasslands and dambos A total of 322 ha of wetland is found within the Project ROW. Although the majority of wetlands have been transformed for agricultural purposes, natural patches of wetland are susceptible to support *Disa aequiloba*. Targeted surveys of natural wetland areas to determine if the species is present are needed in order to detail further mitigation measures and determine the residual impact on this species. As *Disa aequiloba* is an herbaceous species, its presence within the right-of-way can be largelly protected and maintained during construction and operation of the line. With the application of avoidance and minimization measures provided above, the project will not lead to a significant loss of the species or its habitat.

*Euphorbia perplexa var. Kasamana* is found in the rock outcrops in the Kasama Forest Reserve. A total of 4,8 ha of rock outcrop is found within the Project ROW in the Kasama forest reserve. It is recommended to undertake targeted surveys of the area to detail mitigation measures to reduce the residual impact on this species. As *Euphorbia perplexa var. Kasamana* is a low-lying species, its presence within the right-of-way can be largely protected and maintained during construction and operation of the line. With the implementation of avoidance and minimization measures provided above, the project will not lead to a significant loss of the species or its habitat. However, if feasible technical options to avoid the crossing of rock outcrops in proximity and within the Kasama Forest Reserve are identified, this would further prevent any residual impact.

Specific mitigation measures for these critical habitat features are described in the BMP.

As a botanist will be part of the site preparation team, specimens of species of conservation concern will be preserved, when possible. However, if cutting off a species of conservation concern is necessary during clearing activities, the GPS coordinates of each specimen and the description of their habitats will be noted. Each lost specimen will be offset by replanting, and the success of their plantation will be monitored.

Flora species also have an important role as they provide many ecosystem services contributing to the likelihood of local communities. According to baseline data, local habitats contribute to timber products, poles, firewood, animal fodder, soil, water stability and quality, tannins, dyes, food, and medicine. Habitat loss will result in a local reduction of natural resources used by people located along the ROW and access roads.

Extended vegetation clearings for the ROW, access roads, and work areas could result in an increased likelihood of invasive alien species' (IAS) establishment along the transmission line route, as these species often thrive in disturbed environments. Habitats providing food and cover for local wildlife may be altered or lost if these IAS outcompete existing native plants, resulting in a loss of plant and animal diversity.

The transport activities and excavation work could increase particulate matter in the air, with a risk of deposition on leaves and plants' reproductive organs. These deposits could impair the photosynthesis and reproduction processes, with associated impacts on recruitment. However, this impact is expected to affect flora very locally.

### IMPACT ASSESSMENT

The intensity of the impact on terrestrial flora is high, considering that all shrubs and trees within the ROW will be cleared to maintain vegetation height below 50 cm. Although the application of mitigation measures will limit the extent of the impact, the intensity of the residual impact remains High. The extent of the impact on terrestrial flora is limited since the Project will follow other existing and planned transmission lines and a large portion of the affected area is used for agriculture. The impact duration is considered long as the vegetation must be cut and maintained at a given height.

The residual impact on terrestrial flora is thus considered of major importance. The probability of occurrence is high since, if the Project is approved, the construction work will take place. A compensation plan will allow to offset remaining residual impacts.

| **Residual Impact on Terrestrial Flora during the Construction Phase** | |
|---|---|
| Intensity: High | Importance: Major |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: High | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Maintenance of the vegetation in the early stages of regeneration;
- Impairments of natural habitats and associated flora communities;

– Potential introduction of invasive alien species (IAS).

## SOURCES OF IMPACT

– Maintenance and repairs;

– Transportation and circulation.

## MITIGATION MEASURES

Mitigation measures for minimizing impacts on terrestrial flora during the operation phase are identified in the ESMP's Chapter 3. However, key mitigation measures are as follows:

– Make chopped woody resources and residues available to local populations in order to reduce additional pressure on natural resources;

– Undertake selective cutting of the vegetation in dambos, rock outcrops and riparian habitats to keep low shrubby and herbaceous species that do not represent a risk for the powerline, including the Mungwi Forest Reserve;

– Use mechanical methods for vegetation control inside the ROW. Forbid use of chemical pesticides to control vegetation in the ROW;

– Implement an IAS monitoring program;

– Develop and implement the BMP for mitigation and compensation of impacts on natural and critical habitat, as well as protected areas

## DETAILED IMPACT DESCRIPTION

During the operation phase, the ROW's maintenance will require regular vegetation clearing to reduce short-circuit risks caused by electric arcing. This means no vegetation will be allowed to grow above 0.5 m within the ROW, continuously altering natural habitats. The most affected forms of flora are woody species, which can grow over these limits. This periodic disturbance will maintain ROW habitats in earlier vegetation development stages, leading to the presence of more common species and the rarity of specialized species.

The presence of access roads in previously inaccessible areas could lead to an increase in natural resource exploitation and a reduction of species communities with higher use, particularly inside forested areas. This could generate additional fragmentation and degradation of forest species.

Moreover, periodic ROW maintenance activities can also lead to IAS proliferation, especially if these activities include moving and clearing of vegetation. Once introduced, IAS will likely spread and impact adjacent areas with habitats that correspond to their ecological requirements.

## IMPACT ASSESSMENT

The application of the proposed mitigation measures and the fact that most of the impacts on flora are associated with the construction phase, the intensity of the residual impact is considered low since the vegetation will need to be cut below a certain height to reduce risk to the transmission line operation. The extent of the impact on terrestrial flora is local, as maintenance work will be needed along the entire ROW, but natural vegetation presence is quite limited. The impact duration is considered long as the impact will be effective during the entire operation phase due to the continuous need for ROW maintenance. The residual impact on terrestrial flora is thus considered of moderate importance. The probability of occurrence is high as maintenance works will be undertaken periodically during the operation phase.

| Residual Impact on Terrestrial Flora during the Operation Phase | |
|---|---|
| Intensity: Low | Importance: Moderate |
| Extent: Local | |
| Duration: Long | |
| Probability of occurrence: High | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Change in vegetation composition and structure;
- Modification of species composition in flora communities present in the Project area;
- Potential introduction of IAS.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Decommissioning activities;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures to reduce impacts on terrestrial flora are found in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

Sources of impact on terrestrial flora will first be related to the removal of vegetation (i.e., on access roads, work laydown areas, etc.). Decommissioning activities will require that some access roads be returned to the same condition as during the construction stage, therefore requiring vegetation clearing as well as clearing work areas for dismantling of infrastructure.

Once decommissioning has been completed, roads will be removed and reclaimed, and the wayleave and work areas will be reseeded and revegetated with endemic flora species to prevent the introduction of undesirable plant species into reclaimed areas. Restoration of work areas paired with the cessation of maintenance activities within the ROW will positively impact the vegetation structure and diversity through a reduction of soil erosion and direct loss of vegetation. Successful native restoration will increase plant diversity and structure, reduce the proportion of exotic species, and improve habitats.

### IMPACT ASSESSMENT

The decommissioning and the application of the proposed mitigation measures will result in a positive residual impact on vegetation overall. The extent of the impact will be limited, as work will affect only part of the ROW, and vegetation regrowth will occur only in areas where there is no agriculture. The impact duration is considered long, as once decommissioning activities are done, vegetation will regrow and persist in wayleave. The impact on terrestrial flora is thus considered of minor importance. The probability of occurrence is medium since local populations may use the reclaimed areas for agriculture or other purposes, reducing vegetation regrowth.

| Residual Impact on Terrestrial Flora during the Decommissioning Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: Moderate | |

### 6.2.3.2 AVIFAUNA

## CONSTRUCTION PHASE

### POTENTIAL IMPACTS

- Permanent displacement through the loss or modification of bird habitat;
- Permanent and temporary displacement through disturbance, specifically breeding species;
- Potential alteration of habitats for species of conservation concern;
- Direct mortality because of collisions with vehicles;
- Direct mortality of ground-nesting birds, specifically nestlings;
- Local reduction of avifauna density because of poaching.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Construction activities;
- Waste and hazardous materials management;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures for minimizing impacts on avifauna are identified in Chapter 3 of the ESMP. However, key mitigation measures are as follows:

- Undertake a pre-construction inspection (avifaunal walk-through) of the final powerline route alignment and road access routes;
- Where a threatened bird species is nesting, do not undertake tree clearing within a radius of 1 km. Wait until the nest is deserted. Check weekly to verify nest activity;
- Compensate any loss of breeding/nesting sites by the creation of suitable habitats elsewhere, notably from enhancement of degraded habitats;
- Develop and Implement the Biodiversity Action Plan.

## DETAILED IMPACT DESCRIPTION

Construction activities will lead to habitat loss, modification and fragmentation for some terrestrial and water birds. Vegetation clearing will be reduced to the extent possible. In some cases, extensive areas of vegetation will be cleared, reducing the number of habitats available to birds for foraging, roosting, and breeding. All species recorded in the BESA have the potential to be displaced by the proposed ZTIP as a result of habitat transformation and disturbance, including threatened or near threatened species according to IUCN, which include Bateleur (*Terathopius ecaudatus*)-EN, Tawny Eagle (*Aquila rapax)*-VU and Steppe Eagle (*Aquila nipalensis*)-EN, the Crowned Eagle (*Stephanoaetus coronatus*)- NT, the Martial Eagle (*Polemaetus bellicosus*) -EN, the Pallid Harrier (*Circus macrourus*) - NT, the Lappet-faced Vulture (*Torgos tracheliotos*) – EN, the White-backed Vulture (*Gyps africanus*)- CR, the White-headed Vulture (Trigonoceps occipitalis)-CR, the Southern Ground-hornbill (*Bucorvus leadbeateri*) – VU and the Cape Parrot *(Poicephalus robustus*)- VU. However, many of these species have persisted despite existing disturbance within the study area. This resilience, coupled with the fact that similar habitats (except for the riverine forests) are available throughout the broader area, means that the displacement impact is unlikely to be of regional or national significance. The loss of habitats may be more significant for smaller passerine species with small home ranges, as entire territories could be removed during construction.

Similarly, excavation and construction activities are a source of significant noise disturbance from the machinery and workers that are present on site for the duration of the construction phase. For most bird species, construction activities are likely to be a cause of temporary disturbance impacting foraging and roosting behaviour. In more extreme cases, construction may impact the breeding success of certain species, particularly if the disturbance occurs during a critical part of the breeding cycle, resulting in temporary breeding failure or permanent nest abandonment.

The High and Medium-High Sensitivity Zones identified in Maps 5-17 to 5-19 of the baseline will be most susceptible to habitat transformation and disturbance. Typically, construction activities associated with a new powerline could have an impact on breeding populations of various bird species, particularly large raptors that may be utilizing the existing infrastructure or breeding in the immediate vicinity. Large raptors breed roughly between March and November. The most critical period within this time span is from March to August, when the eggs are incubated, and again from September to November when the young birds are almost ready to fledge.

Early in the breeding season, if disturbed, the risk of desertion by adults is bigger than later, when the young bird is in the nest and being fed by the adults. At the end of the breeding season, the young bird may be tempted to jump out of the nest and fly prematurely if disturbed, resulting in injury or death. Every attempt will need to be made to restrict the disturbance of these birds to a minimum during construction in these sensitivity zones.

Roadside verges are an attractive habitat to a diversity of bird species (Kaseloo 2006; Pocock & Lawrence 2006; Roach & Kirkpatrick 1985). Vegetation is often dense and lush (when compared to surrounding areas, due to protection from grazing animals and an increased supply of water from road surface runoff), supporting high density of rodents that, in turn, attract predatory birds such as owls, raptors, and herons. Swallows and swifts are attracted to culverts and bridges because of the nesting opportunities they provide. For these species, who are attracted to roads, collisions with motor vehicles transporting materials, equipment, and workers to and from the site may be a source of direct mortality.

Bird mortality due to construction activities is improbable because birds are incredibly mobile and able to move out of harm's way. If mortality does occur, it is likely to be confined to a localised area and restricted to immobile individuals (e.g., nestlings).

An avifaunal inspection prior to construction shall verify the presence of nests or breeding locations pertaining to Red List species. If these are observed, site-specific mitigation measures must be developed and implemented. Tree clearing should not be undertaken within a radius of 1 km until the nest is deserted.

The presence of workers could lead to increased poaching of certain bird species.

An awareness program should be implemented for biodiversity protection with workers, including a prohibition on owning firearms and other hunting equipment, sensitization about the prohibition on engaging in poaching, and sensitization about animal behavior and handling.

## IMPACT ASSESSMENT

The application of the proposed mitigation measures limits the intensity of the residual impact on avifauna to medium. The extent of the impact on the avifauna is limited since vegetation clearing may impact bird habitats locally. The impact duration is considered long, as the habitats will be modified permanently. The residual impact on avifauna is thus considered of moderate importance. The probability of occurrence is high because the ROW requires preparation prior to construction activities and will then generate habitat loss and fragmentation.

| Residual Impact on Avifauna during the Construction Phase | |
|---|---|
| Intensity: Medium | Importance: Moderate |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: Moderate | |

# OPERATION PHASE

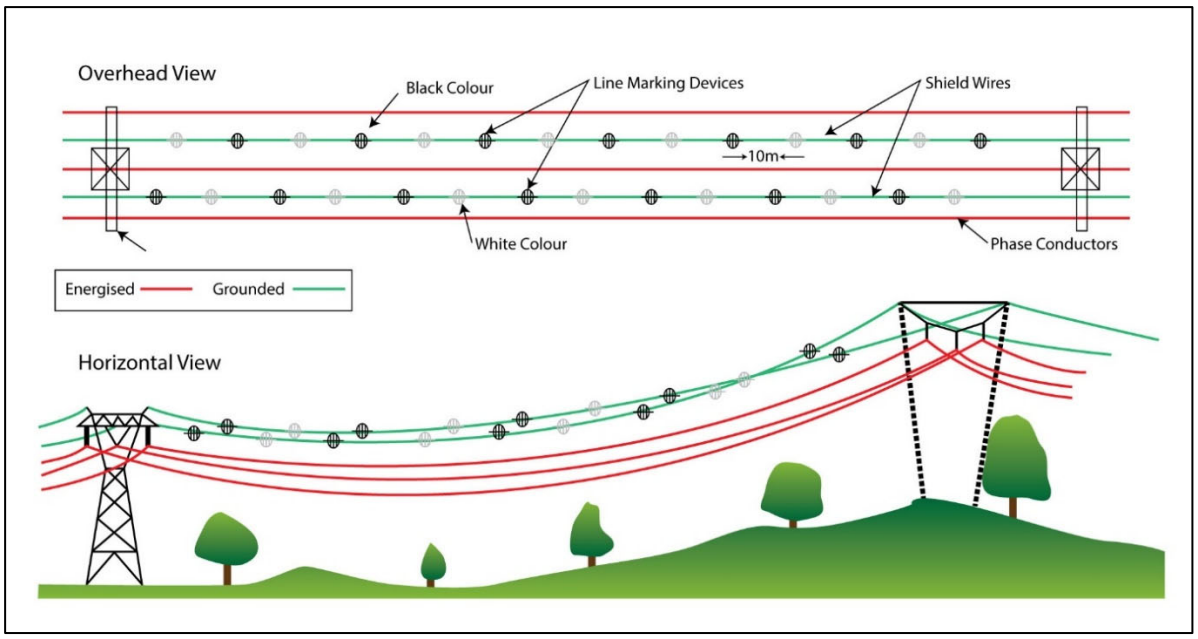
## DESIGN MEASURE

Where the powerline is parallel to another powerline, both should have the same elevation to avoid creating a larger obstacle.

In High, Medium-high, and Medium sensitivity habitats, illustrated in Maps 5-17 to 5-19 and according to observations made during pre-construction walkover surveys (see above), install bird flight diverters on both earth wires in a staggered pattern, using alternating colours and installation on the full-earth wire/ground wire span length. Partial marking (i.e., installing bird flight diverters on the middle 60% of the earth wire span) appears to displace rather than reduce collisions. Research conducted in South Africa showed an apparent increase in dead birds under unmarked sections of marked earth wire spans (Shaw, 2013). Bird flight diverters shall be positioned at 10 m intervals on each earth wire/ground wire.

Bird flight diverters are to be maintained on sections of the powerline during its operational life span.

Typical installation of bird diverters is illustrated in the figure below. The length of transmission line needing protection for each bird sensitivity area and the estimated number of bird diverters are presented in Table 6-10.




Source: Feathers Environmental Services, 2019.

**Figure 6-1 Typical Installation of Bird Diverters**

**Table 6-10 Estimated number of bird diverters per bird habitat sensitivity area**

| Habitat Sensitivity Zone | Sensitivity | Length needing protection | Start PK (km) | End PK (km) | Segment | Average span | Number of spans needing protection | Estimated number of bird diverters |
|---|---|---|---|---|---|---|---|---|
| Area 1 | Medium | 1615,4 | 182,4 | 184,0 | Mpika - Pensulo | 400 | 5 | 400 |
| Area 2 | Medium | 504,6 | 179,0 | 179,5 | Mpika - Pensulo | 400 | 2 | 160 |
| Area 3-4-5 | Medium/Medium-High | 4041,7 | 172,7 | 176,7 | Mpika - Pensulo | 400 | 10 | 800 |
| Area 6-7 | Medium-High | 5022,9 | 165,6 | 170,6 | Mpika - Pensulo | 400 | 13 | 1040 |
| Area 8 | High | 3042,4 | 161,4 | 164,5 | Mpika - Pensulo | 400 | 8 | 640 |
| Area 9 | Medium | 321,4 | 159,8 | 160,1 | Mpika - Pensulo | 400 | 1 | 80 |
| Area 10 | Medium | 1158,7 | 155,1 | 156,3 | Mpika - Pensulo | 400 | 3 | 240 |
| Area 11-13 | Medium | 2148,3 | 150,6 | 152,8 | Mpika - Pensulo | 400 | 6 | 480 |
| Area 12 | Medium | 992,0 | 148,0 | 149,0 | Mpika - Pensulo | 400 | 3 | 240 |
| Area 14 | Medium | 8529,0 | 125,1 | 133,6 | Mpika - Pensulo | 400 | 22 | 1760 |
| Area 15 | Medium-High | 1131,4 | 100,6 | 101,7 | Mpika - Pensulo | 400 | 3 | 240 |
| Area 16 | Medium-High | 6934,9 | 90,6 | 97,6 | Mpika - Pensulo | 400 | 18 | 1440 |
| Area 17 | Medium-High | 827,3 | 84,9 | 85,7 | Mpika - Pensulo | 400 | 3 | 240 |
| Area 18 | Medium-High | 1390,7 | 73,7 | 75,1 | Mpika - Pensulo | 400 | 4 | 320 |
| Area 19-20 | Medium-High | 2312,1 | 63,9 | 66,2 | Mpika - Pensulo | 400 | 6 | 480 |
| Area 21 | Medium-High | 1022,1 | 70,2 | 71,2 | Mpika - Pensulo | 400 | 3 | 240 |
| Area 22-23 | Medium-High | 5542,6 | 57,1 | 62,6 | Mpika - Pensulo | 400 | 14 | 1120 |
| Area 24 | Medium-High | 2238,7 | 52,3 | 54,6 | Mpika - Pensulo | 400 | 6 | 480 |
| Area 25 | Medium-High | 3724,0 | 46,6 | 50,3 | Mpika - Pensulo | 400 | 10 | 800 |
| Area 26 | Medium | 460,4 | 35,5 | 36,0 | Mpika - Pensulo | 400 | 2 | 160 |
| Area 27 | Medium | 2474,7 | 26,9 | 29,4 | Mpika - Pensulo | 400 | 7 | 560 |

| Habitat Sensitivity Zone | Sensitivity | Length needing protection | Start PK (km) | End PK (km) | Segment | Average span | Number of spans needing protection | Estimated number of bird diverters |
|---|---|---|---|---|---|---|---|---|
| Area 28 | Medium | 1932,3 | 15,4 | 17,4 | Mpika - Pensulo | 400 | 5 | 400 |
| Area 29 | Medium | 617,8 | 0,9 | 1,5 | Mpika - Pensulo | 400 | 2 | 160 |
| Area 29b | Medium | 305,7 | 197,3 | 197,7 | Kasama - Mpika | 400 | 1 | 80 |
| Area 30 | Medium | 609,9 | 20,0 | 20,6 | Mpika - Pensulo | 400 | 2 | 160 |
| Area 31 | Medium-High | 2087,3 | 115,8 | 117,9 | Mpika - Pensulo | 400 | 6 | 480 |
| Area 32 | Medium-High | 509,2 | 195,8 | 196,3 | Kasama - Mpika | 400 | 2 | 160 |
| Area 33 | Medium | 14079,2 | 177,1 | 191,2 | Kasama - Mpika | 400 | 36 | 2880 |
| Area 34 | Medium | 447,5 | 164,8 | 165,3 | Kasama - Mpika | 400 | 2 | 160 |
| Area 35 | Medium-High | 6650,2 | 155,3 | 161,9 | Kasama - Mpika | 400 | 17 | 1360 |
| Area 36 | Medium-High | 5097,1 | 148,3 | 153,4 | Kasama - Mpika | 400 | 13 | 1040 |
| Area 37 | Medium-High | 2017,3 | 138,6 | 140,6 | Kasama - Mpika | 400 | 6 | 480 |
| Area 38 | Medium-High | 1691,8 | 133,5 | 135,2 | Kasama - Mpika | 400 | 5 | 400 |
| Area 39 | Medium | 951,6 | 125,3 | 126,2 | Kasama - Mpika | 400 | 3 | 240 |
| Area 40 | Medium | 1763,2 | 117,9 | 119,6 | Kasama - Mpika | 400 | 5 | 400 |
| Area 41 | Medium | 1109,5 | 113,9 | 115,0 | Kasama - Mpika | 400 | 3 | 240 |
| Area 42 | Medium | 4949,6 | 97,0 | 102,0 | Kasama - Mpika | 400 | 13 | 1040 |
| Area 43 | Medium-High | 6596,5 | 82,3 | 88,9 | Kasama - Mpika | 400 | 17 | 1360 |
| Area 44 | Medium | 1496,8 | 73,6 | 75,1 | Kasama - Mpika | 400 | 4 | 320 |
| Area 45 | Medium | 2148,6 | 52,6 | 54,8 | Kasama - Mpika | 400 | 6 | 480 |
| Area 46 | Medium | 4477,8 | 29,6 | 34,1 | Kasama - Mpika | 400 | 12 | 960 |
| Area 47 | Medium | 4991,8 | 21,7 | 26,8 | Kasama - Mpika | 400 | 13 | 1040 |
| Area 48a | Medium-High | 858,6 | 15,4 | 16,3 | Kasama - Mpika | 400 | 3 | 240 |
| Area 48b | Medium-High | 3285,3 | 10,0 | 13,3 | Kasama - Mpika | 400 | 8 | 640 |
| Area 49 | Medium | 3943,1 | 198,8 | 202,7 | Nakonde - Kasama | 375 | 11 | 825 |
| Area 50-51 | High | 4409,3 | 191,6 | 196,0 | Nakonde - Kasama | 375 | 12 | 900 |
| Area 52 | High | 639,8 | 180,2 | 180,8 | Nakonde - Kasama | 375 | 2 | 150 |
| Area 53 | Medium | 3643,5 | 162,8 | 166,5 | Nakonde - Kasama | 375 | 10 | 750 |
| Area 54 | Medium | 8774,9 | 135,4 | 144,2 | Nakonde - Kasama | 375 | 24 | 1800 |
| Area 55 | Medium-High | 4294,0 | 126,4 | 130,7 | Nakonde - Kasama | 375 | 12 | 900 |
| Area 56 | Medium | 6619,2 | 107,2 | 113,8 | Nakonde - Kasama | 375 | 18 | 1350 |
| Area 57 | Medium | 6169,3 | 66,7 | 72,9 | Nakonde - Kasama | 375 | 17 | 1275 |
| Area 58 | Medium | 10406,82355 | 19,44 | 29,84 | Nakonde - Kasama | 375 | 28 | 2100 |
| **Total (bird diverters)** | | | | | | | | **36690** |

## POTENTIAL IMPACTS

- Direct mortality through collisions with the earth wire/ground wire;
- Direct mortality through electrocution on the additional electrical infrastructure within the Nakonde, Kasama, Mpika, and Pensulo substations;
- Permanent displacement through maintenance of the vegetation in the early stages of regeneration, reducing the quality of bird habitats with strict ecological requirements.

## SOURCES OF IMPACT

- Presence and operation of line, substations, and access roads;
- Maintenance and repairs;
- Waste and hazardous materials management;
- Transportation and circulation.

## MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on avifauna during the operation phase are described in Chapter 3 of the ESMP. However, key mitigation measures are as follows:

- Coordinate land planning by local authorities to prevent implementation of infrastructure or land uses that may constitute an attraction for birds, such as landfills;
- Schedule ROW management activities to avoid breeding and nesting seasons of bird species with special status;
- Develop and implement the BMP.

## DETAILED IMPACT DESCRIPTION

Collisions of birds with transmission lines are the largest threat posed by powerlines to birds in Southern Africa (van Rooyen 2004a). Bustards, storks, cranes, vultures, and various species of water birds are the most heavily impacted. These species are mostly heavy-bodied birds with limited maneuverability, making it difficult to avoid colliding with powerlines (van Rooyen 2004a, Anderson 2001). Unfortunately, many collision-sensitive species are considered threatened in Southern Africa.

It is generally accepted that transmission lines pose a greater risk of collision than smaller distribution powerlines (Shaw 2013). In the case of large transmission lines, collision impacts are not linked to a specific structure type but rather to the presence of the thin earth wire at the top of the structure, which is a standard feature irrespective of the tower type, and the presence of species that are particularly vulnerable to collision (Shaw 2013, APLIC 2012).

Interactions between birds and powerlines are highly variable. They are dependent on a complex range of factors, including the technical specifications of the proposed development, the topography of the surrounding landscape, the habitats affected, and the number and diversity of birds present (APLIC, 2012). Along the proposed transmission line, areas with a higher potential for increased bird activity are associated with the presence of wetlands, dambos, open woodland, IBAs, and the Zambezian escarpment, likely to preclude mass migratory movement along and across the transmission line alignments.

A total of 60 species present and potentially present within the BESA are considered priority species, namely because of their susceptibility to powerline-associated impacts. These include species listed in the IUCN Red List, Bateleur (*Terathopius ecaudatus*)-EN, Tawny Eagle (*Aquila rapax)*-VU and Steppe Eagle (*Aquila nipalensis*)-EN, the Crowned Eagle (*Stephanoaetus coronatus*)- NT, the Martial Eagle (*Polemaetus bellicosus*) -EN, the Pallid Harrier (*Circus macrourus*) - NT, the Lappet-faced Vulture (*Torgos tracheliotos*) – EN, the White-backed Vulture (*Gyps africanus*)- CR, the White-headed Vulture (Trigonoceps occipitalis)-CR, the Southern Ground-hornbill (*Bucorvus leadbeateri*) – VU, and species on the regional red-list the African Marsh-Harrier (*Circus ranivorus*) and the Bar-winged Weaver (*Ploceus angolensis*) (Willems & Leonard, 2019).

The following scenarios, potentially involving Red List species, present themselves in the study area:

- Powerline spans crossing avifaunal habitats (i.e., rivers, waterbodies, grasslands, wetlands (dambos), and open woodland areas). Repeated flights between nesting, feeding, and roosting areas in proximity to powerlines will increase the risk of collision. Susceptibility to collisions is partially a function of wing and body size and vision. Larger, heavy birds with short wingspans and poorer vision are more susceptible to collisions than smaller, lighter-weight birds with relatively large wingspans, agility, and good vision;

- Vultures descending to a carcass are at risk of collision with a nearby powerline. Birds will also be at risk when rapidly taking off a carcass if disturbed by people or mammalian predators;

- Research has revealed that vultures have taken to roosting and perching (sometimes overnight) on electrical infrastructure (Wolter *et al.* 2010). Vultures are naturally gregarious and will roost in groups on pylons or tower tops. Vultures will often jostle for a suitable position on the pole or tower and may collide with the conductors when doing so;

- Long-distance migrants that fly at night to reduce heat stress (USFWS, 2002) and avoid predation are extremely vulnerable to collisions;

- The non-migrating birds generally show a flight altitude that is likely within the powerline height range. Their flight is a function of their feeding, reproductive, and foraging behaviours. These behaviours usually occur within approximately 200 m of the ground, which can expose birds to collision risks when in proximity to powerlines (APLIC, 2012);

- For predatory birds, the exposure to collision risks can be related, in part, to the pursuit of prey (APLIC, 2012). Bevanger (1998) suggests that aerial hunters such as swifts, swallows, and certain raptors like the Peregrine Falcon typically have excellent manoeuvrability and very good vision. Yet because they chase prey at high speeds, the presence of a powerline may not be perceived soon enough to avoid collision;

- Environmental conditions, such as inclement weather and poor light, may inhibit visibility, increasing the risk of collision.

Species-specific factors contributing to species' vulnerability to collisions with powerlines are high wing loading and manoeuvrability, flocking behavior, rapid flight, and nocturnal migratory strategies. An important additional factor is birds' visual capacity, i.e., whether they can see obstacles such as powerlines and whether they look ahead to see obstacles with enough time to avoid a collision. In addition to explaining the susceptibility of some species to collision, this factor is essential in planning effective mitigation measures.

Collision rates could be higher for species nesting on powerlines, such as storks or raptors. This could increase the probability of collision by increasing the time spent flying close to powerlines (Martin and Shaw, 2010).

Typically, raptors and large terrestrial birds benefit from the construction of a powerline. Powerline towers provide nesting and roosting substrates for raptors, and the clearing of woodland within powerline servitudes may attract large-bodied species that prefer open habitats for foraging. Although attracting these species to the powerline may also increase the risk of collision with the powerline conductors and/or earth wires. It would, therefore, be best to employ a structure that reduces the chance of raptors and vultures roosting on the towers in large numbers (e.g., the Standard Cross-Rope Suspension Tower). This would have the added benefit of reducing the likelihood of pollution-related faulting on the line (see next section on impacts of avifauna on electrical transmission lines).

Relevant to this development, collisions are likely to be linked to specific habitat types and/or specific sets of circumstances. Powerline spans that traverse areas that have been classed as High, Medium-High and Medium (see section 5.3.3.6 and Maps 5-17 to 5-19) will require mitigation to minimize the collision impact. The standard practice to mitigate avian collision impact is the installation of anti-collision devices (bird flight diverters) on the earth wires. This form of mitigation has proved to be reasonably successful in reducing collisions, with a reduction in mortality of up to 60% (see Jenkins *et al*. 2010).

It is important to note that several sections of the line are located close to existing high-voltage powerlines. There are strong arguments for the proposition that placing a new line next to an existing line with similar sizes, voltage, and tower specifications reduces birds' collision risk. Otherwise, collision risks remain significant. The reasons are two-fold. Namely, it creates a more visible obstacle for birds and resident birds, particularly breeding adults, which are accustomed to an obstacle in that geographic location and have learned to avoid the powerline infrastructure (APLIC 2012; Sundar & Choudhury 2005). Hence, it is recommended that both parallel 330kV lines be at the same elevation to avoid creating a larger obstacle.

Also, roads and railway lines are an indication of human activity. It is assumed that the birds will avoid the immediate vicinity of larger roads and railway lines due to the presence of vehicle traffic and pedestrians, and the general habitat degradation and disturbance associated with them. Infrastructure parallel to the proposed alignments is treated as a risk-reducing factor. For sections of the powerline alongside the 66kV powerline, the collision risk remains significant as birds may rear upwards to avoid the conductors of the smaller 66kV powerline and end up colliding with the conductors/earth wire of the proposed 330kV powerline.

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004b). Electrocution risk is strongly influenced by the powerline voltage and the design of the pole structure. It mainly affects larger, perching species, such as vultures, eagles, and storks, which are easily capable of spanning the spaces between energized components. Due to the large size of the clearances on most overhead lines above 132kV, electrocutions are generally ruled out, as even the largest birds cannot physically bridge the gap between dangerous components.

It can be concluded that electrocutions on the proposed powerlines will not be possible through conventional mechanisms and will, therefore, not be assessed in terms of their importance.

Electrocutions on the proposed additional equipment within the Nakonde, Kasama, Mpika, and Pensulo substations are possible but should not affect the more sensitive Red List bird species, as these species are unlikely to use the infrastructure within the substation yards for perching or roosting. Therefore, the risk of electrocution within the substation yards is evaluated to be of low importance. Since it is difficult to predict with any certainty where birds are likely to nest within the substation yards, coupled with the costs associated with insulating the entire substation, electrocutions can be mitigated reactively using site-specific recommendations if they occur.

The proposed mitigation measures should help reduce the risk of collision and electrocution. However, the success of mitigation measures could be highly variable depending on the species. A proper bird mortality monitoring program will be developed and implemented to identify areas and species that are more impacted. Collisions are thought to be more common during migratory movements (Morkill and Anderson 1991), which suggests that a better understanding of impacts during migration, as well as other critical periods, is needed. Based on the monitoring program results, other measures could be proposed. Collision mitigation may need to vary substantially for different collision-prone species, taking species-specific behaviors, habitats, and foraging preferences into account since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin and Shaw, 2010). It should also be noted that additional bird diverters could be installed on any line segment identified, following an avifaunal walk-through prior to the construction of the proposed powerlines and subsequent bird mortality survey results.

## IMPACT ASSESSMENT

The implementation of the proposed mitigation measures will help reduce the residual impacts on avifauna to medium intensity. The extent of the impact on avifauna is local, as it could happen in any given portion of the line. The impact duration is considered long as it will likely occur during the entire operation phase. The residual impact on avifauna is thus considered of moderate importance. The probability of occurrence is high.

| Residual Impact on Avifauna during the Operation Phase | |
|---|---|
| Intensity: Medium | Importance: Moderate |
| Extent: Local | |
| Duration: Long | |
| Probability of occurrence: Moderate | |

### IMPACT OF AVIFAUNA ON ELECTRICAL TRANSMISSION LINES

It is important to mention that birds could have an impact on the transmission infrastructure and the hardware within the substation.

Both bird streamers and bird pollution occur because of birds perching and defecating on the 330kV and 400kV powerline towers and, often directly above live conductors, causing electrical faults on powerlines. The more faults that occur on a line, the poorer the quality of electrical supply to the end users. Site-specific mitigation can be applied reactively should this impact occur.

Experience has shown that crows and various raptors are quick to nest on any man-made infrastructure. The additional nesting substrate offered by the transmission line towers and the substation infrastructure can be viewed as a positive impact on the resident avifauna but may also pose problems to the towers' structural integrity and have negative impacts on local prey species. As this is a positive impact on the avifaunal species in the area, this impact has not been assigned a significance rating and no proactive mitigation is recommended. However, it should be noted that while it may not be illegal to remove an unoccupied nest that is posing a risk to the structure or its operation, the removal of nests that contain eggs, chicks, or adult birds may require permits to do so in accordance with local legislation. Site-specific mitigation can be applied reactively should this impact occur.

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Permanent displacement through the loss or modification of bird habitats;
- Permanent and temporary displacement through disturbance, specifically breeding species;
- Direct mortality because of collisions with vehicles;
- Direct mortality of ground-nesting birds, specifically nestlings.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Decommissioning activities;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures to reduce impacts on avifauna are found in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

Decommissioning activities will lead to limited habitat loss, modification, and fragmentation of habitats for some terrestrial and water birds, as some removal of vegetation will be required for access roads and work laydown areas. This will be temporary because once decommissioning has been completed, restoration of work areas paired with the cessation of maintenance activities within the ROW will result in overall improved avifauna habitats in the Project area.

Disturbance from the machinery and workers present on site for the duration of the decommissioning works is likely to cause temporary disturbances impacting foraging and roosting behaviours, but in more extreme cases, decommissioning activities may impact the breeding success of certain species, particularly if the disturbance happens during a critical part of the breeding cycle.

As mentioned previously, roadside verges are an attractive habitat for many bird species. For species that are attracted to roads, collisions with motor vehicles transporting materials, equipment, and workers to and from the site may be a source of direct mortality.

Bird mortality as a result of decommissioning activities is improbable because birds are incredibly mobile and able to move out of harm's way. If mortality does occur, it is likely to be confined to a localised area and restricted to immobile species, e.g., nestlings. An avifaunal inspection prior to the decommissioning shall be carried out to verify the presence of nests or breeding locations pertaining to Red List species on or near the towers to be dismantled. If these are observed, site-specific mitigation must be implemented to ensure this impact is reduced to negligible levels.

Finally, decommissioning of the powerline will have the positive impact of reducing bird collisions with the powerline.

### IMPACT ASSESSMENT

The application of the proposed mitigation measures limits the intensity of the residual impact of disturbance and mortality on avifauna to low. Decommissioning will result in an overall positive impact on avifauna habitats. The extent of the impact will be limited, as works will affect only part of the right-of-way and avifauna habitat quality will improve once maintenance of the wayleave is stopped and natural vegetation regrows. The impact duration is considered short as disturbance will stop when decommissioning works are complete. The residual impact on avifauna is thus considered of minor importance. The probability of occurrence is low after the application of mitigation measures.

| **Residual Impact on Avifauna during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Short | |
| Probability of occurrence: Low | |

## 6.2.3.3 TERRESTRIAL FAUNA

### DESIGN MEASURE

The study area comprises an important number of nationally and internationally designated areas, including forest reserves and a national park. The Lavushi Manda National Park and most forest reserves were avoided from the Project line route. The passage of the line route inside high-integrity forests, with higher tree density, was considered in the analysis of alternatives to reduce impacts.

## CONSTRUCTION PHASE

### POTENTIAL IMPACTS

- Terrestrial habitat fragmentation and degradation in some areas along the ROW;
- Modification of species composition in fauna communities present in the Project area;
- Habitat fragmentation and degradation for species of conservation concern;
- Increased hunting pressure on local fauna species
- Permanent and temporary displacement through disturbance;
- Local reduction of fauna density for species of higher use value in given areas;
- Potential introduction of invasive alien species.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Construction activities;
- Waste and hazardous materials management;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on terrestrial fauna are described in Chapter 3 of the ESMP. However, key mitigation measures are as follows:

- Avoid timing of row clearing during seasonal large mammal migration
- Safeguard and clear all construction materials
- Implement a biodiversity protection awareness program with workers;
- Inform the Contractor's E&S Specialist when endangered fauna species are observed in or close to Project sites;
- Record bat activity before and during construction
- Undertake a pre-construction inspection on the final route alignment and access roads to identify any major bat roosts within or close to the areas to be cleared;
- Develop and Implement BMP.

### DETAILED IMPACT DESCRIPTION

During the construction phase, site preparation for access roads and transmission line construction will lead to habitat loss for certain terrestrial fauna species. Removal of vegetation along the transmission line, particularly in areas where natural vegetation is found, can also increase habitat fragmentation in the study area. As described previously, vegetation clearance will be planned and reduced where possible. The mitigation measures proposed will contribute to reducing habitat loss. The movement of heavy machinery increases in traffic during construction could lead to the mortality of small mammals, reptiles, and amphibians.

Habitat fragmentation could affect particularly sensitive species, such as Red-Listed, Near-Threatened mammal species potentially found in the study area. These include the White-bellied Pangolin (EN) the African Savanna Elephant- EN, Lions-VU, Hippos-VU, Leopards-VU and Temminck's Pangolins-VU, Puku-NT, Plains Zebra - NT and African Clawless Otter-NT, as well as the Roan Antelope (*Hippotragus equinus*), which is threatened according to the Fifth National report of Zambia for the Convention on Biological Diversity.. For some of these species, i.e., Puku and Zebra, the BESA is part of their historical distribution, and they may no longer exist. Others are rarely sighted. Implementation of management measures to reduce habitat loss and fragmentation will help the conservation of these species.

Construction activities can also cause increased noise, which may disturb species present in the area. These impacts are temporary and terrestrial fauna species are likely to migrate to similar but quieter habitats in the vicinity of construction areas. .. In order to minimize disturbance of possible large mammal migration in the study area, it is recommended that vegetation clearing within the ROW be conducted during the early dry season, which coincides with low vegetation flush in the Miombo ecoregion, a period where large mammal migration is less likely.

Waste generation has the potential to increase pest fauna locally if it is not managed properly, especially around workers' camps. All construction materials, particularly those used to reinforce structures, such as steel wires, should be safeguarded and cleared from worksites to avoid their use as wire snares, which are widely used in the illegal harvesting of large animals. Wire snaring is now the most sophisticated and deadliest method used by illegal harvesters of large game. During the construction, the Project may result in terrestrial habitat fragmentation and degradation in some areas along the ROW, leading to loss of food sources (fruit trees) and roosting sites. The African Straw-coloured Bat is known to feed in miombo woodlands, on fruit from a variety of fruit trees, including *Ficus spp, Magnistipula butayeii, Parinari curatellifolia, Syzygium cordatum, Syzygium guineense guineense, Syzygium guineense huillense, Uapaca kirkiana, Uapaca banguelensis,* and *Uapaca sansibarica*. Given that 35% of the ROW comprises woodlands, clearing these areas could reduce food availability for this bat species.

Two other special status species, the Striped Leaf-nosed Bat and the Smithers's Horseshoe Bat, are cave bats that can also roost in tree canopies, hollow trees, and dense vegetation. Disturbance of vegetation or landscapes and felling of large hollow trees, such as baobab trees, could disturb or destroy the permanent roosts of this species.

An awareness program should be implemented for biodiversity protection with workers whose presence could lead to increased poaching of certain terrestrial fauna species. This program should include a prohibition on owning firearms and other hunting equipment, sensitization about the prohibition of engaging in poaching, and sensitization about animal behavior and handling. Further, officers from the DNPW should be attached to the Project throughout the construction period. This will not only provide safety from dangerous animals but will also serve as a vehicle for biodiversity awareness.

All mammal species encountered will need to be recorded. Species identity, age, sex, activity at sighting, and status (i.e., shy, not shy, or wounded) need to be assessed and recorded so that appropriate action may be instituted. A clear reporting channel needs to be established from the bearer of the sighting to the Environmental and Social (E&S) specialist so that appropriate action can be instituted quickly.

## IMPACT ASSESSMENT

The application of the proposed mitigation measures reduces the intensity of the residual impact on the medium. The extent of the impact on terrestrial fauna is limited as it is restricted to wildlife habitats along the powerline. The impact duration is considered long, as the habitat will be modified in the long term. The residual impact on terrestrial fauna is thus considered of moderate importance. The probability of occurrence is high because the ROW needs to be prepared prior to construction works and will then generate habitat loss and fragmentation.

| **Residual Impact on Terrestrial Fauna during the Construction Phase** | |
|---|---|
| Intensity: Medium | Importance: Moderate |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: Moderate | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Risks of bat collisions and electrocution;
- Maintenance of the vegetation in the wayleave in early stages of regeneration, reducing quality of habitats for fauna species with stricter ecological requirements.

### SOURCES OF IMPACT

- Presence and operation of line, substations, and access roads;
- Transportation and circulation;
- Maintenance and repairs.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on terrestrial fauna during the operation phase are described in Chapter 3 of the ESMP. However, key mitigation measures are as follows:

- Implement a bat mortality monitoring program;
- Minimize ROW maintenance activities along and during seasonal migration routes for large mammals;
- Biodiversity protection awareness program with workers
- Develop and implement the BMP.

### DETAILED IMPACT DESCRIPTION

During the operation phase, vegetation clearing and maintenance within the ROW will maintain the vegetation in the early stages of regeneration, reducing the quality of habitats for fauna species with stricter ecological requirements that require mature vegetation. It could lead to a local adaptation of wildlife communities with a higher representation of common species. The vegetation maintenance can also affect fauna migration and movements within the study area through disturbance and higher exposure within the ROW. It can also create a barrier effect for smaller terrestrial fauna species. In order to minimize the disturbance of possible large mammal migration in the study area, it is recommended that vegetation maintenance be conducted during the early dry season, which coincides with low vegetation flush in the Miombo ecoregion, a period when large mammal migration is less likely.

The Biodiversity protection awareness program (described for construction) for workers should be maintained and adapted for maintenance workers during the operation phase. It is important that all workers be sensitized to the ills of illegal harvests and trade of wildlife.

Transmission lines may impact bat populations during the operational phase because of a collision risk. The main bat migration known in the study area is the African Straw-coloured Fruit Bat, which can cover large distances for feeding. It is unlikely the proposed powerline will interact with this migration flyway. In fact, bat collisions with the transmission are unlikely as bats generally have exceptional obstacle avoidance capabilities.

Electrocution is only possible when frugivorous bats come in contact with two live wires at the same time. However, this is most often observed with distribution lines that have smaller spacing between live components. The African Straw-coloured Fruit Bat has a wingspan of up to 80 cm (some reports say up to 1 m). If the cables are less than 1 meter apart, there would be a possible electrocution risk. Maintaining 1.5-meter spacings between energized components and grounded hardware is recommended.

A monitoring program will be implemented to determine the number of mortality and species involved. The results of this monitoring will be used to develop species-specific mitigation measures.

### IMPACT ASSESSMENT

The application of the proposed mitigation measures helps limit the intensity of the residual impact to low. Even if most of the significant effects on wildlife habitats will happen during the construction phase, risks of mortality for bats and habitat modifications will occur throughout the operation phase. The duration is considered long since the line will become a permanent feature in the receiving environment. The extent of the impact is local since effects will be felt all along the line corridor. The probability of occurrence is medium, considering the potential impacts on bat communities.

| Residual Impact on Terrestrial Fauna during the Operation Phase | |
|---|---|
| Intensity: Low | Importance: Moderate |
| Extent: Local | |
| Duration: Long | |
| Probability of occurrence: Moderate | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Terrestrial habitat fragmentation and degradation in some areas along the ROW;
- Local reduction of fauna density for species of higher use value in given areas;
- Permanent and temporary displacement through disturbance;
- Potential introduction of invasive alien species.

### SOURCES OF IMPACT

- Site preparation;
- Transportation and circulation;
- Decommissioning activities;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures to reduce impacts on terrestrial fauna are found in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

Decommissioning activities will result in limited habitat loss and modification and fragmentation for some terrestrial mammals, as some vegetation clearing will be required for access roads and work laydown areas. This will be temporary because once decommissioning has been completed, restoration of work areas paired with the cessation of maintenance activities within the wayleave will improve wildlife habitat suitability in the Project area and reduce habitat fragmentation.

Disturbance from the machinery and workers that are present on-site for the duration of the decommissioning works is likely to be a cause of the temporary disturbance. These impacts are temporary and terrestrial fauna species are likely to migrate to similar but quieter habitats near decommissioning areas. Waste generation has the potential to cause a local increase in pest fauna if waste is not managed properly, especially around workers' camps. All decommissioning materials, particularly those used to reinforce structures (i.e., steel wires, should be safeguarded and cleared from worksites to avoid their use as wire snares). Wire snares are widely used in the illegal harvesting of large animals.

In addition, an awareness program should be implemented for biodiversity protection with workers including a prohibition to own firearms and other hunting equipment, sensitization about prohibition to engage in poaching and sensitization about animal behavior and handling.

Finally, decommissioning or the powerline will have the positive impact of reducing bat collisions with the powerline.

#### IMPACT ASSESSMENT

The application of the proposed mitigation measures will limit the intensity of the residual impact of disturbance on terrestrial mammals to low. Decommissioning will result in a positive impact on terrestrial fauna habitats. The extent of the impact will be limited, as works will affect only part of the right-of-way and terrestrial habitat quality will improve once maintenance of the ROW is stopped and natural vegetation regrows. The impact duration is considered short, as disturbances will stop when decommissioning works are done. The residual impact on terrestrial fauna is thus considered of minor importance. The probability of occurrence is low after the application of mitigation measures.

| **Residual Impact on Terrestrial Fauna during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Short | |
| Probability of occurrence: Low | |

### 6.2.3.4 AQUATIC HABITATS AND ASSOCIATED FAUNA

#### DESIGN MEASURE

The number of river crossings was considered a constraint when selecting a preferred route alternative, which will, in turn, reduce impacts on aquatic habitats. Tower siting inside wetlands (e.g., the Chambeshi floodplain) will be avoided where possible, and access roads will be placed to avoid wetland areas.

#### CONSTRUCTION PHASE

#### POTENTIAL IMPACTS

- Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances;
- Local impairment of hydrological dynamics leading to disturbances and alteration of aquatic habitats;
- Impacts on vulnerable *Chiloglanis elisabethianus* habitats;
- Creation of wetlands;
- Potential introduction of invasive alien species (IAS).

#### SOURCES OF IMPACT

- Site preparation;
- Construction activities;
- Waste and hazardous materials management;
- Transportation and circulation;
- Presence of workers.

## MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on aquatic habitats and associated fauna are described in Chapter 3 of the ESMP. However, key mitigation measures are as follows:

- Conduct activities during the dry season to reduce disturbance of sensitive shoreline and wetland areas;
- Avoid construction of temporary access roads along river banks, dambos, or in areas where soils are saturated;
- Undertake selective cutting of the vegetation in dambo areas and riparian habitats in order to keep low-growing species that do not represent a risk for the powerline.
- Maintain fish passage when watercourse road-crossings are unavoidable by utilizing clear-span bridges or open-bottom culverts;
- Develop and implement the BMP

## DETAILED IMPACT DESCRIPTION

The construction of access roads and towers as well as vegetation clearing in the ROW, and vehicles and machinery traffic, could lead to impacts on rivers, wetlands, and riparian areas. The construction of access roads can change the quantity or direction of water flow, causing permanent damage to hydrological conditions sustaining wetland and stream dynamics and habitats. If flowing water is stopped by structures, a lentic habitat could replace the existing lotic ones. Also, if the road blocks the runoff water, it could lead to the creation of wetlands locally. Flora communities would consequently switch and be replaced by adapted vegetation.

Construction of access roads will require the implementation of water crossings, which have the potential to cause modifications to water dynamics and, consequently, deterioration, destruction, or disturbance of wetlands and watercourses comprising habitats for fish and other aquatic organisms. Moreover, access roads have the potential to obstruct aquatic fauna movements, leading to restricted access to specific habitats for a variety of species. This impact will be reduced by implementing design measures to keep access roads away from riparian land except when strictly necessary. Installation of culverts sized according to water flows can further limit this loss of habitats by avoiding the barrier effect these works can have on aquatic habitats and associated fauna.

Construction activities could increase suspended solids, silting spawning and feeding sites for aquatic and semi-aquatic species. Increases in organic material inside the aquatic environment could also result in a higher BOD and a reduction of dissolved oxygen for aquatic wildlife locally. However, implementing the mitigation measures listed above will help prevent these impacts.

Additionally, water could also be contaminated through accidental spills of chemical products, hydrocarbons, and wastewater resulting from poor environmental management. Such contamination during dry seasons, with shallow and slow-moving water, will exacerbate the impacts as the contaminants could be locally concentrated. Environmental contamination could affect the aquatic and semi-aquatic fauna, including amphibians and fish, which are sensitive to the presence of contaminants in their habitats. The implementation of the Emergency Response Plan and the appropriate mitigation measures will reduce this impact.

Moreover, vehicles and construction equipment can introduce IAS that adapt well in wetlands. IAS species may compete with native vegetation, destroying valuable wildlife habitats, adding to direct habitat loss.

Project impacts on aquatic habitats may negatively affect one species of fish considered vulnerable by the IUCN, *Chiloglanis elisabethianus*, a benthopelagic species.

Project impacts on wetlands may negatively affect critical habitat, triggering Disa aequiloba (En). This orchid grows in wetlands (swamps, wet grassland, wet meadows) and is potentially present within the Project area. Specific measures for critical habitat are described in the BMP.

### IMPACT ASSESSMENT

The application of the proposed mitigation measures will help preserve wetland and riparian vegetation and will limit the intensity of the residual impact to medium. Considering construction works are well planned and scheduled during the dry season, the extent of the impact on aquatic habitats and associated fauna will be limited since they are restricted to permanent wetlands and watercourses that cannot be avoided. The impact duration is considered short as it will be limited to the construction period, and hydrological connectivity will be maintained by implementing suitable culverts at necessary stream crossings. The residual impact on aquatic habitats and associated fauna is thus considered of minor importance. The probability of occurrence is medium if management measures are properly applied.

| **Residual Impact on Aquatic Habitats and Associated Fauna during the Construction Phase** | |
|---|---|
| Intensity: Medium | Importance: Minor |
| Extent: Limited | |
| Duration: Short | |
| Probability of occurrence: Moderate | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Disturbances of the water's physical and chemical characteristics causing modifications in aquatic habitats and associated fauna;
- Effects on wetland specialist species and species of conservation interest;
- Potential introduction of IAS.

### SOURCES OF IMPACT

- Presence and operation of line, substations, and access roads;
- Transportation and circulation;
- Maintenance and repairs;
- Waste and hazardous materials management.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on aquatic habitats and associated fauna during the operation phase are described in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

Possible changes in the hydrological conditions that could be related to the presence of access roads and pylons within a flood zone of a wetland or a watercourse could lead to modification of ecological parameters and associated disturbances of the aquatic and semi-aquatic fauna. Maintenance of access roads and related ditches is essential in order to prevent the water crossings from becoming insurmountable obstacles for the aquatic fauna and for soil erosion to encroach spawning grounds or other critical ecological habitats.

As mentioned above, no permanent access roads will be built in wetlands.

During the operation phase, the movement of people and vehicles along the ROW, and access roads for ROW maintenance and for repair of the transmission line, can lead to the introduction of IAS and accidental spills. Seeds and other propagating parts of IAS can be carried out into a wetland or watercourse inadvertently by equipment.

### IMPACT ASSESSMENT

The application of the proposed mitigation measures limits the intensity of the residual impact to low. The extent of the impact on aquatic habitats and associated fauna is limited since the aquatic habitats are punctual along the proposed powerline. The impact duration is considered long, as the impact occurs during the operation phase. The residual impact on aquatic habitats and associated fauna is thus considered of minor importance. The probability of occurrence is medium as it is related to the good maintenance of ditches and access roads.

| Residual Impact on Aquatic Habitats and Associated Fauna during the Operation Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: Moderate | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Local degradation of aquatic and semi-aquatic habitats and associated fauna and flora disturbances;
- Local impairment of hydrological dynamics leading to disturbances and alteration of aquatic habitats;
- Impacts on vulnerable *Oreochromis macrochir* habitats;
- Creation of wetlands;
- Potential introduction of invasive alien species (IAS).

### SOURCES OF IMPACT

- Site preparation;
- Decommissioning activities;
- Waste and hazardous materials management;
- Transportation and circulation;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on aquatic habitats and associated fauna are described in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

The removal of vegetation (i.e., on access roads and work laydown areas), transportation of equipment, materials and workers, and excavation and backfilling associated with filling tower foundations, recontouring and landscaping activities could lead to impacts on rivers, wetlands, and riparian areas.

The construction of access roads can change the quantity or direction of water flow, permanently damaging hydrological conditions sustaining wetland and stream dynamics and habitats. If structures stop flowing water, a lentic habitat could replace the existing lotic ones. Also, if the road blocks the runoff water, it could lead to the creation of wetlands locally. Flora communities would consequently switch and be replaced by adapted vegetation.

Re-establishment of access roads and vehicle traffic associated with decommissioning will necessitate the implementation of water crossings, which have the potential to cause modifications to water dynamics and consequently deterioration, destruction, or disturbance of wetlands and watercourses comprising habitats for fish and other aquatic organisms. Moreover, they have the potential of becoming obstacles for aquatic fauna movements, leading to restricted access to specific habitats for a variety of species. This impact will be reduced by the implementation of design measures where access roads will be kept away from riparian land except when strictly necessary. Installation of culverts, sized according to water flows, can further limit this loss of habitat by avoiding the barrier effect these works can have on aquatic habitats and associated fauna.

Decommissioning activities could increase suspended solids, silting spawning and feeding sites for aquatic and semi-aquatic species. Increases in organic material inside the aquatic environment could also result in a higher BOD and a reduction of dissolved oxygen for aquatic wildlife locally. However, the implementation of mitigation measures will help prevent these impacts.

The development and implementation of a waste management plan and an emergency measures plan by the Contractor and Subcontractors will mitigate the risks from unsound waste management practices and potential spills that could result in both surface water and groundwater contamination.

Moreover, vehicles and construction equipment can introduce IAS that evolve well in wetlands. IAS species may compete with native vegetation, destroying valuable wildlife habitats, adding to direct habitat loss.

#### IMPACT ASSESSMENT

The intensity of the residual impact is low since all impacts can be efficiently mitigated or eliminated through the application of proposed mitigation measures. The extent is limited since the aquatic habitats are punctual along the proposed transmission line, and the impact could be restricted to permanent wetlands and watercourses if the construction work schedule is well planned. The impact duration is considered medium as, with the application of the proposed mitigation measures, the temporary water crossings will be built to maintain the integrity of the watercourse. The residual impact on aquatic habitats and associated fauna is thus considered of minor importance. The probability of occurrence is low if management measures are properly applied.

| **Residual Impact on Aquatic Habitats and Associated Fauna during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Medium | |
| Probability of occurrence: Moderate | |

## 6.2.4 NEGATIVE IMPACTS TO THE SOCIOECONOMIC ENVIRONMENT

### 6.2.4.1 EMPLOYMENT AND ECONOMIC DEVELOPMENT

#### DESIGN MEASURE

Generally, the line alignment was refined to avoid areas where there are local populations, businesses, or industries. This measure helped reduce project-related impacts on employment, economic activities, and development, as entire areas were avoided.

#### PRE-CONSTRUCTION AND CONSTRUCTION PHASES

#### POTENTIAL IMPACTS

– Temporary loss in crops;

- Inflation risk;
- Increased pressure on natural resources.

## SOURCES OF IMPACT

- Displacement of economic activities;
- Transportation and circulation;
- Presence of out of area workers and resulting demand on local goods and services.

## MITIGATION MEASURES

Mitigation measures for reducing impacts on employment and economic development are identified in Chapter 3 of the ESMP. However, key mitigation measures are as follows:

- Adopt procurement and labour policies promoting local products and services, considering timing and availability and in consultation with local communities;
- Carefully select the landing area of falling trees to minimize damage to crops.

## DETAILED IMPACT DESCRIPTION

There are no strong adverse impacts on the local and regional economy at the pre-construction and construction stages. Some land speculation could happen before the beginning of construction, which could act as an upward pressure on land prices and affect resettled people who may wish to look for new land outside their village.

During the construction phase, upward pressures on commodity prices in areas where construction will happen (because of increased demand by workers or Contractors) could temporarily cause some slight market distortions. However, the local markets are expected to react accordingly by increasing local supplies of key merchandise. The increased supply should, in turn, drive prices down to their former level.

The dissemination of reliable information is essential to maintain a swift and efficient market for the goods and services required by Contractors and workers.

Therefore, it will be essential that local and regional populations be informed and organized well in advance of the onset and duration of construction work to allow them to adjust their supplies accordingly and avoid bottlenecks resulting in steep price increases. Specific groups will be targeted for the production of some goods and services to meet the goals of the Social Safeguard Standards for the energy sector, where the government of Zambia has specifically identified women, youth, and persons with disabilities to be targeted for employment opportunities.

As for agricultural activities, adequate compensation measures should offset the temporary loss of crops. The RAP provides the necessary details on the compensation measures and mechanisms.

Impacts on local economies can also be offset by hiring local workers as a priority, especially for unspecialized jobs. Estimates are that 85% of the construction workforce will be sourced locally, with the remaining 15% sourced nationally and internationally.

## IMPACT ASSESSMENT

Some economic activities and inflation could be seen during construction due to increased economic activity near construction areas. The intensity of the residual impact is considered medium due to the already poor communities that could be impacted by inflation if it were to occur. The extent of the impact is local since, if the impact occurs, it will be felt mostly around construction sites. The impact duration is considered short because construction crews are not likely to be in a community for more than 2 to 3 months at a time. The residual impact is thus considered of moderate importance. The probability of occurrence of the impact is medium because inflation may occur.

| Residual Impact on Employment and Economic Development during the Pre-construction and Construction Phases | |
|---|---|
| Intensity: Low | Importance: Moderate |
| Extent: Local | |
| Duration: Short | |
| Probability of occurrence: Moderate | |

## OPERATION PHASE

No adverse impacts on employment and economic development are expected during the operation phase.

## DECOMMISSIONING PHASE

### POTENTIAL IMPACT

- Inflation risk.

### SOURCES OF IMPACT

- Purchase of materials, goods, and services;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures to reduce impacts on employment and economic development are found in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

During the decommissioning phase, upward pressures on commodity prices in areas where decommissioning will occur (because of increased demand by workers or Contractors) could temporarily result in market distortions. However, the local markets are expected to react accordingly by increasing local supplies of key merchandise. The increased supply should, in turn, drive prices down to their former level.

### IMPACT ASSESSMENT

Implementation of mitigation measures will limit the intensity of the residual impact to a low as limited economic activities and inflation will be seen near decommissioning areas. The extent of the impact is local since, if the impact occurs, it will be felt mostly around decommissioning sites. The impact duration is considered medium because inflation would be felt during a limited period. The residual impact is thus considered of minor importance. The probability of occurrence of the impact is medium because inflation may occur.

| Residual Impact on Employment and Economic Development during the Decommissioning Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: Moderate | |

### 6.2.4.2 LAND USE AND TENURE

#### DESIGN MEASURES

Generally, the line alignment was chosen to avoid areas where local populations, businesses, or industries were located. This measure helped reduce impacts on land use as entire areas were deemed unavailable and therefore avoided.

#### PRE-CONSTRUCTION AND CONSTRUCTION PHASES

##### POTENTIAL IMPACTS

- Land use restrictions within the wayleave and resettlement;
- Loss of arable, grazing, and pastoral lands;
- Disruption of farming activities by construction and maintenance works.

##### SOURCES OF IMPACT

- Land acquisition;
- Transportation and circulation.

##### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on land use and tenure are outlined in Chapter 3 of the ESMP and the RAP; however, key mitigation measures are as follows:

- Restrict transportation to the identified RoW and laydown areas by clearly marking out the limit of the ROW and access roads;
- Restrict construction activities, materials, and manpower movements to existing roads/tracks and ROW limits. Maximize use of recently opened roads for the construction of the 330kV Pensulo - Nakonde electricity transmission line;
- Make chopped woody resources and residues available to local populations to reduce additional pressure on natural resources;
- Implement the Resettlement Action Plan.

##### DETAILED IMPACT DESCRIPTION

According to the socioeconomic survey from 2017, 71.4% of households affected by the Project have crops within the wayleave. Agricultural area within the wayleave extends over 633 ha. Agricultural activities and livestock are likely to be affected during construction work due to the loss of arable lands, restrictions imposed on the movement of livestock, and potential breakage of fences and drainage channels.

The following impacts are foreseen:

- Removal of structures from within the demarcated wayleave and limitation of land use rights to current holders. The line does impact a limited amount of area predominantly given over to residential uses.
- Crops in the wayleave area will be impacted or potentially delayed during the construction period, although people will progressively reuse the wayleave to carry out agriculture. The transmission line mostly crosses small-scale agricultural land, as well as some lands that might be used for grazing. Therefore, the clearance of the line's wayleave will impact local farmers. This impact is temporary.

- Crops at the location of pylons will be permanently impacted due to the physical imprint of the pylon.
- Unused customary land will be cleared of vegetation that exceeds demarcated heights.

For the most part, traditional authorities will still consider land under the wayleaves as customary and continue to administer land in the wayleaves (land attribution, agriculture, etc.) since, according to ZESCO, the land will not be alienated, which means that land will remain under customary management and not become the exclusive management domain of ZESCO. The exceptions are the land parcels for the substations and ancillary infrastructure, as well as pylons parcels. Here, ZESCO will extinguish all customary rights and exercise dominant control

Adequate compensation and/or reestablishment measures are proposed to affected households detailed in the RAP.

### IMPACT ASSESSMENT

There is no impact on the overall status of land tenure. However, the rights of usufruct will be altered.

The intensity of the residual impact on land use is medium since compensation and resettlement assistance will be provided to affected households, and small cultivators will tolerate the use of the wayleave.

The extent of the impact on land use is local since it will mainly be altered along the transmission line and new access roads. The impact duration is considered medium since land use will be altered during construction. The residual impact on land use during the pre-construction and construction phases is thus considered of moderate importance. The probability of occurrence is high since the land used will certainly be altered.

| **Residual Impact on land use and tenure during the pre-construction and construction phases and economic resettlement** | |
|---|---|
| Intensity: Medium | Importance: Moderate |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Land use restrictions in the wayleave;
- Occasional maintenance activities.

### SOURCE OF IMPACT

- Maintenance and repairs.

### MITIGATION MEASURES

Mitigation measures for minimizing impacts on land use in the operation phase are identified in the ESMP's Chapter 3 and in the RAP; however, key mitigation measures are as follows:

- Allow grazing and cultivation in the ROW, provided plantations do not exceed 2 m in height;
- Plan for maintenance activities to be conducted outside of the growing and grazing seasons, and during cultivation.

### DETAILED IMPACT DESCRIPTION

During the operation phase, impacts on land use consist of land use restrictions in the wayleave and passage of machinery on crops during maintenance. Effects on land use should not be significant since grazing will be tolerated within the wayleave. Farming will also be tolerated, but only for annual culture and plantations that do not exceed 2 meters in height. Moreover, the impact on crops resulting from maintenance work will be prevented by conducting maintenance activities outside the growing and grazing seasons, and following cultivation.

In addition, some farmers could choose to farm the land in the wayleave since it will be tolerated. In the event of maintenance work, the removal of these crops should be compensated.

### IMPACT ASSESSMENT

The intensity of the residual impact is considered low since maintenance work will be required sporadically. The extent of the impact on land use is limited since a small portion of the population will feel it within the Project area. The impact duration is considered long since land use will be altered over the entire Project lifetime. The residual impact on land use during the operation phase is thus considered of minor importance. The probability of occurrence of the impact is high because land use will be restricted but some local farmers could choose to grow crops inside the wayleave.

| **Residual Impact on Land Use during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: High | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Loss of crops;
- Disruption of farming activities by construction works.

### SOURCES OF IMPACT

- Site preparation;
- Decommissioning activities.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on land use are outlined in Chapter 3 of the ESMP and in the RAP.

### DETAILED IMPACT DESCRIPTION

Site preparation and decommissioning activities may result in impacts on land uses within the ROW and on access roads. During operation, agricultural activities will be permitted within the ROW. If current land use within the ROW is used to predict future land use, it is likely that small-scale agricultural activities and grazing will gradually take place. If present at the time of decommissioning, crops in the wayleave area may be destroyed. Clearance of the line's ROW and decommissioning activities will, therefore, impact local farmers. However, it is not possible to provide a detailed description of the impacts on agricultural activities due to uncertainty regarding land use at that time.

Another risk comes from the arrival of new settlers in the newly available wayleave after decommissioning. This may lead to conflicts on land use with local communities.

### IMPACT ASSESSMENT

The intensity of the residual impact on land use is medium because after decommissioning, it is assumed that prior agricultural land use will be permitted to continue. The extent of the impact on land use is local since land use will mainly be altered within the ROW and along access roads. The impact duration is considered medium since impacts on land use will be limited to the decommissioning phase. The residual impact on land use during the decommissioning phase is thus considered of moderate importance. The probability of occurrence is high since the land used will certainly be altered in the ROW.

| Residual Impact on Land Use during the Decommissioning Phase | |
|---|---|
| Intensity: Medium | Importance: Moderate |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

## 6.2.4.3 BUILT ENVIRONMENT

### DESIGN MEASURE

Generally, the line alignment was chosen to avoid residential housing. This measure helped reduce Project impacts through the avoidance of dense urban areas.

### PRE-CONSTRUCTION AND CONSTRUCTION PHASES

### POTENTIAL IMPACT

– Relocation of houses and other buildings located within the ROW.

### SOURCES OF IMPACT

– Land acquisition;

– Resettlement.

### MITIGATION MEASURES

Mitigation measures at reducing impacts on the built environment are identified in Chapter 3 of the ESMP and in the stand-alone RAP.

### DETAILED IMPACT DESCRIPTION

A number of structures that could be a nuisance to the safety and reliability of the transmission line will need to be removed from the ROW. ZESCO has already compensated almost all the structures located within the ROW along the Kasama-Nakonde section. The number of houses located within the wayleave for this section was of 647. Few additional houses may have been built within the wayleave since the cut-of-date. In the Pensulo-Kasama section, the transmission line will be parallel to the existing 330kV, further reducing the number of affected households. A number of 87 structures have been identified within the additional wayleave required for this section-based satellite imagery interpretation. Houses can be seen and other assets in the wayleave include many secondary structures (such as latrines and kitchens). These assets and structures will be demolished or moved.

The RAP report details the procedures and compensation measures aimed at reducing impacts associated with land acquisitions and resettlement. The impact of the Project on these households will be minimized but still be potentially significant. Sufficient time and care to assist communities and households is crucial to minimize the impact of these resettlements. It should, however, be noted that the definitive number of households likely to be displaced will be established during the final property and asset inventories.

### IMPACT ASSESSMENT

The intensity of the residual impact is moderate since the built environment within the wayleave will be compensated according to the agreement reached between ZESCO and the owner. Additionally, households will not be resettled at great distances and will remain within their communities. The extent of the impact is limited since it will occur intermittently in the wayleave. The impact duration is considered long since houses and buildings will be relocated for the lifetime of the transmission line. The residual impact is thus considered of moderate importance. The probability of occurrence of the impact is high because the built environment and habitations within the Project area will be displaced.

| **Residual Impact on Habitations during the Pre-construction and Construction Phases (physical resettlement)** | |
|---|---|
| Intensity: Medium | Importance: Moderate |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: High | |

### OPERATION AND DECOMMISSIONING PHASES

No negative impacts on houses and secondary structures are expected during the operation and decommission phases since these structures will have been displaced during the pre-construction phase. Building houses in the wayleave will be forbidden.

## 6.2.4.4 GENDER AND GENDER-BASED VIOLENCE

The risk and impact assessment considers the following factors as outlined in sections 5.4.6 and 5.4.7:

- Women in Zambia represent 53% of the working-age population (15 years and older), however they represent only 40% of employed people across the country. Roughly one in three women (34%) and men (31%) age 15-49 work in the agriculture sector.
- Women are more typically employed in the informal sector, making it difficult for them to effectively compete with those who have employment experience in formal sector businesses. Moreover, persistent stereotyping of jobs that are traditionally male dominated raise barriers to entry for skilled and qualified women.
- Women have completed a median of 4.6 years of schooling on average, while men have completed a median of 5.3 years. Moreover, there remains a strong gender divide in literacy levels, with 66 percent of women being literate, compared to 82 percent of men.
- Vulnerable groups are usually more adversely affected by project impacts and/or more limited than others in their ability to take advantage of a project's benefits. Women, youth and persons with disabilities (PWD) are identified as vulnerable groups, which is reflected in the national Social Safeguard Standards for the energy sector. Thus, women, youth and pwd are targeted for benefits from the project, including employment.

Concerning gender based violence (GBV):

- Sexual exploitation and abuse (SEA) are considered forms of GBV. As such, the following discussion regarding GBV also includes SEA;

- Some of the contributing factors to GBV are likely to be aggravated due to the Project, for example alcohol consumption amongst workers can also contribute to GBV;
- Some of the pre-existing types of GBV are likely to be exacerbated by the Project. For example, local experience shows that the presence of many male workers puts local women and girls at risk of sexual abuse, unwanted and unsupported pregnancy, unsafe abortions and forced early marriage;
- While GBV can be the result of individuals or groups on women, some risks also originate during the Project preparation phase when GBV risks are not proactively acknowledged, with measures to address GBVs omitted in bidding documents; this is known to be one of the main factors that perpetuate GBV in large infrastructure projects (World Bank, 2016).

Typical barriers that keep women from seeking help in cases of GBV were collected during stakeholder meetings in 2019 and also found in the literature reviewed as outlined in Chapter 5, Section 5.4.7:

- Fear of social stigma from the community (according to the institutions working on GBV, met by the Consultant, 9 court cases out of 10 were withdrawn by the victim herself);
- Fear of retaliation from employers if the woman is working on the Project; many victims who opened-up on GBV never filed a complaint;
- Lack of knowledge on the meaning of GBV and culturally accepted types of GBV. For example, child marriage is the most common type of GBV in the study area but also the least reported according to a meeting with the One-Stop Center in Mpika;
- Traditional ways of addressing GBV are still present in some Chiefdoms. Although some Chiefdoms are proactive in fighting GBV, others are interfering with legal prosecution in unfavorable ways for women. For example, some cases are traditionally "solved" when the family of the perpetrator pays money to the victim's family and discourages the victim from filing a complaint (this was observed by the Consultant during a meeting with a Chief where he mentioned that GBV cases are solved involving families of the victim and the perpetrator);
- Recent efforts to strengthen the involvement of chiefs in GBV prevention and response, include the establishments of four Village One Stop Centres (VLOSCs) at the chiefdom level by the National Legal Aid Clinic for Women (NLACW) under the GRZ-UN Joint Programme on GBV Phase II. The VLOSCs can be found in Chief Chamuka's chiefdom (Chibombo) and Chief Mumena's chiefdom (Solwezi). Other programmes, such as the EU-funded Natwampane programme, have worked with chiefs in Northern and Luapula Province to establish by-laws that prohibit acts of GBV, including child marriage;
- All affected districts by the project have Once Stop Centres (OSCs) or GBV Help Desks currently the process of becoming OSC's;Presence of a dual legal system: one customary and statutory. Most people are inclined to deal with GBV in front of traditional authorities where financial compensation can be obtained (Avocat Sans Frontières and YWCA (2017);
- Witnesses denying the GBV incident occurred especially when community members realize the victim had contacted a GBV Service Provider;
- Cost of travelling to the police station or other GBV service providers, especially in rural areas;
- Lack of infrastructure like inadequate facilities, such as the lack of child-friendly courtrooms and improper infrastructure, has been widely acknowledged. Victim Support Units (VSUs), in particular, face challenges in maintaining confidentiality due to inappropriate office facilities.
- Lack of essential equipment and diagnostic tools, like rape kits, is a significant obstacle to an effective response.
- Shortage of staff within existing GBV service providers.

- There are only 16 shelters for GBV survivors across Zambia (4 in Northern Province, 1 in Muchinga Province and none in Central Province). The shortage of shelters makes it difficult for women who are economically dependent on their abusers to report the abuse. Many are ultimately forced to return home, often back into an abusive environment.

Means to contribute in overcoming these barriers are addressed in this ESIA and in the ESMP.

As presented in Chapter 5 (Baseline), during 2019 public consultations, the Consultant focused on collecting perceived GBV risks to women. In addition, research was made based on various documents published by lenders to help in risk identification.

GBV is considered a risk based on the project stakeholder's feedback and literature that links development projects to an increase in violence. Impacts of GBV on women, families and the community at large is discussed in this section. The significance of the risk is not assessed, since any GBV event should be considered as being of major significance for the survivor of GBV and children.

By understanding the pre-existing forms of GBV and the contributing factors and by considering the significance of proper Project preparation, risk management measures are required.

## PRE-CONSTRUCTION, CONSTRUCTION, AND DECOMMISSIONING PHASES

The gender and GBV risks and impacts are considered the same for pre-construction, construction, and decommissioning. As such, they are discussed together in the following section.

### POTENTIAL RISKS AND IMPACTS

- Community health and safety impacts associated with increased traffic resulting from construction vehicles leading to potential impact on women's safety and security;
- Gender-Based Violence issues and related incidents, especially in rural areas where there is poorer access to GBV service providers.
- Impact on vulnerable groups such as women, youth and people with disabilities as these groups are more exposed to key risks due to their sensitive status;
- Impact on crops, and local livelihood due to dust, particles, and pollution and affecting women's livelihood;
- Women, youth and persons with disabilities subjected to direct and indirect job discrimination.

Exploitative working conditions such as hazardous unsafe areas, non compliance with labour laws and health and safety regulations, risk of abuse by contractors.The project could potentially cause the following positive impacts:

- Create local employment opportunities through the purchase of materials, goods, and services and creating job opportunities for women, youth and persons with disabilities;
- Improve the livelihood of Vulnerable Groups through creating employment opportunities and purchasing goods and materials from this group.

### SOURCES OF RISKS AND IMPACTS

During pre-construction, the risks originate from:

- Bidding process (writing the terms of references for call for tenders, evaluating proposals, selecting contractors, and drafting contracts) that omits requirements to address GBV and to provide opportunities to vulnerable groups
- Resettlement process (resettlement of people out of the wayleaves and compensation payment).

During construction and decommissioning, the risks originate from:

- Labour influx with the establishment of the workers' and supervising engineer's camps resulting in increased crime, sexually transmitted disease, and leading to potential increase in GBV occurrences;
  - Arrival of Project workers;
  - Influx of migrant workers;
- Cultural misinterpretation of the term GBV and reluctance to enforce code of conduct or respond to complaints
- The workplace environment of construction and worker camps, which may be misogynistic (toxic masculinity)

## MITIGATION MEASURES

Mitigation measures for minimizing risks and impacts on gender and GBV are presented hereunder and reflected in Chapters 3 and 5 of the ESMP (Gender Action Plan).

## DETAILED RISK AND IMPACT DESCRIPTION

**1 - Potential risks and impacts originating from the bidding process**

The bidding process represents a risk. Experience has shown that many bidding documents do not consider measures developed in the ESMP and that many subsequent E&S problems arise from lack of proper planning and absence of leverage for non-compliances. If, at this stage, the responsibility of implementing E&S measures (including gender and GBV prevention measures) does not cascade down to the Contractors, it is highly probable they will not implement any E&S measures and that the Project E&S performance will be weak. Contractors have the greatest day-to-day presence on the ground and sustained interactions with affected communities, unfortunately many have little or no training in environmental protection nor hold proactive attitudes regarding gender aspects or GBV. Many are also genuinely not aware of their E&S responsibilities because their contract is either silent on these subjects, or there is no incentive to follow E&S management measures in the contract, or both.

Writing the terms of references (ToRs) for call for tenders, evaluating proposals, selecting contractors, and writing contracts are therefore important steps in Project preparation and risk management.

While writing the ToRs and contractual documents, there is a risk that the Procurement Specialist of the implementing agency (ZESCO) does not:

- Include measures developed in the ESMP around gender aspects and GBV prevention and response as requirements in the technical specification.
- Include a E&S/Social Safeguard Specialist in the Schedule of Key Personnel
- Foresee sufficient budget for social safeguards measures, including GBV prevention and response, and for Contractor's E&S Specialist and include this in the Bill of Quantity.

include financial leverage and contractual remedies in case of non-compliances with the ESMP. While designing the evaluation and qualification criteria to assess the Contractors' proposals and selecting Contractors, there is a risk that the implementing agency does not:

- Include qualification criteria related to gender and social aspects such as past social safeguards performance and proof of compliance to labour laws (e.g. letter of clearance form Ministry of Labour and collective agreement).

- Include, in the scoring method, points for the E&S approach of technical and financial proposals; such as demonstrating how GBV prevention and response measures will be implemented and how the employment of targeted citizens should be achieved.

- Seek to verify the bidders' reputation regarding E&S.

**Risks and impacts management measures: safeguards instruments need to be effectively translated into contractual requirements**

The bidding documents and contracts for construction Contractors shall include measures developed in the ESMP including the Code of Conduct and the Grievance Redress Mechanism and other GBV prevention measures. In order to effectively incorporate social safeguards requirements in the bidding documents, careful consideration needs to be given to how the costs for the Contractor to implement the social safeguard requirements will be treated in the bid, evaluated, and paid as such. One option to consider is the use of a provisional sum which would cover the Contractor's reasonable costs of implementing the social safeguards measures. The advantage of this approach is that all bidders would have a consistent level of funding in their bids, neutralizing the implications of underpricing or overpricing.

Whenever mitigations in the ESMP use a framework approach (for example the framework of GBV Action Plan), the bidding document and contract shall include clear directions on how the Contractor's Environmental and Social Management Plan (C-ESMP) shall adapt measures to become operational based on site and Project realities (the final Project design, the proposed construction method statements, the nature of the project site, etc.).

In addition to standard requirements and criteria such as length of time in business and contract completion rate, the Procurement Specialist shall include "special selection criteria" in the bidding document such as:

- Self-assessment of past client relationships and experience regarding gender aspects of project construction and prevention of GBV;

- Self-assessment of relationships with surrounding communities and stakeholders presenting past claims or grievances by ngos, by traditional authorities, vulnerable groups, and other community members;

- Past projects involving an ESIA, ESMP, and RAP, and monitoring and auditing activities;

- The development of a Worker and Labor Management Plan in line with World Bank requirements, as well as ensuring compliance in respect to Workers Compensation Fund Control Board (WCFCB), the National Health Insurance Management Authority (NHIMA) and the National Pension Scheme Authority (NAPSA).

- Ensure that a Letter of Clearance from Ministry of Labor and Social Security (MLSS) is included in the evaluation and qualification criteria of the procurement documents and consider additional verification methods of HSESG performance.

The bidding document and contract for construction Contractors shall reflect the new requirements of the World Bank as highlighted in the documents "Summary of Environmental, Social, Health and Safety (ESHS) Enhancements Standard Procurement Documents (SPDs) & Standard Bidding Documents (SBDs)", World Bank Good Note Practice on Sexual Exploitation, Abuse and Sexual harassment and the Social Safeguard Framework of the Ministry of Energy (MOE). These documents highlight that:

- Bidders are required to make a declaration listing any civil work contracts that have been suspended or terminated for ESHS reasons;

- Bidders must submit a Code of Conduct that will apply to their employees and Subcontractors as well as their Environmental, Social, Health and Safety Policy, detailing staff in charge of E&S management;

- Bidders must have a collective agreement in place, this could either be a Joint Industrial Council (JIC) Collective Agreement through an Employer Association or an individual agreement with the union.

- Bidders must be aware that a Contractor's Environmental and Social Management Plan (C-ESMP) will be required within a short timeframe before commencing physical work and that the C-ESMP will be reviewed and approved by the Client / Supervision Consultant (in consultation with the Design Engineers), and the World Bank before construction of the TL is permitted;

- Bidders will be required to provide an ESHS Performance Security in the form of a demand bank guarantee;

- A provisional sum should be included for ESHS outcomes which would see Contractors paid for reasonable costs of implementing the ESMP (and GBV activities), bidders will then have a consistent level of funding in their bids, neutralizing the implications of underpricing or overpricing. This could be done by including line items in bill of quantities for well defined ESMP activities (including GBV activities);

- Bidders are required to demonstrate that they have suitably qualified ESHS specialists among their key personnel, key personnel must be named in the proposal, and in the contract. Lastly, the quality of the proposed ESHS specialists should be assessed during the evaluation of proposals. Bidders need to be aware that removal of personnel (and legal prosecution) may be requested if they engage in GBV or if their behavior breaches the Code of Conduct;

- Contracts must contain specific ESHS reporting requirements and mention that work will be supervised for compliance regarding E&S measures;

- Contracts must contain financial leverage. Use of contractual remedies is recommended, including suspension of disbursements, delays on payment until there is clear evidence of an improvement of the Contractor's performance.

- Develop an Equal Job Opportunity and Local Content Plan with a clear process to recruit women, youth and people with disabilities in employment positions and to procure goods and services to camps from local businesses. Prime contractor to have specific targets and measures related to:

    - Employment and recruitment of women, identifying targeted citizens for skilled positions through engagement with NGOs, universities and training institutions, and industry associations as part of stakeholder engagement.

    - Set targets for unskilled workforce and rationale for target. Example of quotas: At least 30% of the total workforce will be youth (persons aged 19 to 35); At least 10% of the total workforce will be women ; At least 5% of the total workforce will be persons with disabilities (assumes 85% are from local communities, 15% national and international).

- Organize women and people with disabilities into groups and provide training for specific line of service providing such as catering and food production, camp cleaning and maintenance, repairs to PPE and construction apparel, as examples.

Bidding documents and contracts for the Supervising Engineer (SE), including the Technical Specification, shall also include some specific measures from the ESMP and outline the SE's E&S responsibilities. Activities and the costs of the resulting mitigation measures should be made explicit in both bidding documents and the final contract to ensure that they are, in fact, implemented:

- Requirements to foresee dedicated staff with appropriate qualifications and experience to manage and monitor specific social and environmental impacts;

- Requirements to produce regular E&S reports to assess compliance with GBV and other E&S measures;

- Ensure that the PPE requirements in the Occupational Health, Safety and Security Management Plan to be developed, include an obligation to provide PPE suitable for female workers (diverse range of body shapes and sizes).

- Requirements to develop a SE Code of Conduct and to take active part in the Grievance Redress Mechanism;

- Requirements to respect ratified conventions from the International Labour Organization (such as child labor, forced labor, and all other conventions that Zambia ratified, these are presented in the ESMP).

**Risks and impacts management measures: evaluating Contractors' proposals and selecting Contractors**

- When evaluating bidders' proposal, it is important to evaluate the contractor's GBV response and confirm, prior to finalizing the contract, the contractor's ability to meet the project's GBV requirements.

- It is also recommended to verify the self-assessment of contractors' previous relationships with surrounding communities and stakeholders.

**2 - Potential risks and impacts originating from resettlement**

Resettlement of people from the ROW and compensation payment represent a risk for vulnerable groups as well as a risk of GBV. This is particularly true when compensation is paid in cash to men, as their wife might not benefit. In polygamous marriages, junior wives are especially at risk to be overlooked. Experience has shown that, in some cases, men spend the money instead of investing it in the household resettlement or that men seek to remarry another woman and abandon their family. Women are often bypassed when compensations are negotiated and distributed.

During the Consultant's 2019 social surveys, female headed households were consulted to discuss perceived risks due to resettlement, and according to respondents:

- Women will be affected more than men because of the distance they will travel to where they draw water, to the clinic, and to their church;

- Some women currently occupy plots they bought in the past, resettlement will require women to look for other plots to buy, which may be difficult;

- For single women, some family members may try to take their compensation money because they helped them build the house in the past;

- On the other side, some female heads of households consulted in focus group discussions mentioned that cash compensations would be good for them, since they would have the chance to move out of an area where they fear land grabbing by family members.

**Risks and impacts management measures: in kind compensation is recommended as well as women's participation**

In kind compensation such as land, is usually highly recommended by lenders. However, as detailed in the RAP, ZESCO only intends to give cash compensations. As explained in the RAP, given the context of the Project and the moderate significance of resettlement, where people will only be displaced a short distance, and given the fact that cash compensation is well accepted by PAPs, it is considered an acceptable means to compensate PAPs. In fact, most people the consultant met view cash compensation as a means of improving their house and living conditions. However, some women fear cash compensation would be detrimental to them because of the risk of men running away with it. To reduce risks, women shall participate in the negotiation process and sign offs, as well as be aware of the amount given as compensation. To address this risk, ZESCO's resettlement policy "Resettlement and Compensation Action Plan" requires that the wife be present during counselling, disclosure of the compensation packages, and when making compensation payments. This is done to encourage the couples to make informed decisions together. In addition, the couple will be informed of the resettlement monitoring plan, which as part of the RAP, determines whether the household is better or worse off as a result of resettlement. ZESCO's Consent for Compensation/ Disclosure form, included in the RAP should be adapted for more than one signature in case of household in unions, including polygamous marriages. According to the Social Safeguard Standard 4 of the Ministry of Energy, documentation of ownership or occupancy and compensation payments should be issued in the names of both spouses or single heads of households as relevant.

It is also highly recommended that all compensation payments be made before beginning construction.

Lastly, to reduce the risk to female headed households during resettlement, an awareness program will be put in place during Project preparation aiming at Traditional Authorities (TAs) to ensure women have equal access to land (as presented in the GBV Action Plan in the ESMP). This topic is also further developed in the RAP.

**3 - Cultural misinterpretation of the term GBV and other barriers**

During meetings with Chiefs held in 2019, it was obvious that the term GBV is poorly understood by some traditional authorities, and that there may be some form of resistance from men to address this proactively. . In many cases, traditional leaders resolve criminal cases directly and do not refer them to the formal system. In situations of sexual violence, this could lead to survivors not seeking formal health services till after the critical 72 hour time window for post exposure interventions to prevent STIs, HIV and unwanted pregnancy.Other Chiefs such as Chief Chikwanda (Mpika District) and Chieftainess Nawaitwika (Nakonde) are championing anti-GBV actions and have requested to be met by the construction Contractor prior to work to sensitize them on GBV.

The Consultant recommends that chiefs are involved in the GBV Action Plan, although the level of engagement with specific chiefs will vary depending on their attitude and response to GBV in their chiefdoms, Chiefs and other traditional leaders have a unique role in the referral pathway given the high level of trust and influence that they have in the community. This must be leveraged. However, this requires awareness training (covering among other things, the roles of the formal service providers and the importance of timely referrals)The Traditional Leaders Engagement Strategy on GBV should be consulted (USAID/Zambia, 2010)

It is recommended that GBV Service Providers be involved as detailed in the next paragraphs. Involving an independent GBV Service Provider, from outside the community, to address GBV was recommended by women during focus group discussions.

**4 - Risks and impacts from construction and decommissioning activities: workers' and engineers' camp designs**

Camp design represents a risk for women; especially if it is poorly designed (not well lit, women's and men's quarters not separated, etc.) and its entrance not controlled. If the camp is located too close to communities, it may also increase the risk of GBV and interaction with people.

**Risks and impacts management measures for the workers' camp design**

During 2017 consultations, community members highlighted the risk of promiscuous interactions and GBV if the workers' camp was located too close to villages. It is recommended that the implementing agency (ZESCO) engages with communities to select the most suitable place for the workers' camps.

Some measures could be covenanted in the Contractor's future contract, such as:

- The workers' camps shall be fenced and clearly delineated to control entrance;
- Locker rooms and latrines shall be well-lit and gender-segregated and should include the ability to be locked from the inside;
- Signs shall be displayed in local language around the camp that signal to workers and the community that the project site is an area where gbv is prohibited;
- For national workers, if feasible, bus tickets shall be provided for them to get back to their family on weekends and holidays;
- Unskilled labor shall be sourced from the affected communities and a local content plan shall be developed in the C-ESMP.

**5 – Risks and impacts from construction and decommissioning activities: arrival of Project workers and influx of migrant workers and community health and safety**

Projects with a large influx of male workers with higher than average wages may increase the demand for sex work, the risk of trafficking of women for the purposes of sex work, or the risk of forced early marriage.

Sadly, many of those are livelihood strategies for the victim's family. A term commonly used to describe this phenomenon is "fraternization".

Influx of people in search for a job is also an additional risk, often these are young men from other regions of the country. They are hired informally and are not officially part of the Contractor's workforce. Return of experience of the Consultant in work supervision has shown that, due to their unofficial worker status, they often are not included in any form of training and sensitization on E&S issues, are not under the scrutiny of any form of E&S supervision, are not lodged in the workers' camps, and often build informal houses close to the community or the workers' camp. This type of labor influx is often associated with an increase of GBV, STDs, and conflicts with communities.

Arrival of male workers may change the dynamic in the communities and lead to conflict, jealousy, and GBV within households, especially where local women interact with male workers.

These risks are the most obvious ones and the most likely to take place given the pre-existing social context and that some types of GBV are culturally tolerated.

There is a risk that children be informally hired by the Contractor to "help" with certain tasks in the camp kitchen or that children are sent to the camp to sell goods . This could lead to lower attendance of children in schools and child abuse.

Lastly, there is a risk the Project inadvertently undermines established service providers and local businesses of the affected communities, by providing catering and camp services through one single business entity.

**Risks and impacts management for arrival of Project workers and influx of migrant workers and community health and safety:**

- Promote local content opportunities based on local service providers capacity. According to the Social Safeguard Standard of the Ministry of Energy, the developer should identify goods and services which could be provided by the community, including women, youth and people with disabilities.

**6 - Risks from construction and decommissioning activities: physical construction work**

During construction activities, there is a risk that GBV is not adequately monitored, and cases remain undeclared and unaddressed.

This is often caused by a lack of commitment form the Contractor or the Supervising Engineer, a lack of resources to detect and address these situations and the absence of a Grievance Redress Mechanism (GRM). Weakness in the supervision of a construction site, has led to escalating GBV situations in similar projects.

**Risk prevention measures for workers influx and construction activities**

Robust community engagement: a Stakeholder Engagement Plan (SEP) is presented in a separate chapter. Part of the C-ESMP requirements is to make the SEP operational to allow the Contractors and the Supervising Engineer to understand the community dynamics and social context. It is therefore required that the Contractors and Supervising Engineer meet regularly with community members in a meaningful and transparent way. Meetings should have sufficient representation of women who are often disproportionately affected by Project impacts. Community engagement includes implementing a Grievance Redress Mechanism.

Code of Conduct (CoC) for all workers (formal, informal, and those from Subcontractors): The framework of the CoC is detailed in the ESMP. The Contractor and Supervising Engineer will design, implement, and maintain the CoC based on the provided framework.

The following paragraphs are the general principles of the CoC:

- The CoC is an important tool to prevent and sensitize workers on GBV. The CoC objectives are to ensure all workers behave respectfully with surrounding communities, women, and children, and to ensure they are regularly trained and sensitized on GBV, and to enhance social acceptability of the Project;

- The CoC must be produced by both the Contractor and the Supervising Engineer and be operational and validated before commencement of work;

- The CoC must detail how the Contractors and the Supervising Engineer intends to prevent GBV but also other forms of misconduct such as speeding on roads, drinking on site, bribery, and poaching. It must list all the prohibited activities and associate each breach with a penalty measure. The CoC shall also list actions that are criminal offences by national legislation;

- The CoC must be translated into local language and induction trainings must be given to all workers who need to sign it, the CoC shall be annexed to workers' contract. Informal workers and Subcontractors are subject to the same CoC obligations as regular workers and compliance with the CoC is the Contractor's responsibility;

- The CoC must be monitored by both the Contractor and the Supervising Engineer, using performance indicators and the Grievance Redress Mechanism.

A draft CoC is provided in Appendix F of MOE's Social Safeguard Framework. Awareness on the Code of Conduct, HIV, and STDs for all workers and community members

A social awareness program is the basic requirement for all workers and community members as encouraged by the Social Safeguards Framework of the Ministry of Energy. An HIV awareness plan was also the most commonly proposed measure by community members during the 2017 rounds of public consultations.

This social awareness program should be made of induction trainings for all workers and cover the various work-related measures (health and safety) but also the Code of Conduct, HIV/STDs, SEAH, Sexual and Reproductive Health and Rights (SRHR), and alcohol abuse, GBV and the GRM.

This programme may also include training in financial literacy and joint decision making in households and encourage workers to form saving groups among themselves or in the community. This would help reduce higher disposable income thus contributing to reducing alcohol abuse, risky sexual behaviours and GBV occurrences.

Upon completion of this training, workers will be asked to sign a document confirming that they have followed the training course, and they understand the implications of the Code of Conduct.

This induction training and its budget shall be developed as part of the Contractor C-ESMP (see ESMP) and shall include hiring NGOs and medical staff. During these induction trainings, the local police law enforcement shall be present to explain the national laws that make sexual harassment and gender-based violence a punishable offence. Discussions with the Police Victim Support Unit (VSU) in Lusaka has highlighted the fact that many Contractors refuse to involve the VSU in induction trainings, it is therefore important to highlight in Contractors' contract the mandatory presence of VSU during induction training.

Identification of local clinics that offer tests for STDs and medication is also required and workers need to know where they can get tested.

Labor Influx Management Plan

Each Contractor, as part of their C-ESMP, shall detail how they intend to manage workers in a Labor Influx Management Plan based on recommendations from the World Bank document "World Bank Good Note Practice on Labour Influx" and Standard 4 of MOE Social Safeguard Framework "Community Protection and Empowerment". This requirement shall also be embedded in tender documents. The Labor Influx Management Plan shall detail how recruitment of local staff will be done and how informal workers will be avoided. It shall also detail how the Contractor intends to hire workers.

**Addressing and responding to GBV and SEA starts with the implementation of a Grievance Redress Mechanism (GRM) and a Contractor Control System**

Return of experience of the Consultant in construction site monitoring shows that cases of GVB are usually difficult to identify especially when GBV involves the Contractors. Most of the time, even if workers are suspected, gathering proof is difficult because the victims fear retaliation from their employee, they fear social stigma, and sometimes retaliation from local authorities.

Supervising Engineers and contractors are also usually not inclined to identify and address this issue because of the risk of impacting work progression and deteriorating Contractor-project-owner relationships.

This ESIA proposes three methods to detect GBV, these are further detailed in the ESMP:

- A GBV Allegation Procedure that needs to be publicly presented during consultations with communities as well as during induction training with workers;
- The regular grievance redress mechanism (GRM) where people can convey their grievances to a focal point;
- Contractor Control System from the Supervising Engineer as part of its audit on ESHS.

The framework of the GRM is detailed in the ESMP.

Previous experience shows that GRMs usually aim at overall Project management and are detailed in a generic company's policy, with little focus on resettlement and the construction phase. In many projects, the GRM falls under the responsibility of Project implementation units who generally are not on site offering limited possibility for Project affected people to convey their grievances outside the regular customary channels.

It is therefore required to broaden the scope of the GRM to include all Project phases and to involve a GRM focal point, a GBV Service Provider, the Contractor, and the Supervising Engineer.

Previous experience shows that a GRM is better managed when grievances are outsourced to a focal point because, as soon as a GRM is advertised to the community, the high number of grievances, questions, and opinions on the Project can quickly become a burden for the Contractor and Supervising Engineer.

Typically, a grievance is brought to the village headmen, then to the Chiefs, and sometimes to the DC office. Given the nature of the Project and the fact that resettlement will take place, a quicker method to implement GRMs with less intermediaries is recommended. Again, this justifies the need for a GRM focal point.

GRM focal points are better suited for such projects compared to the regular customary way of dealing with grievances because:

- International practices recommend that all grievances be recorded in a database of files, tracking grievances is key to the success of the mechanism and traditional authorities are used to exchange orally and are not accountable to Project owner;
- PAPs may fear discussing certain subjects with Chiefs or village headmen. The GRM shall allow people to file a complaint anonymously without fear of social stigma;
- GRM focal points must be easily accessible to women, children, and other vulnerable groups. Therefore, focal points should preferably be women;
- The number of intermediaries before the grievance reaches ZESCO office in Lusaka leads to delays before an action is undertaken (village headmen-Chiefs-DC office-ZESCO);
- It is important to avoid elite capture since traditional authorities' interests are sometimes different from those of community members.

Consultations with communities and stakeholders (2019) have allowed to study several options to deal with grievances and discuss openly with stakeholders about their feasibility:

- Having a mobile Grievance Redress Committee (GRC) that would travel on regular basis to the site to collect grievances. This mobile unit could be made of representatives from several departments: The Department of Labor to address grievances during construction, the Department of Agriculture to address grievances related to crop compensation and livelihood restoration, Community Development and Social Services to address grievances from communities, and the Victim Support Unit (Police) to address GBV cases. This GRC would face several obstacles since such mobile units do not exist, since the Project is crossing many districts and that a mobile unit would require funds for the purchase of a vehicle and allowances for government members.

- Empowering existing local institutions that are already well respected such as Ward Development Committees which are made of elected persons. Such committees are based at ward level, therefore closer to people. Some participants recommended that these Ward committees be used for the time of the Project and be trained on recording grievances. However, their role is to develop the local economy, not to deal with project related impacts. Some participants also mentioned that these institutions are absent in many wards.

- Selection of single focal point persons for each district that could travel on a set basis along the transmission line to collect grievances. In addition to this focal person, "Community Based Champions" could be selected and trained to become informants of the focal point, since they know their community. Involving such champions was tested by an NGO called "Development of People's Empowerment (DOPE)". This solution seems to be the most appropriate given the small amount of people that will be resettled and seems to be better adapted to site realities where communities are scattered in the study area.

Outsourcing management of grievances to a focal point and the operational details of this measure are provided in the ESMP. As presented in the ESMP, funds shall be allocated to allow these focal points to function, the main issue (as highlighted in meetings with stakeholders) is to provide reliable transportation and fuel to the GRM focal point.

**Selection of a GBV Service Provider**

A GBV Service Provider is an organization offering specific services for GBV survivors, such as health services, psychosocial support, shelter, legal aid, safety/security services, etc. Good examples of such Service Providers are the One-Stop Centers (OSC) which refers to organisations that provide GBV survivors with all key services (health, psychosocial, police and legal) under one roof to avoid survivors moving from one place to another. There are currently 69 OSCs operating in Zambia under Ministry of Health and an additional 31 OSCs will be created by transitioning GBV Help Desks into OSCs

With the exception of Chitambu in Central Province, all affected districts have OSCs. Chitambo district has a GBV Help Desk, which is in the process of transitioning to a OSC. Consultations with communities and stakeholders (2019) has allowed to study several options for the GBV Service Provider and discuss openly with stakeholders about their feasibility. In addition, meetings in Lusaka with several NGOs and the Ministry of Gender have allowed to pre-identify GBV Service Providers and to make appointment to meet with them in their respective districts. Although OSCs is likely to be the preferred option in most districts, depending on the geographical distance to the OSC, other GBV Service Providers might be considered. It should be noted that the Zambian Government, through the Gender Division has an online GBV Referral Pathway Dashboard, which includes information of the GBV response service providers present across the country[1]. The selected GBV Service Providers must be able to provide both prevention and response services.

**Reporting of GBV cases**

The Ministry of Gender does not have regional departments and they depend on NGOs for work on GBV issues while the Victim Support Unit (VSU) from the police have units in every district. The VSU is a special unit of the police to prevent and legally addressed GBV cases. A meeting with the National Coordinator of the VSU has allowed to understand the way this unit operates. A person of the VSU is a member of each one-stop center in the country to take the lead on legal prosecution against perpetrators. This ESIA recommends that the VSU be involved with each GBV Service Provider presented in the ESMP. Unfortunately, constraints for victims to report an aggression to the VSU exist, stakeholders have highlighted that victims from rural areas are usually not inclined to report an aggression to the VSU because of the cost of transportation to go to town. Therefore, this ESIA recommends that the VSU accompany GBV Service Providers on the field whenever required. As presented in the ESMP, funds shall be allocated to allow these Service Providers to function, the main issue (as highlighted in meetings with stakeholders) is to provide reliable transportation and fuel.

There are GBV fast track courts in Zambia to accelerate court cases, however none of these are in the study area.

[1] The GBV Referral Pathway can be accessed online : GBV REFERAL PATHWAY – Gender Division

There are also District Gender Focal Points at each district, some of them were met in the course of stakeholder meetings. These are employees at the local council and they are responsible for managing the "Gender-Based Violence Task Force" at the district level. The GBV task forces are expected to coordinate activities related to GBV and to meet with GBV Service Providers on a regular basis. However, some District Gender Focal Points and GBV Task Forces are not as active as expected, possibly due to limited resources, lack of training, or competing priorities within the districts. The District AIDS Coordination Advisor are also situated in the local council and is responsible for functions related to HIV/AIDS management, human rights and gender mainstreaming at community level. The District Gender Focal Points and DACAs shall be met at inception of construction work to present the GBV Action Plan.

In the case of GBV, best practices recommend adapting the GRM to detect cases. Whenever GBV complaints are brought up, the GRM focal point must keep allegations confidential to safeguard the survivor's identity and refer the survivor to a local GBV Service Provider, through the Referral Pathway mentioned above. Global best practice recognizes that it is essential to respond appropriately to a survivor's complaint by respecting the survivor's choices. This means that the survivor's rights, needs and wishes are prioritized in every decision related to the incident. The survivor of SEA/SH, who has the courage to come forward, must always be treated with dignity and respect. Every effort should be made to protect the safety and wellbeing of the survivor and any action should always be taken with the survivor's consent. These steps serve to minimize the potential for re-traumatization and further violence against the survivor.

The GBV Service Provider shall handle all local cases of GBV in affected communities (whether directly linked to the Project or not, as recommended by best practices) in accordance with the law, the employment contract, and the Code of Conduct. This GBV Service Provider shall be responsible for:

- Receiving and handling GBV complaints either directly or indirectly through the GRM focal point;
- Assessing the nature of complaints;
- Providing the survivor with support which should include advice and referrals on health services, psychological, and legal support;
- Proposing the appropriate remedy to be applied to the perpetrator through a GBV resolution mechanism. This resolution mechanism is presented in the ESMP. This resolution mechanism must be consistent with national law and labor legislation.

The GRM, including the GRM for GBV, shall be promoted to local communities, workers, and all stakeholders. The Project actors involved in the Stakeholder Engagement Plan must provide information to employees and the community on how to report cases of GBV.

A framework of GRM for GBV is presented in the ESMP. This framework could be used as terms of references for selecting a GBV Service Provider.

Regarding the Contractor control system, it is recommended that the Supervising Engineer carry out regular ESHS audits on all Contractors and their Subcontractors.

Concerning monitoring, it is recommended that an independent third-party is commissioned to provide GBV Management Plan monitoring reports. This third-party has a high-level monitoring oversight function to confirm that all project actors, including the GBV service provider and the designated focal points or committee address and resolve GBV complaints, are implementing the GBV Action Plan. The third-party also verifies that the provisions to prevent and respond to GBV are in place and functioning, and so can provide early warning of problems that may surface.

Measures against child labor

Several conventions from the International Labor Organization (ILO) shall be explicitly covenanted in the tender and Contractors' contracts but also enforced on site by the Contractors. The Supervising Engineer, during monitoring shall pay attention to this aspect to ensure cases are reported to the PIU and the GBV Service Provider. The contractor will be required to keep copies of national identity documents of all employees to ensure that there are no underaged workers.

### IMPACT ASSESSMENT

Since GBV is a risk rather than an impact, it is not possible to assess. Any GBV event should however be considered as being of major significance.

The adoption of adequate prevention measures and awareness programs should greatly reduce the risk of GBV. While GBV is the result of individual or group behavior on women, risks originate during Project preparation phase when GBV needs to be proactively acknowledged and measures included in bidding documents. The selection of a construction Contractor and the inclusion of appropriate mitigation measures in call for tenders and contracts is therefore a crucial step as most Contractors have no experience in dealing with grievances and GBV. Therefore, the selection of the construction Contractor will require a conscious decision by Project proponent and financing agencies prior to tendering.

In addition, many measures proposed in this ESIA and ESMP involve costs for the construction Contractor, call for tenders shall be clear on the requirements to quantify measures.

## OPERATION PHASE

### POTENTIAL RISK

- Occurrence of GBV and SEA.

### SOURCES OF RISK

- Maintenance and repairs;
- Presence of workers.

### MITIGATION MEASURES

At this stage all measures would be of ZESCO's responsibility since maintenance will be done by its employees. The best mitigation is to maintain awareness programs for ZESCO employees and community members. Given the rareness of maintenance activities, specific measures are difficult to implement. However, involving a GBV Service Provider, whenever a survivor requires assistance, is recommended for the life span of the Project through community grievance mechanism for instance.

### DETAILED RISK DESCRIPTION

During operation of the Project, risks to GBV could be diminished because transmission lines do not require permanent staff on site. Some risks can originate from the permanent settlement of people who came for work (although this is unlikely) and from the presence of maintenance workers (as highlighted during focus group discussions with women, there are cases of maintenance workers and unwanted pregnancies along transmission lines).

### IMPACT ASSESSMENT

Since GBV is a risk rather than an impact it is not possible to assess its significance. Any GBV event should however be considered as being of major significance for the survivor.

## DECOMMISSIONING PHASE

As highlighted above, during decommissioning, the risks are similar to those during construction and should be addressed the in same way, with the involvement of a GBV Service Provider.

### 6.2.4.5 INFRASTRUCTURE

#### DESIGN MEASURE

General design parameters were followed for road and railway infrastructure.

#### PRE-CONSTRUCTION AND CONSTRUCTION PHASES

##### POTENTIAL IMPACTS

- Need for relocation of some existing infrastructure;
- Increased traffic and disturbance of traffic flow;
- Damage to existing infrastructure;
- Pressure on existing local health infrastructure.

##### SOURCES OF IMPACT

- Site preparation;
- Decommissioning activities;
- Transportation and circulation.

##### MITIGATION MEASURES

- Mitigation measures aimed at reducing impacts on infrastructure are outlined in Chapter 3 of the ESMP.

##### DETAILED IMPACT DESCRIPTION

Roads, electricity, railways, and telecommunications infrastructure were surveyed and described in the baseline chapter. On main roads, the presence of construction vehicles and equipment may lead to increased traffic and affect traffic flow. The Project's equipment could potentially damage some existing infrastructure. Also, several existing secondary roads will be used as access roads to the wayleave, which will lead to their degradation, and new access roads will be constructed.

Also, the Project will cross railways along its path. Coordination will be required between the Contractor and the relevant authorities to ensure work is performed safely without interfering with railway operations. Construction work should not create any impacts on the operation of nearby existing telecommunication antennas except by temporarily limiting their access.

Lastly, it is highly probable that the capacity of the rural health post is not sufficient to address workers' injuries and that their presence may lead to pressure on health services.

##### IMPACT ASSESSMENT

The intensity of the residual impact is low since the application of the proposed mitigation measures will offset the impact of the construction activities on infrastructure within the Project area. The extent of the impact is local since the impact on infrastructure, if any, will be felt mainly by the population living in proximity to the line and access roads.

The impact duration is considered medium since the negative effect on infrastructure will be felt continuously throughout the construction phase. The residual impact on infrastructure is thus considered of minor importance. The probability of occurrence of the impact is low because the Project construction is not likely to damage or cause the relocation of existing infrastructure.

| Residual Impact on Infrastructure during the Pre-construction and Construction Phases | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: Low | |

## OPERATION PHASE

### POTENTIAL IMPACT

- Radio and television signal interruption.

### SOURCE OF IMPACT

- Presence of line, substations, and access roads.

### MITIGATION MEASURES

No specific mitigation measures apply to this component.

### DETAILED IMPACT DESCRIPTION

Transmission lines do not usually interfere with normal television and radio reception. In some cases, interference can occur very close to the wayleave due to weak broadcast signals or poor receiving equipment. No other significant impact on infrastructure is expected to occur during the operation phase.

### IMPACT ASSESSMENT

The intensity of the residual impact is low as infrastructure within the Project area will be minimally affected by operation activities. The extent of the impact is local since the impact will be felt mainly by the population living very close to the wayleave. The impact duration is considered short since a negative effect could be felt sporadically over a short period. The residual impact is thus considered of minor importance. The probability of occurrence of the impact is low because the transmission line is unlikely to cause the interruption of radio and/or television signals.

| Residual Impact on Infrastructure during the Operation Phase | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Short | |
| Probability of occurrence: Low | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS

- Increased traffic and disturbance of traffic flow;
- Damage to existing infrastructure;
- Pressure on existing local health infrastructure.

### SOURCES OF IMPACT

- Site preparation;

- Decommissioning activities;
- Transportation and circulation.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on infrastructure are outlined in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

The impacts during the decommissioning phase are expected to be similar to those of the construction phase.

### IMPACT ASSESSMENT

The intensity of the residual impact is low since the application of the proposed mitigation measures will offset the impact of the decommissioning activities on infrastructure within the Project area.

The extent of the impact is local since the impact on infrastructure, if any, will be felt mainly by the population living in proximity to the line and access roads. The impact duration is considered medium since the negative effect on infrastructure will be felt continuously throughout the construction phase. The residual impact on infrastructure is thus considered of minor importance. The probability of occurrence of the impact is low because the Project decommissioning is not likely to damage or cause the relocation of existing infrastructure.

| **Residual Impact on Infrastructure during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: Low | |

## 6.2.4.6 COMMUNITIES AND SOCIAL COHESION

### DESIGN MEASURE

Generally, the line alignment was adjusted to avoid residential housing and development, where possible. This measure helped reduce potential impacts by avoiding dense urban areas.

### PRE-CONSTRUCTION AND CONSTRUCTION PHASES

### POTENTIAL IMPACTS

- Land use and compensation disputes, reviving old quarrels (land resource and power conflict);
- Tension with workers from the outside;
- Increased marginalization of vulnerable groups;
- Inadequate communication with communities and stakeholders.

### SOURCES OF IMPACT

- Land acquisition;
- Resettlement;
- Displacement of economic activities;

– Presence of workers.

### MITIGATION MEASURES

Mitigation measures for minimizing impacts on communities and social cohesion are identified in the ESMP's Chapter 3. The key measure is the development and implementation of a SEP and a GRM.

### DETAILED IMPACT DESCRIPTION

The steps leading to final arrangements associated with resettlement prior to the construction could stress some communities, reviving old quarrels. Moreover, the distribution of compensations among claimants (e.g., landlord, tenants, and family members) can create tension inside and outside the impacted households.

Recommended solutions include proper communication of compensation rules and procedures to all affected parties and implementation of the GRM.

The construction phase will mainly impact communities and social cohesion due to the presence of workers, sometimes from outside of the region, and dispersed throughout the different sections of the line. Due to the presence of different stakeholders (Project Managers, Contractors, Subcontractors, employees and/or Consultants), the local population will be exposed to different systems of values that may be conflicting with their own. The aforementioned factors could potentially lead to tension, conflicts with local and traditional authorities, as well as create distance between different groups.

Impacts on the livelihoods of vulnerable groups (such as the elderly, the disabled, the landless, and female-headed households) may be more severe since these groups usually have fewer resources and find it difficult to use available services due to their condition.

### IMPACT ASSESSMENT

The application of the proposed mitigation measures establishes the intensity of the residual impact at medium. The extent of the impact is considered local, as only a portion of the population in affected communities may be affected. The impact duration is medium as it will be felt continuously during the construction phase. The importance of the residual impact on communities and social cohesion is thus considered moderate. The probability of the occurrence of this impact is high because land and compensation disputes, tension between the local population and foreign workers, and the increase in marginalisation of vulnerable groups will most likely occur during the pre-construction and construction phases.

<table>
<tr><th colspan="2">Residual Impact on Communities and Social Cohesion during the Pre-construction and Construction Phases</th></tr>
<tr><td>Intensity: Medium</td><td rowspan="3">Importance: Moderate</td></tr>
<tr><td>Extent: Local</td></tr>
<tr><td>Duration: Medium</td></tr>
<tr><td colspan="2">Probability of occurrence: High</td></tr>
</table>

## OPERATION PHASE

### POTENTIAL IMPACTS

– Tension between local population and maintenance workers;

– Land use disputes, reviving old quarrels (land resource and power conflicts).

### SOURCE OF IMPACT

– Presence of workers.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on communities and social cohesion during the operation phase are identified in Chapter 3 of the ESMP. Maintaining the SEP and a GRM during the operation phase are key mitigation measures.

### DETAILED IMPACT DESCRIPTION

Although the impacts on communities and social cohesion are likely to be mostly felt during the construction phase, they could also be felt, to a lesser degree, during the operation phase due to the presence of workers for maintenance activities. In addition, compensation payments may lead to conflicts within families, which will continue throughout the operation phase. Disputes could also arise from misunderstandings regarding the uses allowed within the wayleave. This could lead to frustrations within local communities or conflict between community members.

### IMPACT ASSESSMENT

The application of the proposed mitigation measure limits the intensity of the residual impact to low because the size of the workforce to be employed during the operations will be very limited. The extent of the impact is considered local, as only a small portion of the PAPs may be affected. The impact duration is short as it will be felt sporadically over the maintenance phase. The importance of the residual impact on communities and social cohesion is thus considered minor. The probability of the occurrence of this impact is medium because tension between the local population and maintenance workers is possible during the operation phase. Pending conflicts between family members regarding compensation are also possible.

| **Residual Impact on Communities and Social Cohesion during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Short | |
| Probability of occurrence: Low | |

## DECOMMISSIONING PHASE

### POTENTIAL IMPACT

- Tension with workers from the outside.

### SOURCES OF IMPACT

- Site preparation;
- Decommissioning activities;
- Presence of workers.

### MITIGATION MEASURES

Mitigation measures for reducing impacts on communities and social cohesion are listed in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

The decommissioning phase will mainly impact communities and social cohesion due to the presence of workers, sometimes from outside of the region, and dispersed throughout the different sections of the line as it is decommissioned. The local population will be exposed to different systems of values that may be conflicting with their own, due to the presence of different stakeholders (Project Managers, Contractors, Subcontractors, employees and/or Consultants). This may lead to tension and conflicts with local and traditional authorities, as well as divide different groups.

In addition, cleared land, that will be freed from access restriction and trees, will be attractive for new settlers to come. This situation may cause conflict with local communities and traditional authorities.

### IMPACT ASSESSMENT

Following the implementation of mitigation measures, the intensity of the residual impact is expected to be low. The extent of the impact is considered local, as only a portion of the population in affected communities will be affected. The impact duration is medium as it will be felt continuously during the construction phase. The importance of the residual impact on communities and social cohesion is thus considered moderate.

The probability of this impact occurrence is moderate because of tension between the local population and foreign workers and the increase in marginalisation of vulnerable groups. Therefore, impacts might occur during decommissioning without any certainty.

| **Residual Impact on Communities and Social Cohesion during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: Moderate | |

## 6.2.4.7 CULTURAL AND ARCHEOLOGICAL HERITAGE

### DESIGN MEASURE

Design measures are proposed, notably by NHCC, and should be considered during the detailed design of the infrastructure:

- Monopole structures should be encouraged in case the transmission line passes through or near the monument area since they have a thinner profile and a simpler presence than lattice structures.
- Reroute the line route at the margins of the site to reduce encroachment within the rock outcrops areas.

### PRE-CONSTRUCTION AND CONSTRUCTION PHASES

### POTENTIAL IMPACTS

- Potential disturbance or destruction of archaeological sites and objects;
- Potential destruction of physical cultural resources within the Mwela Rock Art site;
- Destruction or potential disturbance of burial sites and sacred sites.

### SOURCES OF IMPACT

- Site preparation (mainly excavation);

- Construction activities;
- Transportation and Traffic.

## MITIGATION MEASURES

If archaeological or historic remains are discovered, construction works will immediately stop as part of the Chance Find Procedure in that area and appropriate authorities, including NHCC, should be informed. Specific mitigation measures for the Mwela Rock Art site will be established based on suggestions to be provided in the soon-to-be-completed NHCC assessment. The TORs for the NHCC assessment will be reviewed and must be approved by the World Bank. The study will be completed prior to construction, and adequate mitigation measures will be recommended to reduce impacts, including realignment of the lines, if necessary. However, based on the assessment that was completed for the ICBC Project in that area, proposed mitigation measures are likely to be as follows:

- Any excavation greater than 1 metre deep should be done in collaboration with the NHCC cultural heritage specialist;
- Monitoring should be continuous and random, especially in areas that are likely to yield archaeological heritage resources;
- Formulation of a Transport Management Plan and Cultural Heritage Resources Awareness Training and Visitor Induction;
- If human remains are found on site during the Project execution, report find to appropriate legal bodies and do not disturb finds until removal of remains is complete.

Mitigation measures for reducing impacts on cultural and archaeological heritage, the Cultural Heritage Management plan, including the Chance Find Procedure, are further detailed in Chapters 3 and 4 of the ESMP.

## DETAILED IMPACT DESCRIPTION

As presented in section 5.3.8, several archaeological and cultural resource sites were inventoried in the extended study area, including two archeological sites (Mwela Rock paintings and Nachikufu caves) and three historical cultural heritage sites (Zwangendaba Burial Site, Von Lettow-Vorbeck Memorial National Monument, and Chilubula Mission National Monument). Additionally, the Chishimba Falls National Monument and the Kundalila Falls National Monument were identified as important natural features in the vicinity of the Project. None of those important sites are located close enough to the Project to be considered potentially affected except for the Mwela Rock Art site, which will be crossed by the line. This site is included in a National Heritage Site and the Kasama Forest Reserve No. P47 National Forest. The implication of this is that the site enjoys double protection through the NHCC Act and Forestry Act. The site is also on the tentative list for the UNESCO World Heritage Sites.

The original core area under heritage protection measures 10 square kilometers as a National Monument, but also legally protected are the rock paintings on the outcrops on the southern part of the Kasama – Mungwi Road, namely Sumina, Namalundu and Changa Mwibwe.

Due to the impact risk, the National Heritage Conservation Commission (NHCC) has engaged in discussions with ZESCO to carry out a heritage assessment in the wayleave to determine impacts and associated mitigation measures for the Mwela Rock Art site. This assessment has led to the identification of physical cultural resources in the vicinity of the ZTIP wayleave which will need to be considered and protected during the construction work to avoid any long term impact on the cultural heritage. It is difficult to confirm if the presence of the powerline will reduce the number of tourists at the site or if it will affect classification of the site as World Heritage by UNESCO.

The Cultural Heritage Management Plan, which includes a Chance Finds Procedure, should be improved by the contractor prior to construction and should include information on relevant contact persons in case of a chance find. During construction activities, machinery can discover and partially damage unknown archaeological sites or artifacts. A NHCC archaeologist should accompany the construction team during excavation work and should make some sporadic checks at the pylon locations. His presence will be mandatory during construction activities within the Mwela Rock Art site. Should any archaeological or historic remnants be encountered, construction works will immediately stop along that section, and the proper authorities will be informed.

### IMPACT ASSESSMENT

Regarding unknown cultural heritage sites, due to limited excavation work and depth (mainly shallow excavation around the bases of the towers), if any discovery takes place, the intensity of the residual impact should be low. The extent is limited because the risk of disturbance would be confined to a limited space where shallow excavation occurs. The impact duration is estimated at long if integrity is lost or an archaeological site or artifact is destroyed. Indeed, the nature of such loss or destruction could be permanent and irreversible. The importance of the residual impact on archeology and heritage is considered minor.

The probability of this impact occurring is moderate since it is possible that unknown cultural or archaeological sites will be accidentally damaged along the Project line route.

| **Residual Impact on Unknown Cultural and Archaeological Heritage during the Pre-construction and Construction Phases** | |
|---|---|
| Intensity: Medium | Importance: Moderate |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: Moderate | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Potential disturbance or destruction of archaeological sites and objects;
- Potential destruction of physical cultural resources within the Mwela Rock Art site.

### SOURCE OF IMPACT

- Transportation and circulation;
- Maintenance and repairs.

### MITIGATION MEASURES

Mitigation measures for minimizing impacts on cultural and archeological heritage in the operation phase are identified in the ESMP's Chapter 3; however, key mitigation measures are as follows:

- Formulation of a Transport Management Plan and Cultural Heritage Resources Awareness Training and Visitor Induction;
- Conduct all works within the Mwela Rock Art site with an archeologist from the NHCC.

### DETAILED IMPACT DESCRIPTION

During the operation phase, the transmission line will cohabit with physical cultural resources identified within the wayleave, particularly within the Mwela Rock Art site. Maintenance of the line, vegetation clearing within the wayleave as well as vehicle circulation within the site could lead to the destruction or impairment of cultural heritage components. A dedicated Transport Management Plan and strict work procedures within the site should be developed and implemented.

### IMPACT ASSESSMENT

The intensity of the residual impact is considered low since maintenance work will be required sporadically. The extent of the impact on land use is limited since it will only occur in given area of the Mwela Rock Art site. The impact duration is considered long since maintenance works will be required over the entire Project lifetime. The residual impact on Cultural and Archaeological Heritage during the operation phase is thus considered of minor importance. The probability of occurrence of the impact is medium.

| **Residual Impact on Cultural and Archaeological Heritage during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: Medium | |

## DECOMMISSIONING PHASES

### POTENTIAL IMPACTS

- Potential disturbance or destruction of archaeological sites and objects;
- Potential destruction of physical cultural resources within the Mwela Rock Art site.

### SOURCES OF IMPACT

- Site preparation;
- Decommissioning activities.

### MITIGATION MEASURES

Mitigation measures aimed at reducing impacts on land use are outlined in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

Site preparation and decommissioning activities may result in impacts on cultural heritage within the ROW and on access roads, particularly in the Mwela Rock Art Site. Machinery can partially damage archaeological sites or artifacts. The presence of a NHCC archaeologist will be mandatory within the Mwela Rock Art site during the decommissioning works. Should any archaeological or historic remnants be encountered, works will immediately stop along that section, and the proper authorities will be informed. A dedicated Transport Management Plan and strict work procedures within the site should be developed and implemented. The removal of the infrastructure will however restore the natural landscape of the site.

### IMPACT ASSESSMENT

The intensity of the residual impact on land use is medium because after decommissioning, it is assumed that prior agricultural land use will be permitted to continue. The extent of the impact on land use is local since land use will mainly be altered within the ROW and along access roads. The impact duration is considered medium since impacts on land use will be limited to the decommissioning phase. The residual impact on land use during the decommissioning phase is thus considered of moderate importance. The probability of occurrence is high since the land used will certainly be altered in the ROW.

| **Residual Impact on Cultural and Archaeological Heritage during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Limited | |
| Duration: Long | |
| Probability of occurrence: Medium | |

## 6.2.4.8 LANDSCAPE

### PRE-CONSTRUCTION AND CONSTRUCTION PHASES

### POTENTIAL IMPACT

– Permanent degradation of landscape through wayleave clearing.

### SOURCES OF IMPACT

– Site preparation;

– Construction activities.

### MITIGATION MEASURES

To reduce impacts on landscape, existing access roads will be used as much as possible. Temporary access roads and work areas will also be restored upon completion. Mitigation measures aimed at reducing impacts on landscape are further detailed in Chapter 3 of the ESMP.

### DETAILED IMPACT DESCRIPTION

Aesthetic impacts during the construction phase will be limited to the work areas. Deforestation of the ROW will alter the landscape. Moreover, to minimize the impacts of construction activities on the landscape, existing access roads will be used as much as possible. Finally, all temporary access roads and work areas will be restored upon completion.

Natural landscape units, particularly when the line route crosses forest reserve, are more likely to be affected by construction activities as they are not as disturbed as anthropic landscapes. Also, the line route crosses the Mwela Rock Art site. In terms of the actual loss of biomass, it is expected that 1.5 kilometers out of a total of 2.8 kilometers of land, translating into 12.75 Hectares, will be seriously impacted, thereby affecting the landscape at that magnitude. The other part is basically made up of natural rock outcrops, which will also be compromised over a distance of 1.3 kilometers. This implies that 11 Ha of the rocky areas will be affected. The proposed power corridor will likely take up the Projected area of slightly more than 23 Hectares inside the National Monument.

There will be a permanent loss of land from heritage conservation and potential tourism development, considering that this whole area is meant for tourism trails and sustainable tourism development.

### MITIGATION MEASURES SHOULD BE IMPLEMENTED TO INCLUDE THIS INFRASTRUCTURE IN ITS ENVIRONMENT PROPERLY. IMPACT ASSESSMENT

The application of the proposed mitigation measures limits the intensity of the residual impact on the landscape during the pre-construction and construction phases to low. The extent of the impact is regional, as it will be felt along the wayleave and access roads over 600 km. The impact duration is medium, as it will be felt continuously over a period equivalent to the construction phase.

The importance of the residual impact on the landscape during the pre-construction and construction phases is thus considered moderate. The probability of the occurrence of this impact is high because the landscape will certainly be disrupted at the worksites and potentially at scenic areas.

| **Residual Impact on Landscape during the Pre-construction and Construction Phases** | |
|---|---|
| Intensity: Low | Importance: Moderate |
| Extent: Regional | |
| Duration: Medium | |
| Probability of occurrence: High | |

## OPERATION PHASE

### POTENTIAL IMPACTS

- Permanent alteration to the landscape;
- Potential degradation of sensitive scenic areas, including the Mwela Rock Art site and forest reserves.

### SOURCE OF IMPACT

- Presence of lines, substations, and access roads.

### MITIGATION MEASURES

To reduce the visual impact, visual barriers (trees and shrubs) will be installed, where possible, to reduce the line's visibility. Finally, existing access roads will be used as much as possible during maintenance activities to avoid new landscape disturbance. Relevant mitigation measures aimed at reducing impacts on the landscape are further detailed in Chapter 3 of the ESMP. Some mitigation measures are specific to the protection of the Mwela Rock Art site and are recommendations from the NHCC:

- The transmission structures should be designed with a relatively narrow profile that minimizes the amount of vegetation clearing that is required within the proposed power transmission corridor.
- Monopole structures should be encouraged in case the transmission lines are allowed to pass through or near the monument area since they have a thinner profile and a simpler presence than lattice structures.
- Maintain and/or restore vegetation at road crossings, with due respect to the underlying landowner's authority, to minimize or screen the view-down transmission corridors and concentrate or limit viewer attention in the immediate foreground. Note that the vegetation specified in the vicinity of the transmission line must be non-capable, implying that it should not be able to grow to a height that would interfere with the conductors of electricity.
- Ensure that riparian vegetation is maintained and/or restored at stream crossings, subject to underlying landowner permission to restore cleared areas with naturalistic landscaping. Riparian vegetation (Mushitu) also has to be non-capable.

## DETAILED IMPACT DESCRIPTION

The overall aesthetic effect of a transmission line is likely to be negative to most people, especially where proposed lines would cross natural landscapes, including mature woodlands within the crossed forest reserves. The tall steel structures may seem out of proportion and incompatible with agricultural landscapes, vast plains, or luxuriant hills. Substations will generally have a more subtle impact on the landscape as they will blend better with the urban or peri-urban areas in which they will be installed.

Research and experience show that reactions to the aesthetics of the transmission lines vary. Some residents do not notice them or find them objectionable from an aesthetic perspective. To some, the power transmission lines or other utilities may be viewed as part of the infrastructure necessary to sustain everyday lives and activities and are, therefore, acceptable. To others, new transmission lines may be viewed positively as they are associated with economic development. During the community and household consultations, the aesthetic impact of the Project was not mentioned, which indicates that it is not a major concern for the impacted populations.

A landscape and visual impact assessment was conducted by the NHCC to assess impacts associated with the ZTIP on the Mwela Rock Art site (NHCC, nd). Impacts on various receptors were assessed. It was underlined that considering the landscape character of Mwela Rock Art Site is distinguished and recognized by a pattern of elements that occurs consistently here and considering its heritage protection status; it is perceived by people that it should have a high degree of wilderness value by continuing to reflect particular combinations of geology (quartzite outcrops), landform, soils, vegetation, land use and human settlement. Thus, it is expected that this will continue to create a particular sense of place in different landscape areas (GLVIA, 2002).

Thus, the removal of natural components and addition to any of these would be tantamount to compromising the integrity of the landscape. This is further strengthened by the fact that the landscape in question is not just a mere heritage site but one which is declared a National Monument for the purpose of protecting the rich rock art embedded on various rock outcrops. This is the largest concentration of rock art in Zambia and probably in the Southern Part of Africa hence Zambia's quest to wanting to nominate it as a UNESCO World Heritage Site.

## IMPACT ASSESSMENT

The application of the proposed mitigation measures limits the residual impact on the landscape during the operation phase to a low intensity. The extent of the impact is regional, as the impact will be felt along the entire length of the transmission line. The impact duration is long as it will be felt continuously for the lifetime of the transmission line. The importance of the residual impact on the landscape during the operation phase is thus considered moderate. The probability of the occurrence of this impact is high because the landscape will certainly be disrupted and, potentially at scenic areas.

| **Residual Impact on Landscape during the Operation Phase** | |
|---|---|
| Intensity: Low | Importance: Moderate |
| Extent: Regional | |
| Duration: Long | |
| Probability of occurrence: High | |

# DECOMMISSIONING PHASE

## POTENTIAL IMPACT

- Temporary degradation of landscape at worksite.

## SOURCES OF IMPACT

- Site preparation;
- Decommissioning activities.

### MITIGATION MEASURES

Relevant mitigation measures are listed in the ESMP's Chapter 3.

### DETAILED IMPACT DESCRIPTION

Aesthetic impacts during the decommissioning phase will be limited to the work areas. Vegetation clearing within the ROW and access roads will alter the landscape. To reduce impacts of decommissioning on the landscape, existing access roads will be used as much as possible. Furthermore, the ROW and temporary access roads and work areas will be recontoured and vegetated using local seed mixes following decommissioning activities. Landscape will be changed with the removal of the infrastructure and the remediation of the area.

### IMPACT ASSESSMENT

Following the implementation of mitigation measures, the intensity of the residual impact on the landscape during the decommissioning phase is low. The extent of the impact is local, as the impact will only be felt along the ROW and access roads. The impact duration is medium as it will be felt continuously during the decommissioning phase. The importance of the residual impact on the landscape during the decommissioning phase is thus considered minor. The probability of the occurrence of this impact is high because the landscape will certainly be disrupted at the worksites and potentially at scenic areas.

| **Residual Impact on Landscape during the Decommissioning Phase** | |
|---|---|
| Intensity: Low | Importance: Minor |
| Extent: Local | |
| Duration: Medium | |
| Probability of occurrence: High | |

## 6.2.4.9 SAFETY AND PUBLIC HEALTH

The risk to safety and public health is considered the same for pre-construction, construction, and decommissioning. As such, they are discussed together in the following section.

### PRE-CONSTRUCTION AND CONSTRUCTION PHASE AND DECOMMISSIONING PHASE

### POTENTIAL RISKS

- Risks of increased incidences of STDs and HIV/AIDS;
- Risks of sexual abuse by workers and especially child abuse;
- Risks of abuse by Contractors hiring underage workers (child labor);
- Accidents and physical injuries involving workers or residents;
- Risks of accidents when trucks use community roads;
- Increased stress related to nuisances (noise, dust, and air pollution).

### SOURCES OF RISK

- Site preparation;
- Construction and decommissioning activities;
- Waste and hazardous materials management;

- Transportation and circulation;
- Presence of workers.

## MITIGATION MEASURES

Various mitigation measures should be implemented to protect the health and safety of the surrounding communities. These measures include:

A detailed Communities Health and Safety Management should be developed and implemented by the Contractor.

A STI and HIV/AIDS prevention program for both communities and workers should be developed and implemented.

To prevent accidents, the Contractor shall secure equipment and demarcate excavations when construction is not in progress, such as with temporary fences. Non-authorized persons will also be kept away from any construction sites. In addition, warning signs will be posted for public safety.

The Contractor will develop appropriate strategies to manage the transportation of supplies and ensure compliance with all applicable laws and regulations, such as maximum load restrictions and speed limits. These measures will reduce the risk of accidents due to project-related traffic.

As outlined in section 6.2.4.4, the bidding document and contract for construction (or decommissioning) Contractors shall reflect the new requirements of the World Bank as highlighted in the document "Summary of Environmental, Social, Health and Safety (ESHS) Enhancements Standard Procurement Documents (SPDs) & Standard Bidding Documents (SBDs)". Other relevant mitigation measures are listed in Chapter 3 of the ESMP; some are also presented in the GBV section.

## DETAILED RISK DESCRIPTION

The influx of migrant workers may cause significant health and safety impacts on local communities. First and foremost, interactions between workers and female community members increase intimacy, possible sexual relations, and the risk of communicable disease transmissions such as HIV/AIDS and other STBBI. A number of work and lifestyle factors expose construction workers to the risk of HIV infection (ILO, 2008):

- High mobility, resulting in long periods spent away from home and family, or contact with highly mobile workers.
- Isolation and working in confined environments with limited contacts.
- Demographic factors – a majority are young adults or sexually active age groups.
- Male-dominated profession and a predominantly masculine environment, with cultivation of a "macho culture" including openness to occasional sexual relations.
- Access to and ready availability of sex workers.
- Receiving cash wages, with no safe storage for money.
- Stress due to working and living conditions.
- Misinformation or lack of information about HIV/AIDS.

Worker camps should be located away from towns and villages to prevent this impact. Implementing different management plans with adequate training will also contribute to reducing anticipated impacts, including the Community Health and Safety Management Plan, the Code of Conduct, and the Occupational Hygiene, Health, and Safety Plan.

Close interactions between workers and communities may also result in cases where some workers commit acts of sexual abuse and/or have sexual intercourse with underage community members. Such serious offence should be strictly forbidden and, in case of violation, determined actions should be automatic.

Also, during Project construction, the population of the Project area may increase temporarily, increasing the pressure on local health systems. It will thus be important to ensure the presence of an adequately equipped nurse at the worker camps to reduce the demand for local health services.

Accidents are likely to happen during construction work. In fact, construction sites pose potential hazards to nearby communities because they may raise curiosity, especially among children. In order to prevent any accidents, a Community Health and Safety Management Plan shall be implemented. The contractor will secure equipment and demarcate any excavation area when construction is not in progress, such as with temporary fences. Non-authorized persons will also be kept away from any construction sites. In addition, warning signs will be posted for public safety. Finally, educational programs in schools and communities could be implemented to educate people about the dangers and safe practices when playing or working near a high-voltage transmission line.

Increased traffic in the villages could cause accidents. The contractor will have to develop appropriate strategies to manage the transportation of supplies and workers and ensure compliance with all applicable laws and regulations, such as maximum load restrictions and speed limits. These measures will minimise the risk of accidents due to Project-related traffic.

An awareness program for truck drivers to speed limits and other precautionary measures will be implemented. Sign indications (inhabited areas, schools, pedestrian crossings, etc.) and speed limits will be in place where appropriate. Community awareness programs will include all risks, including road accidents.

Regarding quality of life, noise, dust, and air pollution generated during construction works will create disturbances in generally calm rural areas. In addition, some communities may be nervous about the presence of foreign workers and or feel uncertain concerning the electrification of their community. However, the application of appropriate mitigation measures, such as awareness programs and the conduction of work during normal working hours, will reduce these inconveniences to the local population. The CCF will also allow for support beyond compensation for the disadvantages or losses of affected communities. It will include measures to improve communities' quality of life conditions and contribute to local development. For example, it can be used to participate in rural areas' electrification for agricultural product processing or provide socio-community infrastructure. Some requests were made by the affected population during public consultations (see chapter 6).

Additionally, this Project may create an "induced development" effect, i.e., an influx of population in the area, usually people looking for employment opportunities, which can increase the pressure on public services. This risk is low due to the moving nature of the construction site.

### IMPACT ASSESSMENT

Since safety and public health events are a risk rather than an impact, assessing them is impossible. However, safety and public health events could be considered as being of major significance depending on the event's severity.

The adoption of adequate risk assessments, prevention measures, and awareness programs should greatly reduce the risk to safety and public health.

## OPERATION PHASE

### POTENTIAL IMPACTS

- Risks of electrocution caused by equipment breakdowns, illegal connections, steel thefts, and all other forms of unsafe contacts;
- Accidents and physical injuries involving workers or residents;

- Increased stress related to nuisances;
- Risks of accidents due to Project related traffic;
- Risks of collision with low-flying aircrafts.

## SOURCES OF IMPACT

- Waste and hazardous materials management;
- Transportation and circulation;
- Presence of lines, substations, and access roads.

## MITIGATION MEASURES

Relevant mitigation measures are listed in the ESMP's Chapter 3; however, key mitigation measures include the following:

- Consistent application of a formal and documented risk assessment process conducted by a competent and experienced team of professionals at the planning stage of the operation activities to embed occupational health & safety considerations in the decision process;
- An audit and inspection program tailored to the risks specific to operations;
- Development and implementation of an Emergency Measures Plan.

## DETAILED IMPACT DESCRIPTION

The presence of electric powerlines constitutes potential safety risks for the population living nearby, either from equipment failure and breakdowns, illegal connections, steel thefts or other sort of unsafe contact that may result in electrical or physical hazards. Indirect electrocution can result from cranes, ladders, tools, vehicles or other devices and equipment being touching or being too close to energized components.

Equipment failures and breakdowns resulting from infrastructure degradation, defects in manufacturing, or adverse weather can constitute a serious safety hazard for communities, as downed electrical conductors can energize the ground or other nearby objects.

However, towers are designed according to the best practices and applicable norms and standards. The land use restrictions within the ROW will prevent contact with the energized conductors and minimize risks to public safety in the event of a tower collapse.

Health problems related to the exposure to electromagnetic fields (EMF) are often raised by local communities when a new transmission line is proposed. According to research activities on EMF, there is no strong association between EMF associated with powerlines and long-term health effects (WHO, 2016). However, fear of exposure to EMF can cause increased stress.

Project infrastructure will be designed to comply with the International Commission on Non-Ionising Radiation Protection (ICNIRP) guidelines for public and workers exposure to EMF.

The presence of the powerline can also cause potential risk on aircraft safety directly through collision or indirectly through radar interference. Markers in dedicated areas will reduce such risks.

## IMPACT ASSESSMENT

Since safety and public health events are a risk rather than an impact, they are impossible to assess. Safety and public health events could, however, be considered as being of major significance depending on the severity of the event.

The adoption of adequate risk assessments, prevention measures, and awareness programs should greatly reduce the risks to safety and public health.

#### 6.2.4.10 OCCUPATIONAL HEALTH & SAFETY

The workforce will be exposed to occupational health and safety risks at all stages of the Project. As outlined in Chapter 3 of the ESMP, these risks can be reduced by developing and implementing an Occupational Health, Safety and Security Management Plan. The purpose of the Occupational Health, Safety and Security Management Plan is to manage health and safety risks and to encourage compliance with established labour and workplace standards. The Occupational Health, Safety and Security Management Plan will outline health and safety practices, procedures and policies, including training requirements.

One of the key elements included in the Occupational Health, Safety and Security Management Plan is the risk assessment process, which is one of the key levers to preventively address occupational health and safety risks whilst being consistently applied and documented. It should be conducted by a competent and experienced team of professionals at the start of each of the Project's phases, from pre-construction to decommissioning.

Accountability will be clearly defined for all levels of management involved in the Project based on documented roles and responsibilities. As each of the Project phases progresses, risks should be reassessed to ensure new risks are not introduced without adequate control measures.

At the start of each phase, a specific risk assessment should be conducted by a professional and reviewed with all stakeholders, including all levels of Project management, from field Supervisors to Project Executives. The risk assessments to be completed at each Project phase are summarized as follows:

- Construction: conduct a formal on-site risk assessment to document and identify all critical risks as well as risks specific to the Project;
  - High-risk activities, such as commissioning and testing activities, shall be covered by a specific risk assessment.
- Operations: conduct a formal on-site risk assessment to document and identify all critical risks as well as risks specific to the Project;
  - High-risk activities, such as maintenance, troubleshooting, emergency repairs (i.e., possibility of live electricity), etc., shall be covered by a specific risk assessment.
- Decommissioning: conduct a formal on-site risk assessment to document and identify all critical risks as well as risks specific to the Project.

More specifically, the objective of a documented risk assessment process is to define proper control measures that would enable elimination or management of residual risks while objectively:

- identifying hazards;
- assessing the probability of each hazard and its consequences.

Control measures of residual risks should follow the ALARA principle (e.g., reduce risks "As Low as Reasonably Achievable"). Therefore, elimination of risks should always be considered first, and when elimination at the source is not reasonably achievable, defining control measures to reduce risks through various control measures should then be defined. These measures could be grouped into one of the following two main categories:

- Engineering controls, either to isolate risks or substitute equipment or products that may reduce the risks;
- Administrative controls ranging from personal protective equipment, communication, limiting exposure, procedures, etc.

Maintenance of this process is intertwined with other key processes of the Occupational Health, Safety and Security Management Plan, thus enabling the Project team to consistently address these risks, including the development and implementation of:

1. audit and inspection programs;
2. accident investigation program combined with a monitoring and reporting system of accidents, incidents, near miss incidents, and corrective/preventive measures;
3. training program.

Although not considered an exhaustive list, a combination of the following critical risks could be present at various stages of similar Projects:

- Excavation;
- Traffic management;
- Safeguarding of machinery;
- Electrical safety, including Arc Flash;
- Material handling;
- Fall control (working at heights);
- Industrial hygiene (occupational health), e.g., dust, contaminants, and noise levels;
- Confined spaces;
- Chemical (usage, handling, storage, and disposal);
- Hot work;
- Working in remote areas (limited communication and access);
- Specific environmental risks such as fauna.

In the following sub-sections, more specific information regarding occupational health and safety risks at different Project stages is provided.

## CONSTRUCTION PHASE

### POTENTIAL RISKS AND SPECIFIC RISKS

- Risk of non-adherence to labour standards;
- Deterioration of the well-being of construction workers and of any other category of workers/employees that may be exposed to occupational health & safety risks during construction (e.g., authorities visiting the site, engineers visiting the site, management visiting the site, or supervising the construction, etc.);
- Work-related injury, health effects, or death;
- Whilst not considered an exhaustive list, the following specific risks need to be addressed through the risk assessment process before the construction phase begins:
  - Risks specific to commissioning and testing activities, especially electrical safety (including Arc Flash) and lock out/tag out;
  - Suitability and availability of tools and equipment available for teams traveling to remote locations, including insulated tools, ladders, moveable fences, personal protective equipment, first aid kits, etc.;

- Risks related to difficulty maintaining continuous communication with teams in the field.

- Emergency measures, including protocol to follow in the event of a severe accident requiring medical evacuation from remote areas.

## SOURCES OF RISK AND MITIGATION MEASURES

A formal and documented risk assessment process will be followed to identify potential sources of risk. The risk assessment process will be conducted by a competent and experienced team of professionals at the planning stage of the construction activities to allow occupational health & safety considerations to be considered in the decision-making process.

The risk assessment methodology shall be based on the ALARA principle. In the construction context, this will include controlling site access and egress.

Risks should be reassessed throughout the construction phase to ensure that new risks are not introduced without being adequately controlled.

This process will be supported by:

- an audit and inspection program tailored to the risks specific to construction sites, including risks specific to the current Project;

- investigation of all accidents, incidents, injuries, or near misses reported and while formally monitoring the implementation and communication of control and/or preventive measures;

- provision of training specific to the construction site to the workforce as well as any employee, Contractor, Subcontractors, or visitor accessing the construction site. Training specific to the construction site shall be provided before being allowed access to the site.

- Contractor to develop and implement an Occupational Health and Safety Management Plan

## DETAILED RISK DESCRIPTION

The most common causes of accidents on construction sites related to a combination of risks and behaviours leading to a wide range of consequences for the workforce and the people accessing the construction site and include but are not limited to:

- Electrical safety (including Arc Flash), lock out/tag out procedure, and device issues leading to electrocution or burns if not properly defined or applied;

- Traffic management and moving equipment issues leading to fatal accidents, especially where heavy machinery is operated while having pedestrians are working in the same environment;

- Safeguarding of machinery issues leading to contusions or amputations;

- Working at height issues leading to falls of varying consequences (e.g., contusion, fracture, severe multiple injuries, and death) or injuries from being struck by falling objects;

- Excavation work issues leading to crush injuries;

- Weather condition issues altering the work surfaces, leading to slips and trips or influencing the strenuousness of the activities being conducted (humidex, sun, etc.);

- Constrained position issues leading to strains and musculoskeletal injuries;

- Confined space issues leading to respiratory problems or illnesses;

- Hot work or chemical product issues leading to burns, occupational injuries, eye injuries, respiratory problems, or illnesses;

- Working around or in water issues leading to drowning;
- Working in wild areas issues leading to encounters with dangerous fauna.

In the event of an accident or illness, access to medical facilities is crucial. Section 5.3 of the ESIA provides details regarding the number of health facilities per province for districts that intersect the study area. Furthermore, first aid kits and first responders should be readily accessible and available on site, whether at defined locations, in vehicles, or through radio communication.

Providing good working conditions including reasonable working hours, wages and other good working practices should be adopted.

The construction workforce will be housed in temporary work camps. Poor conditions at worker camps can impact the workers' health and well-being. For example, poor or limited access to clean drinking water or sanitation facilities can lead to illness. Temporary housing for workers should provide adequate lighting, services such as air conditioning, plumbing, and sanitation facilities, and safety features such as fire exits, extinguishers, and suppression systems. Company policies (i.e., retrenchment policies) and terms of employment should be clearly defined before beginning work.

It is also recommended that all workers have written contracts to ensure they are included in the Contractors' health and safety program.

### IMPACT ASSESSMENT

Since occupational health and safety events are risks rather than impacts, they are impossible to assess. Depending on their severity, however, they could be considered of major significance.

As outlined in section 6.2.4.4, the bidding document and contract for construction Contractors shall reflect the requirements of the World Bank as highlighted in the document "Summary of Environmental, Social, Health and Safety (ESHS) Enhancements Standard Procurement Documents (SPDs) & Standard Bidding Documents (SBDs)". The adoption of adequate risk assessments, prevention measures, and awareness programs should greatly reduce the risk of occupational health and safety.

## OPERATION PHASE

### POTENTIAL RISKS AND SPECIFIC RISKS

- Risks of non-adherence to labour standards;
- Deterioration of the well-being of workers and of any other category of workers or employees that may be exposed to occupational health & safety risks during the operation phase (e.g., authorities visiting the site, engineers visiting the site, management visiting the site, etc.);
- Work-related injury, health effects, or death;
- Whilst not considered an exhaustive list, the following specific risks need to be addressed through the risk assessment process before the operation phase begins:
    - Risks specific to maintenance activities, especially electrical safety (including Arc Flash) and lock out/tag out for remote facilities such as substations:
        - Investigate if "troubleshooting" activities where workers might have to work on live electricity is required;
        - Investigate if teams have the proper tools and equipment as they may travel to remote locations, including insulated tools, ladders, personal protective equipment, first aid kits, etc.
    - Risks associated with SF6 leakage from circuit breakers;

- Risks related to difficulty maintaining continuous communication with teams conducting field inspections or conducting emergency field work or repairs;
- Process to communicate engineering changes to the maintenance team and all involved Contractors or Subcontractors;
- Emergency measures, including protocols to follow in the event of a severe accident or event, such as fires (including at substations), major soil erosion events, seismic activity, or where medical evacuation from remote areas would be required.

## SOURCES OF RISK AND MITIGATION MEASURES

A formal and documented risk assessment process will be followed to identify potential sources of risk. A competent and experienced team of professionals will conduct the risk assessment process at the planning stage of the operation activities to allow occupational health & safety considerations to be embedded in the decision-making process.

The risk assessment methodology shall be based on the ALARA principle. In the context of operation, this will include controlling site access and egress while being embedded in site security protocols.

Over the course of the operation phase, risks should be reassessed to ensure that new risks are not introduced without being adequately controlled. This process will be supported by:

- An audit and inspection program tailored to the risks specific to the Project site, including risks specific to the current Project;
- Investigation of all accidents, incidents, injuries, or near misses reported and while formally monitoring the implementation and communication of control and/or preventive measures;
- Provision of training specific to the Project site to the workforce as well as any employee, Contractor, Subcontractors, or visitors accessing the site. Training specific to the Project site shall be provided before access to the site is allowed.
- Development and implementation of an Occupational Health and Safety Management Plan.

## DETAILED RISK DESCRIPTION

The most common causes of accidents during the operation of transmission lines relate to a combination of risks and behaviours leading to a wide range of consequences for the workforce and the people accessing the site, and include but are not limited to:

- Electrical safety (including Arc Flash), lock out/tag out procedure, and device issues leading to electrocution or burns if not properly defined or applied;
- Traffic management and moving equipment issues leading to fatal accidents especially where heavy machinery is operated while having pedestrians working in the same environment;
- Safeguarding of machinery issues leading to contusions or amputations;
- Working at height issues leading to falls of varying consequences (e.g., contusions, fractures, severe multiple injuries, and death) or injuries from being struck by falling objects;
- Weather condition issues altering the work surfaces leading to slips and trips or influencing the strenuousness of the activities being conducted (humidex, sun, etc.);
- Constrained position issues leading to strains and musculoskeletal injuries;
- Confined space issues leading to respiratory problems or illnesses;

- Hot work or chemical product issues leading to burns, occupational injuries, eye injuries, respiratory problems, or illnesses;
- Working around or in water issues leading to drowning;
- Working in wild area issues leading to encounters with dangerous fauna.

In the event of an accident, injury or illness, access to medical facilities is crucial. Section 5.3 of the ESIA provides details regarding the number of health facilities per province for districts that intersect the study area. Furthermore, first aid kits and first responders should be readily accessible and available on site, whether at defined locations, in vehicles, or through radio communication.

Providing good working conditions including reasonable working hours, wages, and other good working practices should be adopted.

### IMPACT ASSESSMENT

Since occupational health and safety events are a risk rather than an impact, they are impossible to assess. Occupational health and safety events could, however, be considered as being of major significance depending on the severity of the event.

The adoption of adequate risk assessments, prevention measures, and awareness programs should greatly reduce the risk to occupational health and safety.

## DECOMMISSIONING PHASE

### POTENTIAL IMPACTS AND SPECIFIC RISKS

- Risks of non-adherence to labour standards;
- Deterioration of the well-being of decommissioning workers and of any other category of workers or employees that may be exposed to occupational health & safety risks during decommissioning activities (e.g., authorities visiting the site, engineers visiting the site, management visiting the site, etc.);
- Work-related injury, health effects, or death;
- Whilst not considered an exhaustive list, the following specific risks need to be addressed through the risk assessment process before the decommissioning phase begins:
  - Risks specific to dismantling activities, including electrical safety and lock out tag out for remote facilities such as substations;
  - Means of maintaining continuous communication with the field teams;
  - Emergency measures, including protocols in events of a severe accident where medical evacuation from a remote area would be required.

### SOURCES OF IMPACT AND MITIGATION MEASURES

A formal and documented risk assessment process will be followed to identify potential sources of impact. The risk assessment process will be conducted by a competent and experienced team of professionals at the planning stage of the operation activities to allow occupational health & safety considerations to be embedded in the decision-making process.

The risk assessment methodology shall be based on the ALARA principal. In the context of operation, this will include controlling site access and egress while being embedded in site security protocols.

Over the course of the operation phase risks should be reassessed to ensure new risks are not introduced without being adequately controlled. This process will be supported by:

- An audit and inspection program tailored to the risks specific to decommissioning activities, including but not limited to risks specific to substations, maintenance employees, and any other critical risks that apply to the various work environments and categories of activities required to decommission a transmission line;
- Investigation of all accidents, incidents, injuries, or near misses reported, and while formally monitoring the implementation and communication of control and/or preventive measures;
- Provision of training specific to decommissioning activities to be provided to the workforce as well as any employee, Contractor, Subcontractor or visitor accessing the site. Training specific to the various work environments and categories of activities required to decommission a transmission line.

## DETAILED IMPACT DESCRIPTION

The most common causes of accidents while decommissioning a transmission line relate to a combination of risks and behaviours leading to a wide range of consequences for the workforce and the people accessing the site, and include but are not limited to:

- Lock out/tag out procedure and device issues leading to electrocution or burns if not properly defined or applied;
- Traffic management and moving equipment issues leading to fatal accidents, especially where heavy machinery is operated while having pedestrians working in the same environment;
- Safeguarding of machinery issues leading to contusions or amputations;
- Working at height issues leading to falls of varying consequences (e.g., contusions, fractures, severe multiple injuries, and death) or injuries from being struck by falling objects;
- Excavation work issues leading to crush injuries;
- Weather condition issues altering the work surfaces, leading to slips and trips or influencing the strenuousness of the activities being conducted (humidex, sun, etc.);
- Constrained position issues leading to strains and musculoskeletal injuries;
- Confined space issues leading to respiratory problems or illness;
- Hot work or chemical product issues leading to burns, occupational injuries, eye injuries, respiratory problems, or illness;
- Working around or in water issues leading to drowning;
- Working in wild areas issues leading to encounters with dangerous fauna.

Access to medical facilities is crucial in the event of an accident, injury, or illness. Section 5.3 of the ESIA provides details regarding the number of health facilities per province for districts that intersect the study area. Furthermore, first aid kits and first responders should be readily accessible and available on site, whether at defined locations, in vehicles, or through radio communication.

Providing good working conditions, including reasonable working hours, wages, and other good working practices, should be adopted.

## IMPACT ASSESSMENT

Since occupational health and safety events are risks rather than impacts, they are impossible to assess. Depending on their severity, however, they could be considered of major significance.

The adoption of adequate risk assessments, prevention measures, and awareness programs should greatly reduce the risk to occupational health and safety.

### 6.2.5 TRANSBOUNDARY IMPACTS

Impacts on migratory birds qualify as transboundary impacts, considering that Project-induced mortality in migrant species would influence migratory bird populations in other countries crossed by those same birds.

The ESMP provides mitigation measures to reduce the transboundary impacts of bird mortality from collisions with the transmission line, including installing bird diverters in areas where collisions with large-bodied, low-flying birds are more likely (e.g., near wetlands and ridges). The significance of the impact on residents and migrant birds has been assessed as moderate.

Nevertheless, some uncertainty remains regarding the effectiveness of the proposed mitigation. Consequently, the effectiveness of proposed mitigation measures will need to be assessed via a bird mortality monitoring program during the operation phase.

## 6.3 CUMULATIVE IMPACTS

Cumulative effects are 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.

To facilitate consideration of cumulative impacts, 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 VESCs when combined with activities of other past, present, or future Projects;
- The baseline description of the VESCs (Chapter 5) should include past environmental issues;
- The Projects expected to be susceptible to interaction with the impacts of the main Project should be known.

It is, therefore, appropriate to list the environmental effects that can be combined with the project's impacts, resulting in cumulative impacts, based on available information or logical assumptions made by professional judgment.

The current condition of the VESCs within the study area was presented in the baseline section of the ESIA, Chapter 5. The assessment presented in Chapter 5 outlines environmental conditions before Project implementation, considering past human actions and their environmental impacts. Section 6.2 assesses the likely impacts of the proposed Project on VESCs. The purpose of cumulative impact assessments is to describe the evolution of VESCs in the receiving environment, considering reasonably foreseeable future developments.

The cumulative impact assessment is based on available baseline information and the foreseeable impacts of future Projects. Unless accurate data are available, the environmental effects of Projects other than the main Project are estimated based on the typical effects resulting from similar Projects.

The cumulative impact assessment identifies Projects or other activities located in the Project area that may affect the same VESCs. As with the analysis of direct and indirect impacts presented in the previous sections, the cumulative impact assessment considered study areas that vary by component. For this evaluation, only future Projects that may act cumulatively with the residual and permanent impacts of the main Project were considered. For impacts with short-term or medium-term impact duration, mitigation measures and management plans will be developed and implemented to reduce the impacts. It is believed that the likelihood of cumulative interactions can be effectively reduced or managed for short-term or medium-term impacts if properly implemented. It is, however, important to mention that as the ZTIP has been combined with the ICBC Kasama-Nakonde 330kV line, sharing the same ROW, and also as the ZTIP shares a part of its ROW with the existing Pensulo-Kasama 330kV line, the

cumulative impacts with these Projects are then considerably reduced. Interactions of the other Projects and activities with VESC.

Projects and activities susceptible to generating cumulative impacts include the following:

- Powerline Projects, including existing ones (including Pensulo-Kasama 330kV) and planned lines (including Kabwe-Pensulo 330kV line).
- Road construction and rehabilitation Projects, including
  - Expansion of the highway lanes passing through Kasama Town.
  - Rehabilitation of the Nakonde to Mpika Road that was deteriorating, as well as the Nakonde to Mbala Road.
  - Upgrade of 27 km of township roads to bituminous standards in Nakonde.
  - Upgrading of 200 km all-inclusive gravel roads to bituminous standard in Senga Hill district.
  - Rehabilitation of 231 km all-inclusive feeder Roads to gravel standard in Senga Hill district.
  - Construction of 105 km of internal road network in Mpika District.
  - Rehabilitation of 438.18 km feeder roads to prescribed standards in Mpika District.
  - Rehabilitation of 110 km Mpika-Kasama road to prescribed standards.
  - Upgrading of 30 km township roads to bituminous standards in Mpika District.
  - Construction of an Intercity bus station in P47 area along Kasama-Mbala Road.
  - Rehabilitate a total of 300 km of feeder roads in Nakonde.
  - Construction and rehabilitation of bridges in Mpika District.
- Mining activities, including active mining concessions crossed by the ZTIP and artisanal mining.
  - Farming and agriculture Projects
  - Transportation Projects
- Upgrading of the Kasama Airport.
- Expand the existing airstrip in Nakonde and improve the runway to bituminous standards with modern auxiliary facilities.
- Rail line connection from Kayambi to Mpulungu.
- Construction of 201 km of a railway line from Chozi to Mpunlungu.
- Infrastructure Projects, including
  - Construction of 10 Dams for water supply in Nakonde.
  - Construction of 3 dams in Senga Hill.
  - Establishment of a solar farm on a 100-hectare piece of land within Manyowe Farm.
  - Construction of 30 institutional sanitary facilities.

Cumulative impacts are generated when Projects and activities are likely to have effects on the same VESCs. The following table, therefore, suggests the potential interactions of these Projects or activities with the components affected by the Zambia-Tanzania Power Interconnector Project. The interactions are based on experience in similar Projects. In light of the other Projects identified, some of which will have much more significant environmental impact (i.e., power dams), it is expected that the ZTIP will have reduced cumulative impacts on biophysical and socioeconomic components.

As shown in Table 6-11, it is estimated that ongoing Projects do not result in cumulative impacts on occupational health and safety as risks and impacts on this VESC are specific to each individual Project.

**Table 6-11 Interactions between VESCs affected by the ZTIP and Activities Susceptible of Generating Cumulative Impacts**

| Impact sources | VESCs | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Physical Environment | | | | | Biological Environment | | | | Human Environment | | | | | | | | |
| | Air quality | Greenhouse gases | Noise levels | Soils and agriculture | Water resources | Habitats and flora | Terrestrial fauna | Avifauna | Aquatic and semi-aquatic habitats and fauna | Land planning and use | Infrastructures and public services | Economy, employment, and livelihoods | Communities' quality of life, health, and safety | Occupational health and safety | Community and social cohesion | Gender aspects and vulnerable groups | Cultural heritage | Landscape |
| Mining activities | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | | | ✓· | | ✓· | ✓· | | | | ✓· | |
| Powerlines (Commissioned and underway) | | | | ✓· | | ✓· | | ✓· | | ✓· | ✓· | | ✓· | | | | | ✓· |
| Road and road infrastructure Projects (construction and rehabilitation) | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | | ✓· | ✓· | ✓· | ✓· |
| Infrastructure development Projects | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | | ✓· | ✓· | ✓· | ✓· |
| Farming activities | ✓· | ✓· | | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | | ✓· | | | ✓· | ✓· | ✓· | |
| Transportation | ✓· | | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | ✓· | | ✓· | | | | | | ✓· |

### 6.3.1 CUMULATIVE IMPACTS IDENTIFICATION

Based on the identified Projects, the cumulative impacts likely to be generated are described below.

#### 6.3.1.1 PHYSICAL ENVIRONMENT

Different cumulative impacts may be experienced by the VESC of the physical environment at the study area level. The cumulative impacts to which the Project will contribute will mainly happen during the construction phase. These impacts are mainly of a negative nature:

- Continuous land conversion and significant soil disturbances could lead to changes in air quality due to wind erosion and manipulation of granular material, the emission of carbon that was once buried in the soil or captured by natural vegetation as well as emission coming from vehicles and machinery.
- Various construction activities, including transport activities, could generate noise. This impact will be amplified if the noise sources are active on simultaneous periods in specific locations. The magnitude of the cumulative impact will also depend on the source of the noise generated.
- Changes in land use, excavation, backfilling, and the installation of various infrastructures will alter the soil profiles, generate losses in organic soils and could transform drainage and erosion patterns. These impacts may be exacerbated in areas where infrastructure is most concentrated.
- Spills of hazardous materials on land or water could modify the physicochemical properties of soils and water, leading to subsequent contamination of the environment. These risks could arise in case of mismanagement of hazardous materials as well as waste in the cities and towns along the powerline.
- Surface and groundwater needs for construction and operation activities can affect water availability and quality locally through excessive pumping and poor management of the water. This can also have an effect on ecosystems and local communities.
- Modification of local topography through land grading combined with the installation of water-retaining structures will modify local and regional hydrology.
- Poor management of erosion phenomena and the release into the atmosphere of dust and atmospheric emissions could modify the physicochemical quality of surface waters and soils.

#### 6.3.1.2 BIOLOGICAL ENVIRONMENT

The main cumulative negative impacts on the biological environment resulting from the identified Projects and activities are as follows:

- Different developments, water retention infrastructure (hydropower dam), linear infrastructure and urban expansion will lead to a reduction in the total surface area of natural habitats. Reducing natural habitat areas and their connectivity could lead to the disappearance of the most specialized species. Moreover, population growth could increase pressures on the natural resources in place, limiting the presence of species with higher utility or cultural value and causing progressive habitat loss. Power transmission lines, roads and dams have serious effects on land resources, particularly ligneous resources. The power transmission lines and roads ROW are generally not extensive; they may, however, encroach or fragment natural habitats along them and, for roads, create a barrier effect that is dangerous to cross for many animal species. Dams, by flooding large areas, encroach on natural land areas, which, depending on local topography, can extend within large areas (over flat land areas) or long corridors (along rivers with steep slopes).
- Potential transformation of the physicochemical parameters of the environment (air, soil, and water) will lead to the degradation of the natural habitats in place. These changes will influence the composition of plant and animal communities, with potential proliferation of the most resistant species. The most sensitive or vulnerable species, such as those with special statuses, could be the most affected.

- Loss of natural habitat areas reduces and fragments the habitat of flora and fauna species and could have an even more negative impact on the threatened species identified in the study area. The latter are generally the most sensitive to habitat loss.

- Combined local construction activities or operation activities generating elevated noise levels and vibrations will perturb local fauna and avifauna activities and behaviour and limit the areas favourable for hunting, nesting, etc.

- Many powerlines in the landscape will generate multiple obstacles for the bird communities and could increase the probabilities of bird collisions and associated mortalities.

#### 6.3.1.3 HUMAN ENVIRONMENT

The main cumulative negative impacts on the human environment that result from the identified Projects or activities are the following:

- Implementation of infrastructure inside the territory will transform the current land use. Development activities and the demographic growth contribute to the densification of human presence and to the apparition of new land uses within the study area.

- Displacement of populations in the context of land use change and population growth can lead to conflicts and access issues. Problems associated with resettlement, notably unsolved land issues, were expressed during stakeholder consultations. Consequently, affected communities may already be concerned by Project resettlement aspects. The RAP, including compensation strategy, will need to be discussed with communities for compensation payment prior to the beginning of work.

- Identified Projects and activities will lead to electrification, improvement of transportation, increased access to water, and greater access to jobs and services. These improvements are likely to promote economic development and local population growth. Rapid economic development and population increase could accelerate the change in the lifestyles of the communities that are beneficiaries. There are strong inequalities that can be accentuated in the absence of measures to distribute wealth, improve social mobility, and ensure equal access to new services. These persistent inequalities can lead to high vulnerability to poverty for part of the population and increase the risk of gender-based violence and conflict-affecting community cohesion.

- Supply of electricity to urban centers and the establishment of transport networks increase the attractiveness of urban centers as opposed to rural areas. This phenomenon increases the urban density and land use conflict, especially in peri-urban areas, where the urban area could replace areas devoted to agricultural activities.

- The presence of new infrastructure and equipment near communities that are not accustomed to their presence will represent new health and safety risk for their populations, such as collision with vehicles, electrocution, increase risk of water born diseases, exposure to contaminants, etc.

- The Mwela Rock Art site already faces multiple threats to its integrity, including new residential area (52 ha), Gondwe family claims and associated land use changes (21 ha), illegal cultivation (140 ha) and stone quarry (8.4 ha). The ZTIP will just add on the encroachment within the site.

- The important changes to local and regional physical and natural components brought by the various Projects considered will increase the possibility of affecting cultural heritage components and landscape, thus affecting local traditions and local tourist-related activities.

- The Zambia-Tanzania Power Interconnector Project, together with identified Projects and activities, are also likely to generate the following positive cumulative impacts:

- Job creation will stimulate the local economy.

- Electrification of the area as an indirect impact of the Project. Quality of life of the surrounding populations is likely to improve due to the improvement of public and private services and a more stable electricity supply: better lighting, improved refrigerated storage of food and medicine, electrical machinery for industrial and domestic work, etc.

## 6.4 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

To reduce the negative effects of anticipated impacts, an Environmental and Social Management Plan (ESMP) was developed as a stand-alone document. It proposes an environmental and social management strategy aligned with the mitigation hierarchy. Mitigation measures are proposed in chapter 3 of the ESMP for the pre-construction and construction, operation and decommissioning phases. By applying the mitigation hierarchy to manage anticipated Project impacts, the project reduces its contribution to the various expected negative cumulative impacts.

The ESMP also contains specific management plans, institutional arrangements for its implementation, as well as an environmental and social monitoring program. Additionally, it assesses institutional capacity and identifies training needs to make sure institutions in charge of implementing the ESMP have sufficient organizational capacities.

A schedule and preliminary budget are also presented. Estimated costs for ESMP implementation during the pre-construction and construction phase include a lump sum of 1,412,730 USD as well as yearly costs of 377,500 USD (those yearly costs will be incurred during the expected 12 months of preconstruction as well as 27 months of construction). Estimated costs during the operation phase include a lump sum of 490,000 USD as well as yearly costs of 260,000 USD. The ESMP implementation budget is detailed in Chapter 9 of the ESMP.

# 7 STAKEHOLDER ENGAGEMENT

This chapter outlines the public information and consultation process that has accompanied the completion of the ESIA and RAP studies for the Zambia-Tanzania Interconnector Project-ZTIP as well as ESIA process for the ICBC Kasama-Nakonde 330kV line. Relevant national and international requirements for stakeholder engagement and public disclosure are first briefly described. The main elements of the approach developed to facilitate the informed participation of stakeholders in the development of the studies are described. Finally, the public information and consultation activities conducted at various stages of the Project, stakeholders reached, and the concerns, expectations and recommendations expressed are reported.

## 7.1 NATIONAL AND INTERNATIONAL REQUIREMENTS

Key elements of the national regulations and international requirements relative to stakeholder engagement and relevant for the Project's ESIA and RAP development process are highlighted below.

### *7.1.1 NATIONAL REQUIREMENTS*

EIAR's Regulation 10, on Public Consultations, stipulates that:

- "The developer shall, prior to the submission of the environmental impact statement to the Council, take all measures necessary to seek the views of the people in the community which will be affected by the Project.
- In seeking the views of the community […], the developer shall:
  - publicize the intended Project, its effects and benefits, in the mass media, in a language understood by the community, for a period of not less than fifteen days and subsequently at regular intervals throughout the process;
  - after the expiration of the period of fifteen days […], hold meetings with the affected community in order to present information on the Project and obtain the views of those consulted."

In addition to the above, the Zambian Environmental Management Agency (ZEMA) has produced a guiding document for the preparation of terms of reference for EIA studies ("General Guidance on Preparation of Terms of Reference", undated), which emphasises that stakeholders shall be consulted as part of the scoping exercise and their concerns incorporated into the TORs for the EIA study.

### *7.1.2 INTERNATIONAL REQUIREMENTS*

#### WORLD BANK'S REQUIREMENTS

A few Environmental and Social Standards (ESS) address stakeholder consultation requirements in the WB Environmental and Social Framework (ESF). ESS 1 on Assessment and Management of Environmental and Social Risks and Impacts underlines the importance of engaging and providing sufficient information to stakeholders throughout the life cycle of the Project. This is done in a manner that is appropriate to the nature of their interests and considering the potential environmental and social risks and impacts associated with the Project.

ESS 5 on Land Acquisition, Restrictions on Land Use and Involuntary Resettlement also requires that Borrowers engage with affected communities, including host communities, through a structured process of stakeholder engagement. ESS 10 on Stakeholder Engagement and Information Disclosure specifically addresses stakeholder engagement and states the following requirements:

- A stakeholder engagement process needs to be integrated to the environmental and social assessment during the design and implementation of the Project.
- Development of a Stakeholder Engagement Plan (SEP) proportionate to the nature and scale of the Project and its potential risks and impacts. It should describe the timing and methods of engagement throughout the Project.
- Importance of open and transparent engagement between the Borrower and Project stakeholders to improve environmental and social sustainability of Projects, enhance Project acceptance, and make significant contribution to successful Project design and implementation. As such, consultation activities should be documented and results should be disclosed.

The stakeholder engagement approach followed under the first versions of the ESIA (round 1 to round 5) was aligned with the World Bank's Operational Policy 4.01 on Environmental Assessment, which T, requires that, during the ESIA process, the Project-affected groups and local NGOs are consulted about the environmental aspects of the Project and their views considered. .Under the current ESIA update process (round 7), consultations were undertaken in alignment with ZESCO Stakeholder Engagement Plan and in compliance with WB ESS.

## 7.2 APPROACH FOR STAKEHOLDER ENGAGEMENT

This section outlines the public information and consultation process that has accompanied the completion of the ESIA as well as the previous RAP for the Zambia-Tanzania Interconnector Project.

### 7.2.1 GENERAL OBJECTIVES

General stakeholder engagement objectives for the ZTIP were to:

- Ensure prior and informed consultation of stakeholders at key stages of the ESIA and RAP, to improve results and increase the credibility of the process;
- Enable stakeholders' views to be taken into account in project design and environmental and social management strategies;
- Promote effective, accessible, and inclusive engagement activities with affected stakeholders throughout the project cycle on issues that could affect them;
- Ensure that appropriate project information, including on environmental and social risks and impacts, is disclosed to stakeholders in a timely, understandable, accessible and appropriate manner and format;
- Ensure compliance with national and international requirements, including those stipulated by the World Bank's environmental and social framework and relevant standards, on stakeholder information and consultation during ESIA and RAP studies for major development Projects;
- Ensure that the ESIA helps to consolidate efforts made by ZESCO to establish lasting relationships with affected communities and other stakeholders.

### 7.2.2 TARGET STAKEHOLDER GROUPS

Stakeholder groups that were engaged through the development of the ESIA and RAP studies are briefly described in Table 7-1. A comprehensive list of stakeholder organizations identified in Zambia and extracted from ZESCO's Stakeholder Engagement Plan are presented in Appendix 7-1.

**Table 7-1 Target Stakeholder Groups**

| Stakeholder Groups | Description |
|---|---|
| Concerned ministries and national agencies | ZESCO, ZEMA and the Ministries in charge of Energy, Environment, Agriculture, Lands, Rural Development, Tourism, Gender, Wildlife, Cultural Heritage, Occupational Health and Safety, Labour, among others. |
| International partners | World Bank, financiers of the Project. |
| Government technical services at provincial / regional and district levels | Relevant technical services from the affected provinces / regions (Northern, Muchinga and Central Provinces). |
| Local administrative authorities | Provincial permanent Secretaries, as well as District and Municipal Councils. |
| Customary authorities | Traditional Chiefs are influential in the study area, and more particularly in Zambia where they hold significant power over land issues, in a complex web of Chiefs and sub-Chiefs. |
| Project-affected communities and households | All members of communities affected by the selected corridor for the transmission line, as well as all potentially displaced households. |
| Industrial and commercial stakeholders | Industrial / commercial organizations affected by corridor options and final line route. Includes TAZAMA, TAZARA, large commercial farms and potentially other industrial sites. |
| NGOs at national and regional levels | Relevant NGOs and agencies in conservation, such as Birdwatch International Zambia and the World Wildlife Fund (WWF), social development, and human rights. |
| Mass media and associated interested groups | Local, regional, and national print and broadcast media, digital/web-based entities, and their associations. |

### 7.2.3 CONSULTATION ROUNDS

Engagement activities were planned according to key stages, or decision moments, throughout the various ESIA and RAP processes, including their respective update associated with the various Project changes in design,where the informed participation of stakeholders was likely to make the most significant contribution to the ongoing analysis. Table 7-2 identifies these stages, or “consultation rounds” and presents specific engagement objectives, target groups and implementation periods for each of them. Public consultations and disclosure activities performed, and results achieved, are detailed in Sections 7.4 (scoping phase of the ICBC Kasama-Nakonde 330kV line in 2012 – round 1), 7.5 (for consultation rounds 2, 3, and 4), 7.6 (for consultations round 5), 7.7 (consultations round 6 for the update of the ESIA and RAP reports in 2019), and 7.8 (consultations round 7 for the current ESIA update in 2024).

**Table 7-2 Specific Engagement Objectives and Target Groups According to Study Phases**

| Study Phases | Engagement Objectives | Target Groups | Timeline |
|---|---|---|---|
| Scoping Report phase – ICBC Kasama-Nakonde 330kV<br>Consultations Round 1 | – Inform the communities and the local authorities on the proposed Project and undergoing ESIA.<br>– Provide an opportunity for stakeholders to share their views and concerns relating to the Project.<br>– Identify key concerns and expectations associated with the Project and the ESIA / RAP process. | – Affected Communities.<br>– Local administrative authorities and technical services. | November and December 2012 (Northern Province). |
| Scoping - Consultations Round 2 | – Inform regulatory and administrative authorities of the Project and undergoing ESIA process.<br>– Identify elements of the Project area that could influence the determination of corridor options.<br>– Identify key concerns and expectations associated to the Project and the ESIA / RAP process.<br>– Validate / enhance the list of Project stakeholders.<br>– Gather information of relevance for baseline studies. | – Concerned ministries and government agencies at national level.<br>– Local administrative authorities and technical services.<br>– NGOs. | December 2013 (Tanzanian Border – Kasama).<br>July and August 2014 (Kasama – Pensulo section). |
| Preliminary ESIA / RAP - Consultations Round 3 | – Present corridor options under study and identify potentially associated environmental and social issues.<br>– Involve concerned authorities, technical services and other key stakeholders in the best corridor selection process.<br>– Consult relevant authorities on key elements of the ESIA and RAP frameworks.<br>– Discuss best community engagement approach in view of the upcoming detailed ESIA activities and community surveys.<br>– Gather any information of relevance for the development of environmental and social management plans.<br>– Identify potential partnerships and linkages with other stakeholders in the implementation of management plans. | – Concerned ministries and government agencies at national level.<br>– Local administrative authorities and technical services.<br>– NGOs.<br>– Industrial / commercial stakeholders affected by corridor options. | February and March 2014 (Tanzanian Border – Kasama).<br>September. 2015 (Kasama – Pensulo section). |
| Project Update Meetings - Consultations Round 4 | – Provide authorities and other key stakeholders with up-to-date information regarding the Project and the status of the ESIA and RAP study.<br>– Provide an opportunity for stakeholders to reiterate or update their concerns regarding the Project.<br>– Present upcoming stakeholder engagement activities and validate the proposed communication channels and formats. | – Focus on stakeholders that had remained unaware of the Project's extension to Pensulo and reviewed schedule (i.e. stakeholders on the Mbeya – Zambia border section). | February and March 2015. |
| Draft ESIA-RAP Report - Consultations Round 5 | – Publicize the Project and selected corridor to the public (population of affected districts).<br>– Disclose and validate critical elements of the draft ESIA and RAP reports with stakeholders. | – Affected Communities.<br>– District and provincial authorities and technical services.<br>– Central ministries and NGOs. | June and September 2017. |

| Study Phases | Engagement Objectives | Target Groups | Timeline |
|---|---|---|---|
| Project update and ESIA/RAP data collection meetings - Consultations Round 6 | – Present design changes and identify potentially associated environmental and social issues.<br>– Consult relevant authorities on key elements of the ESIA and RAP frameworks, specifically as they relate to the biological and socioeconomic environments.<br>– Conduct focus group discussions with affected communities and meet with NGOs to discuss gender-based violence and gender issues.<br>– Meet with stakeholders to discuss resettlement, gender-based violence (GBV) and possible means to implement a Grievance Redress Mechanism (GRM).<br>– Meet with additional stakeholders to complete stakeholder mapping.<br>– Rapid social surveys were conducted with a selected sample of 17 villages along the transmission line. Topics included resettlement and GBV. | – Concerned ministries and government agencies at national level.<br>– Local administrative authorities and technical services.<br>– Government technical services at provincial / regional and district levels.<br>– NGOs.<br>– Customary authorities.<br>– Community members. | September and October 2019 (Tanzanian Border – Kasama). |
| Latest Project update and ESIA update<br>Consultation<br>Round 7 | – Inform the local authorities about the new Project alignment and update of the ESIA, ESMP and RAP (Pensulo-Kasama section).<br>– Validate associated environmental and social sensitivities, concerns and expectations.<br>– Collect relevant information for the update, including development plans, ongoing and planned Projects as well as biological and socio-economic data.<br>– Collect specific information about resettlement planning and implementation for the ICBC Kasama-Nakonde 330kV for the RCAP audit.<br>– Discuss and validate specific management measures for forest reserves with the appropriate technical services. | – Local administrative authorities and technical services – district level.<br>– Department of National Parks and Wildlife at national level. | May 2024 (Tanzania Border – Muchinga and Northern Provinces) |

## 7.3 STAKEHOLDER ENGAGEMENT DURING PROJECT PREPARATION, CONSTRUCTION, AND OPERATION

This section presents the objectives, principles, and overall approach to stakeholder engagement. Stakeholder engagement is detailed in a Stakeholder Engagement Plan (SEP) developed by ZESCO (ZESCO, 2024).

A SEP is a communication plan that details how communication with communities, workers, and stakeholders will be conducted throughout the Project lifespan both in terms of information disclosure and communication. It is a dynamic document, to be maintained and adjusted to achieve goals. Since it involves several actors, it is important to design an agreed approach to engagement. An important component of the SEP is the GRM to ensure grievances from communities are recorded and addressed. Experience has shown that a GRM allows for the mitigation of tension and frustration related to Projects and community expectations.

The SEP and GRM objectives are as follow:

- Enhance social acceptability;
- Ensure meaningful and inclusive communication is undertaken throughout the Project life cycle with affected communities, stakeholders, and workers;
- Communicate issues that could potentially affect communities;
- Ensure relevant environmental and social information is disclosed and disseminated;
- Ensure that grievances related to the Project are addressed in a timely manner.

The ESMP further details the operational measures that need to be implemented during Project preparation, operation, and maintenance and includes the following tools:

- The framework of the SEP and its GRM;
- The various responsibilities to implement the SEP and its GRM;
- The required training, capacity building, and sensitization required to ensure long term results.

### *7.3.1 INFORMATION DISCLOSURE*

The stakeholder engagement program also includes information disclosure activities to inform affected stakeholders about the project and, more specifically, on expected environmental and social risks and impacts. ZESCO's SEP (ZESCO, 2024) includes a strategy in terms of information disclosure. It includes making electronic copies of disclosure materials on the ZESCO, World Bank and ZEMA websites, as appropriate. Documents to be disclosed include the Environmental and Social Commitment Plan, the Stakeholder Engagement Plan, the Labour Management Procedure, the Grievance Redress Mechanism, the results of the ESIA, ESMP, RCAP Audit and RAP reports, including expected impacts, management measures and specific management plans, the project progress reports, the monitoring reports on the Project's environmental and social performance as well as the project completion report. The goal is to make documents easily accessible to all relevant stakeholders. Disclosure documents will also be shared directly with targeted stakeholders through email and during all project-related meetings.

Additionally, formal channels will be put in place by ZESCO to register and document comments, suggestions and grievances from the public regarding shared documents or any other aspects of the Project.

Updated reports will also be shared directly with ZEMA. Although an approval letter has already been issued for the Project, ZEMA may have comments regarding the updated studies, including the specific management plans (Chapter 4 of ESMP Report).

# 7.4 CONSULTATION ROUND 1 – KASAMA-NAKONDE EIS PROCESS

This section summarizes the activities conducted as part of the first round of consultations under the Scoping Phase for the ICBC Kasama-Nakonde 330kV line held in November 2012 and the key concerns and recommendations expressed by stakeholders. Detailed minutes of all meetings held are provided in Appendix 7-2

## 7.4.1 ACTIVITIES PERFORMED

Informative and consultative meetings with Project stakeholders occurred in November 2012. The aim was to inform the communities about the proposed Project and get their views and concerns, reinforcing that the meetings held followed local environmental legislation. The stakeholders were also informed of the importance of the consultation meetings along the ESIA process. The target groups for this consultation effort were community members, farmers, teachers, and businessmen.

The stakeholder engagement activities were essentially community meetings and were undertaken by ZESCO.

During the meetings, ZESCO representatives explained the Project's motivation to communities, the transmission line capacity, and the route. They reinforced that the Project is aligned with the objectives of the Rural Electrification Master Plan. It was explained to the community that the power line to be constructed would be a very high-voltage transmission line, and, therefore, no structures would be permitted to be built under this line for safety reasons, and people are not allowed to settle within the ROW. ZESCO informed communities that when selecting the most suitable route for the power line, ZESCO will ensure settlements are avoided.

## 7.4.2 STAKEHOLDERS REACHED

Table 7-3 summarizes all the meetings held during stakeholders' consultations round 1, along with the date, location, and participants for each meeting.

**Table 7-3 List of Stakeholders Met during Consultations Round 1**

| Date | Location | Stakeholder Organization or Group | Description of Participants |
|---|---|---|---|
| Nov. 14 (2012) | Mungwi | Project-affected communities and households | 52 participants, including 9 teachers, 26 peasant farmers, 5 businessmen, Head of Masembe, Sub Chief of Chimba, Head man of Chasenama, 4 representatives from ZESCO-Ndola and 1 Agricultural Assistant. |
| Nov. 15 (2012) | Mungwi | Project-affected communities and households | 34 participants, including 7 representatives from ZESCO, 1 Pastor, 1 representative of MOH, 1 ESO-ED, 1 Deputy Treasurer MDC, 1 Deputy Planner-Council, 1 Committee Member-Mungwi Market. |
| Dec. 02 (2012) | Mungwi | Project-affected communities and households | 31 participants, including 1 Area Councillor, 20 farmers, 3 representatives from ZESCO and 1 businessman. |
| Oct. 03 (2012) | Makasa | Project-affected communities and households | 66 participants, including 1 Ward Councilor, 43 farmers, 1 Pastor, 3 barber men, 2 Brick layer, 1 ZESCO representative from Lusaka and 5 ZESCO representative from Ndola. |
| Nov. 15 (2012) | Malole | Project-affected communities and households | 32 participants, including 1 Area Councillor, 20 farmers, 2 crafts, 1 businessman, 6 ZESCO LTD-Ndola representatives. |

### 7.4.3 KEY CONCERNS, EXPECTATIONS, AND ISSUES RAISED BY STAKEHOLDERS

During consultations, stakeholders raised issues and concerns and outlined Project expectations. The following outlines the key items raised during round 1 of community consultations:

- Details were asked regarding the Project timeline and capacity, who would be responsible for the power line connection and distribution to households/teachers/schools, and any interested party. Additionally, questions were made about prepaid meters being installed and what would be the power connection fees.
- Stakeholders were concerned about what type of houses would receive power connection.
- Several questions were raised regarding who the contractor for the installation of prepaid meters and what are the requirements needed to get a power connection.
- Concerns were raised on the security associated with power installation, how it will be guaranteed that communities are wired by genuinely qualified people, stating the fact that if houses are not wired correctly, accidents such as fires due to short circuits might occur.
- Stakeholders expressed their interest in the employment opportunities and recruitment selection criteria. It was requested that ZESCO provide opportunities for unemployed youth.
- ZESCO was advised to collaborate with the roads department because roads became impassable during the rainy season in Mungwi District, particularly Chimba – Masaka-Kayambi Road. A concern was raised that the contractor might face some challenges in the transportation of construction materials.
- Stakeholders requested the ESIA report to be disclosed to district authorities once it gets ZEMA approval.
- Stakeholders raised concerns about potential impacts on schools, cemeteries, and associated compensation.
- Questions were raised on specific measures to be applied to protect sensitive environmental features such as rivers.
- Concerns related to the RAP, specifically to the asset inventory and socio-economic surveys, particularly on admissibility to compensation.

## 7.5 RESULTS FROM CONSULTATION ROUNDS 2, 3 AND 4

Results from consultation rounds 2, 3, and 4 are briefly described hereafter, including the activities performed, the organizations that were met, and the key concerns and expectations that were raised. Detailed consultation reports for each consultation round, including meeting minutes and registers of participants' signatures are included in Appendices 7-3 to 7-7.

### 7.5.1 ACTIVITIES PERFORMED

The following stakeholder engagement activities were performed:

- Round 2a (Tanzanian Border – Kasama): initial consultation meetings as part of the environmental and social scoping exercise, in December 2013, with a limited number of ministerial authorities and other key informants at the local (study area) and national (Lusaka) levels. Meeting request letters were sent out 2 weeks prior to the proposed dates. Information about the Project was disclosed during the meetings, including information on the Project's objectives, key components and timelines, as well as the main benefits and potential impacts generally associated with transmission lines. Printed pictures (large format) featuring the type of towers likely to be used (single and double pylon options) were used during the meetings to better illustrate the nature of the proposed infrastructure. Minutes of meetings and signature sheets are provided in Appendix 7-3.

- Round 3a (Tanzanian Border – Kasama): informative and consultative meetings on corridor options with local administrative authorities, government technical services, and village headmen from the study area (February / March 2014). This was performed through open assemblies held in Kasama (Provincial Planning Unit Conference Hall) and Nakonde (Mweetwa Guesthouse), after being advertised in the media for two weeks. A Background Information Document (BID) about the Project, the corridor options, and the ESIA process (objectives and deadlines) expected benefits and potential impacts have also been distributed prior to the assemblies to the concerned districts (electronic copies) and to participants (hand-outs) during the assemblies. Printed maps showing corridor options as well as pictures of types of towers likely to be involved were also used to support discussions. The BID and the detailed minutes of meetings are provided in Appendix 7-4.

- Round 2b (Kasama – Pensulo section): in Zambia, a new series of initial consultation meetings was performed as part of the revised scoping exercise for the Project's extension to Pensulo, in July and August 2014, with a limited number of ministerial authorities and other key informants at the local (study area) and national (Lusaka) levels. Meeting request letters were sent out to target organizations two weeks prior to the meetings, along with a revised copy of the Project BID. Copies of the BID were handed out to participants during the meetings (Appendix 7-5).

- Round 4: additional stakeholder meetings were held in February and March 2015 to "touch base" with concerned authorities at central and district levels, as well as other key stakeholders, and provide them with up-to-date information about the Project and the current status of the ESIA process. This time, the focus was on those stakeholders unaware of the extension of the Project to Pensulo and the revised schedule. This was also seen as an opportunity to document any additional concern or expectations raised by the Project. An updated version of the BID, in memo format, was produced and distributed through email to target stakeholder organizations, along with the meeting request letters, one week prior to the meetings (Appendix 7-5). This was preceded by telephone communications to inform such organizations about the meetings' objectives and proposed dates. District secretaries or other stakeholders' representatives were asked to share the electronic copy of the BID with all the relevant technical officers and other individuals concerned by the meetings. Finally, printed copies of the BID were handed out to participants during the meetings. Minutes of meetings and signature sheets are provided in Appendix 7-7.

- Round 3b (Kasama – Mpika and Mpika - Pensulo sections): informative and consultative meetings on corridor options with concerned ministerial and administrative authorities at national, provincial and district levels, NGOs, industrial stakeholders, and technical services from the study area, in Zambia (September 2015). Consultations in Zambia were performed through individual meetings with national stakeholders and through group meetings with concerned authorities and key technical staff at the provincial and district levels. Meetings were held with representatives from the three provinces concerned, and with seven out of eleven districts involved for these sections of the Project. Meeting request letters were sent out to target organizations one week prior to the proposed dates, along with a revised copy of the BID. Printed maps showing corridor options were used during the meetings to support discussions. Minutes of meetings and signature sheets are provided in Appendix 7-6.

### 7.5.2 STAKEHOLDERS REACHED

Table 7-4 presents an exhaustive list of the organizations that were engaged during each round of consultations.

**Table 7-4 Stakeholders Met in Zambia during the Studies' Inception (consultation rounds 2a and 2b) and Preliminary Phases (consultation rounds 3a, 3b, and 4)**

| Location | Stakeholder Groups / Organizations | Consultation Rounds | | | | |
|---|---|---|---|---|---|---|
| | | 2a. Scoping | 3a. Preliminary | 2b. Revised Scoping | 4. Update Meetings | 3b. Revised Preliminary |
| Lusaka | ZESCO - Environment and Social Affairs Dept. | 18/12/13 | | 28/07/14 | | |
| Lusaka | ZEMA - EIA Unit | 18/12/13 | | 28/07/14 | 23/02/15 | |
| Lusaka | Ministry of Lands, Natural Resources and Environmental Protection (MLNREP) - Survey Department | 18/12/13 | | | | |
| Lusaka | MLNREP - Lands Department | | | | | 12/08/15 |
| Lusaka | MLNREP - Forestry Department | | | 28/07/14 | | |
| Lusaka | MLNREP - Environmental Protection Department | | | 28/07/14 | | |
| Lusaka | Ministry of Local Govt & Housing - Physical Planning | | | 28/07/14 | | |
| Lusaka | Ministry of Agriculture and Livestock – Depart. of Agriculture | 18/12/13 | | | 23/02/15 | 12/08/15 |
| Lusaka | National Heritage Conservation Commission - Central Region Office | | | 28/07/14 | | 12/08/15 |
| Lusaka | Zambia Wildlife Authority - General Direction | 19/12/13 | | 08/14 | | |
| Lusaka | WWF Zambia | 19/12/13 | | | 23/02/15 | |
| Lusaka | Birdwatch Zambia | | | 28/07/14 | | |
| Lusaka | Ministry of Labor – Occupational Safety and Health Services Department | | | | | 12/08/15 |
| Kabwe | ZESCO - Central Province office | | | 29/07/14 | | 14/08/15 |
| Kabwe | MLNREP - Forestry Department, Central Province | | | 29/07/14 | | |
| Kabwe | Ministry of Agriculture and Livestock - Central Province Office | | | 29/07/14 | | |
| Kabwe | Road Development Agency - Central Province | | | 29/07/14 | | |
| Kabwe | Office of Permanent Secretary - Central Province | | | 29/07/14 | | 13/08/15 |
| Serenje | Serenje District: Council Office and Technical Services | | | 30/07/14 | | 17/08/15 |
| Mpika | MLNREP - Forestry Department, Mpika Office | | | 31/07/14 | | |
| Mpika | Ministry of Agriculture and Livestock - Mpika District Office | | | 31/07/14 | | |
| Mpika | Zambia Wildlife Authority - Mpika District Office | | | 31/07/14 | | |

| Location | Stakeholder Groups / Organizations | Consultation Rounds | | | | |
|---|---|---|---|---|---|---|
| | | 2a. Scoping | 3a. Preliminary | 2b. Revised Scoping | 4. Update Meetings | 3b. Revised Preliminary |
| Mpika | Mpika District: Council Office and Technical Services | | | 31/07/14 | | |
| Mpika | TAZARA | | | | | 18/08/15 |
| Kasama | National Heritage Conservation Commission (NHCC) - Northern Region Office | 16/12/13 | | | 25/02/15 | 19/08/15 |
| Kasama | ZESCO - Northern Province Office | | | | 25/02/15 | 18/08/15 |
| Kasama | MLNREP - Forestry Department, Northern Province | 16/12/13 | 28/02/14 | | 24/02/15 | 19/08/15 |
| Kasama | Office of Permanent Secretary - Northern Province | 16/12/13 | | | 24/02/15 | 19/08/15 |
| Kasama | Kasama Municipality: Council Office and Technical Services | 16/12/13 | 28/02/14 | | 25/02/15 | 19/08/15 |
| Kasama | Kasama Development Coordination Committee | 16/12/13 | 28/02/14 | | | |
| Kasama | Chamber of Commerce and Industry of the Northern Province | | | | 25/02/15 | |
| Kasama | Road Development Agency – Provincial Office | | | | | 19/08/15 |
| Kasama | Ministry of Agriculture and Livestock – Provincial Office | | | | | 19/08/15 |
| Kasama | ZAWA – Regional Office | | | | | 19/08/15 |
| Chinsali | Office of Permanent Secretary - Muchinga Province | 17/12/13 | | 01/08/14 | 26/02/15 | |
| Chinsali | Muchinga Province's Technical Services: ZAWA, Physical Planning, Agriculture and Forestry Depts. | | | 01/08/14 | | 10/09/15 |
| Chinsali | Chinsali District Council | | | | | 20/08/15 |
| Nakonde | Nakonde District: Commissioner Office, Council Office and Technical Services | | 03/03/14 | | 27/02/15 | |
| Nakonde | ZESCO - Nakonde Area Manager | | | | 27/02/15 | |
| Nakonde | Representatives from potentially affected villages in Nakonde District | | 03/03/14 | | | |

### 7.5.3 KEY CONCERNS, EXPECTATIONS, AND ISSUES RAISED BY STAKEHOLDERS

The main concerns, expectations, and issues raised by stakeholders in Zambia during the study's inception and preliminary phases (consultation rounds 2a, 3a, 2b, 3b, and 4) are summarized below:

- General Support to the Project: civic authorities and other stakeholders reiterated their support to the Project, which they understand is of strategic importance for the country.
- Project's social acceptability and communication challenge: local government representatives and other local stakeholders have raised that, given the current situation of continued power outages and underdeveloped distribution networks affecting the region, people may protest if they perceive that this Project will not directly benefit them in terms of access to electricity. Convincing affected communities, as well as political and economic leaders, that this Project will, in the long run, be beneficial for the whole nation is a communication challenge of critical importance for the Project's acceptability.
- Integration of step-down substations along the line: local government representatives have all expressed their wish for the addition of step-down substations along the transmission line to support the electrification of the region. Similarly, the central department of Agriculture has insisted that the Project must bring power to the emerging farm blocks and industrial farming areas that will be affected by the line's route, which are facing significant challenges in terms of power supply to support their development.
- Expected economic benefits from the Project: stakeholders generally hope that the Project will go through their province, district or municipality so they can benefit from jobs, economic opportunities, land lease revenues (pylon bases), and the development of the road network. Access to jobs for local populations is a major concern. The development of new access roads is seen as an opportunity to increase access to rural areas. It was raised that political and economic leaders in Kasama are already excited about this Project and the perspective of Kasama developing as a power hub.
- Importance of engaging with traditional Chiefs: local government representatives and other key informants have all raised that traditional leaders are highly influential in the study area, mostly over land issues, and that they are key to the successful implementation of the Project. Particularly, they need to be informed, consulted and involved in the coordination of the resettlement process.
- Concerns over the resettlement process: stakeholders have generally expressed their expectations for fair compensations and resettlement assistance. Unlike the southern part of the study area (Central Province) where population density is higher, it is perceived that replacement lands will be easy to find in the sparsely populated Northern and Muchinga provinces. Houses are generally made of mud and resettlement is rather seen as an opportunity to improve people's houses.
- Involvement of civic authorities: local civic authorities (Provincial Secretaries and District Councils) consider that they have an important role to play in the implementation of the Project at the following levels:
  - Communication and sensitization activities;
  - Identification of replacement lands for displaced households;
  - Mediation between the population and the Contractors;
  - Coordination of the recruitment process for local workers.
- Preference for in-kind compensations: local authorities in Kasama, Mungwi and Nakonde consider that in-kind compensations for lost structures and other assets are a better option than cash compensations. They see a risk where certain households would drink the compensation money, rather than invest it in better houses. Land-for-land compensations are considered a realistic and beneficial option in the Northern and Muchinga provinces, where replacement lands are easy to find, but would represent a major challenge in densely occupied areas of the Central province.

- Consideration of gender issues and GBV: district representatives have pointed out that men tend to be considered more than women and therefore measures should be planned to ensure women fully participate to the stakeholder engagement and resettlement processes. Women-headed households are said to be numerous. In addition, as presented in chapter 5, during public consultations many participants in public consultations during both 2013-2017 discussed GBV issues, mainly in the form of grievances related to the Project, including:
  - Fear of HIV and other STDs spreading and the need to have HIV awareness programs;
  - Fear that women will be less considered than men in the resettlement and stakeholder engagement processes;
  - Fear that cash compensations would be detrimental to them and to the household since many men do not know how to manage money and will be tempted to abandon their family;
  - Women wish to have equal chances in finding employment during construction and suggest that specific measures be taken to ensure equal chance and equal salary;
  - Selling food to Project staff should be reserved for local women with the help of local headmen;
  - Women fear intimidation by men when they apply for a job;
  - Women fear that men employed for the Project will spend their money drinking alcohol;
  - There is a legacy of GBV from the Pensulo-Kasama 330-kV line where unplanned pregnancies, HIV propagation, and social disruption were reported by community members;
  - There is a legacy of GBV from the Mungwi road construction where unplanned pregnancies and HIV propagation were reported by community members;
  - Participants feel that previous contractors in the area did not collaborate with provincial authorities in the implementation of HIV prevention programs;
  - Communities felt that there is a need to set the worker`s camps as far as possible from villages to prevent interaction between workers and community members and a need for workers to return every weekend to their family to reduce promiscuous behavior;
  - Communities fear that young girls will be vulnerable to sexual abuse due to the presence of workers with high salaries;
  - Communities requested that a Code of Conduct (CoC) be imposed on workers which includes sanctions;
  - Communities requested that an emphasis be put on raising awareness on child abuse;
  - Women requested that spouses be allowed to visit their husband in the camp during weekends to reduce promiscuous behavior with local women.
- Wildlife conservation: concerned ministries and conservation NGOs have raised that national parks and game management areas (GMA) are of critical importance for wildlife conservation and must be avoided by the transmission line route to reduce habitat fragmentation and new entry points for illegal activities. Potential impacts on designated Important Bird Areas, as well as on bird and bat migration corridors, are other important concerns for the study area.
- Protection of forest reserves and headwaters: while many stakeholders have risen that the line route should avoid forest reserves, it is also generally acknowledged that some forest reserves are already severely degraded and therefore do not represent a strong ecological constraint to the Project. Avoiding the ones that are still in good ecological condition and particularly the ones that were established to protect headwater catchments, is considered critical.
- Impacts of right-of-way clearing on nearby communities: it was raised that communities in rural areas rely on the multiple ecosystem services provided by forests for their subsistence. Right-of-way clearing may therefore generate a significant impact on nearby communities. Adequate livelihood restoration assistance measures should be provided.

- Reforestation: although financial compensations are required for cut trees inside forest reserves, those are generally channeled to a national fund and do not directly benefit communities and districts affected by the cuts. It was therefore recommended to integrate reforestation efforts to the Project's environmental and social management measures.

- Protection of archeological sites: NHCC's main concern for the Project is the protection of buried artefacts, fossils or graves that could be affected during excavation work for pylons. The potential for chance findings is considered high everywhere in the Northern and Muchinga provinces. During construction works, NHCC wishes to assist to excavation work at different places along the line.

- Road and railway crossings: for security reasons, the transmission line should minimize road and railway crossings and avoid any encroachment of the infrastructure's rights-of-way. Road crossings may eventually become a constraint for future road extension Projects, which is why repeated crossings over short distances should be avoided.

- New urban extension areas: many District Councils are currently developing new urban development plans (Local Area Plans) which imply the extension of the urban perimeters of major towns such as Kasama, Nakonde, Isoka, Chinsali, Shiwa Ngandu, and Mpika. Stakeholders have risen that the transmission line should avoid these new urban development areas where it would create a considerable constraint to urban planning.

- Consideration of existing and planned powerlines: many high voltage powerlines already exist in the Project area, and many new development Projects are currently underway. The Project should consider the existing and future infrastructure and seek to juxtapose rights-of-way to reduce the fragmentation of natural habitats and minimize constraints on land planning and development.

### 7.5.4 STAKEHOLDERS' COMMENTS ON PROPOSED CORRIDOR OPTIONS

Comments and preferences expressed by stakeholders during the study's preliminary phase on proposed corridor options for the transmission line are summarized below. These inputs from stakeholders were factored into the corridor options' comparative analysis process completed in the Scoping Report.

#### NAKONDE – KASAMA SECTION

- Stakeholders from the agriculture sector have indicated a preference for corridor options 1 and 2 because of their proximity to emerging farm blocks and associated energy supply needs.

- Corridor option 3 is perceived by district-level stakeholders as the one that would most likely induce the least resettlement needs.

- WWF Zambia argued in favor of corridor option 2 because it would have the least impact on wetlands and a greater proximity to the existing road network (less impact induced by the construction of access roads).

#### KASAMA – MPIKA SECTION

- Resettlement needs are perceived by stakeholders to be high for this segment, which raises important concerns. Representatives from different districts consider that the chosen option should remain distant from the main road to reduce resettlement needs, whereas representatives from the Kasama Municipal Council have suggested that the line route should remain close to the main road in order to benefit from existing infrastructure.

- Forest reserves could be affected by corridor options on this segment. The chosen corridor should minimize encroachments within those areas. Where they cannot be avoided, it is recommended to reduce the width of the wayleave within the forest reserves (ZAWA and Northern Province Forestry Department).

**MPIKA – PENSULO SECTION**

- Unfavorable comments associated with corridor 7 were that it would be too close to the eastern escarpment and would potentially have a greater impact on the natural environment, deforestation and ecotourism, as it affects more remote areas.
- Options 5 and 6 were most often preferred to corridor 7 because of their greater proximity to agricultural zones, existing road networks, and existing linear infrastructure.
- However, some concerns were raised by the Office of the Permanent Secretary for the Central Province, in Kabwe, for corridor option 6 on the cumulative impacts from the multiplication of wayleaves with existing transmission lines and numerous powerline development Projects.
- Key concerns expressed over corridor option 5 were related to the resettlement needs, which are perceived to be more important with this option. In general terms, option 5 was perceived as affecting a more densely occupied and more populated area, compared to options 6 and 7.
- ZAWA's representatives indicated a preference for option 7 as it is the only one that does not go through a National Park, whereas options 5 and 6 both encroach into the Lavushi Manda National Park. If options 5 or 6 are chosen, ZAWA recommends that the new line's route be located on the eastern side of the existing powerlines crossing the eastern tip of the National Park.

## 7.6 RESULTS FROM CONSULTATIONS ROUND 5 – ON THE DRAFT FINAL EIA AND RAP REPORTS

This section summarizes the activities conducted as part of the fifth round of public consultations and the key concerns and recommendations expressed by stakeholders. Detailed minutes of all meetings held are provided in Appendix 7-8.

### *7.6.1 ACTIVITIES PERFORMED*

A fifth round of informative and consultative meetings with Project stakeholders took place from September 19 to 28, 2017, to disclose and consult stakeholders on key findings and recommendations from the draft final reports, including the most critical social and environmental management measures, and compensation and resettlement strategies. Target groups for this consultation effort included representatives from the districts and communities affected by the revised line route, extending from Nakonde to the Pensulo substation, and passing through Kasama. Therefore, all the districts from the Central (except for Serenje and Chitambo) and Muchinga (except for Nakonde) Provinces that were engaged in the previous consultation rounds were no longer targeted at this point.

The activities performed during consultations round 5 include:

- work sessions with officials (councillors and technical officers) and local NGOs in all affected districts;
- community assemblies in all affected districts;
- individual meeting with Birdwatch Zambia, an international NGO for wildlife conservation, in Lusaka.

Meeting request letters explaining the purpose of the meetings were sent to the targeted organizations and communities two weeks ahead, along with an updated copy of the Project's Background Information Document. All the meetings began with a presentation of the Project, the proposed line route, and the key findings of the ESIA and RAP studies, including the proposed grievance redress mechanism and ulterior stakeholder engagement activities. The consultation team, composed of ZESCO and the consultants' representatives, then answered questions on the Project and facilitated a discussion around the main concerns raised and most critical findings from the preliminary ESIA and RAP reports.

Provincial and district meetings were planned as two-hour work sessions and have benefited from the participation of many officers from the different technical sectors directly or indirectly concerned with the Project. Local NGOs were also invited to attend these meetings (a total of eight local NGOs have participated to district meetings). These sessions have allowed for a full presentation of the Project supported by a PowerPoint presentation, including maps and pictures of the proposed Project components. Printed copies of the Project background information document, including a map of the line route, were distributed to participants. Discussions following the presentation have focused on the validation, or formulation of counterpropositions, of the proposed environmental and social management measures.

A total of 5 community assemblies were held, reaching out to representatives from 16 different villages from Kasama, Mungwi, Nakonde, Mpika, Serenje and Chitambo Districts (villagers from Serenje and Chitambo Districts were met in the same meeting). In Mungwi, the community assembly took the format of a focus group discussion with women representatives from Chibaba and James East villages. A description of the Project's components was first provided, supported by maps and pictures. Community representatives who had participated to the survey of the line route in August 2017 (as part of RAP development) were invited to stand up and explain where the alignment currently passes in their own words. This was followed by an open discussion where participants could ask questions and raise their concerns. The assemblies were assisted by local translators to Bemba.

### 7.6.2 STAKEHOLDERS REACHED

The Table 7-5 summarizes all the meetings held during stakeholders' consultations round 5, along with the date, location, and participants for each meeting.

**Table 7-5 List of Stakeholders Met during Consultations Round 5**

| Date (2017) | Location | Stakeholder Organization or Group | Description of Participants |
|---|---|---|---|
| Sept. 19 | Kasama | Kasama Provincial and District Governments | 10 Provincial Officers and 8 District Officers, including Agriculture, Environment, Forestry, Health, Education Planning, Community Development, and Child Affairs. |
| | Kasama | Community Assembly | 21 residents from the Lwaluo, Luyeye, Mumba, Chiba and Mulenga villages (Kasama District). |
| Sept. 20 | Mungwi | Mungwi District Government | 26 participants, including 9 District Officers (Planning, Agriculture, Chiefs & Traditional Affairs, Public Infrastructure, Police, Water, and Sanitation & Environment), 7 village headmen and senior citizens, representatives from 3 NGOs (Red Cross, Caritas, and Cross Borders Association), 1 representative from Mungwi Town Council, and 3 representatives from religious organizations. |
| | Mungwi | Women Focus Group | 9 women from Chibaba and James East villages (Mungwi District). |
| Sept. 21 | Nakonde | Nakonde District Government | 15 participants, including representatives from 3 NGOs (Nakonde One-Stop Centre, North Star Alliance, and Zambia Agency for Persons with Disabilities), Town Councillors, and District Officers. |
| | Chitamba | Community Assembly | 53 members of Chitamba village (Nakonde District). |
| Sept. 22 | Mpika | Mpika District government | 13 participants, including 9 District Officers (Chiefs & Traditional Affairs, Water Development, Arts & Culture, Planning, AIDS, Education, and Social Welfare), 3 District Councillors, a town Councillor, and a representative of one NGO (Caritas). |
| Sept. 24 | Chipushi | Community Assembly | 73 villagers from Chafungwa, Munamala, and Chituntama villages (Mpika District). |
| Sept. 25 | Serenje | Serenje District Government | 4 District Officers (Water Coordinator, Town Planner, Assistant Planner, and DAO). |
| | Chitambo | Chitambo District Government | 15 participants, including 8 District Councillors, 6 District Officers (Agriculture, Fisheries & Livestock, and Health and Education) and a representative of one local NGO (Agape Village Foundation). |
| Sept. 26 | Pensulo | Community Assembly | 151 members of Mukando Turn-off, Mulaushi, Chankalamo, Katonga, and Chitambo villages (Chitambo and Serenje Districts). |
| Sept. 28 | Lusaka | Birdwatch Zambia | Chaona Phiri, Project Manager. |

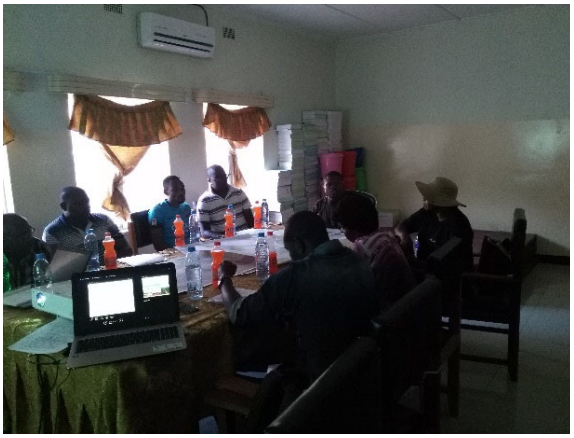
Meeting Kasama Province with District Officials, on Sept. 19

Community Assembly in Kasama, on Sept. 19

Meeting with Mungwi District Officials, on Sept. 20

Women Focus Group in Mungwi, on Sept. 20

Meeting with Nakonde District Officials, on Sept. 21



Meeting with Mpika District Officials, on Sept. 22

Meeting with Chitambo District Officials, on Sept. 25

Meeting with Serenje District Officials, on Sept. 25

Community Assembly in Chitambo, on Sept. 26

Community Assembly in Chitambo, on Sept. 26

## 7.6.3 KEY CONCERNS, EXPECTATIONS, AND ISSUES RAISED BY STAKEHOLDERS

### 7.6.3.1 CONCERNS OVER THE RESETTLEMENT PROCESS

- Generally good comments were recorded from stakeholders regrading the RAP.
- Stakeholders were generally in favor of in-kind compensation. However, some of them wanted to be sure that PAPs will be offered the option of cash compensation.
- Several questions were asked about the institutional arrangements for the implementation of the RAP. Some stakeholders made the comment it was a good thing that the PAPs and community members are involved in the process.
- The schedule of the RAP's implementation was a concern for some stakeholders who were worried that other assets may be built in the planned wayleave after the first survey or were worried about PAPs who would grow crops when construction starts. They wanted to have more details about the cut-off date.
- Details were asked about compensations for crops. A participant asked if the land without crops, such as land in fallow or bare land, will be compensated. Another participant wondered what would happen if someone has papers for the land but does not farm on it.
- A recurrent question was which standards would be used for the construction of the new houses (would the PAPs be better off than prior to the resettlement? Would they be as close to the services as they were before resettlement?).

#### 7.6.3.2 EMPLOYMENT

- During village assemblies, many stakeholders expressed their interest for the employment related to the Project.
- Men and women in the villages mentioned that women need to be considered in the hiring process, as well as unskilled workers.
- The potential corruption and nepotism in the hiring process was a recurrent concern.
- A participant recommended that work training for local people should be imposed on the contractor, not just encouraged.
- ZESCO clearly explained the consequences of alcohol consumption on working hours and this seemed to be important for several stakeholders.

#### 7.6.3.3 EXPECTED ECONOMIC BENEFITS FROM THE PROJECT

- Generally, stakeholders shared their expectations that benefits from the Project may be as local as possible.
- One of the main benefits that stakeholders could foresee in the Project is rural electrification, for the potential industrial development and investments it can bring. They also highlighted the positive changes from enhancement of PAP quality of life.
- Some stakeholders wanted to make sure the Project would benefit Zambia as much as it would Tanzania.

#### 7.6.3.4 HIV-AIDS

- The importance of awareness and sensitization about HIV-AIDS was an issue raised by many stakeholders. Some of them asked who will take charge of these activities. It was important for many that these activities be pursued by already existing local NGOs who have trained employees. It was also important for many of the stakeholders that sensitization start early in the Project implementation.
- Having measures adopted to minimize the spread of Sexually Transmitted Infections (STIs) was important for several stakeholders. Some suggestions were made such as hiring workers who can go back and forth from their house to the work site instead of having to live at the work camp. Other suggestions were to allow wives to visit their husband in the camps in order to control the influx of women in the camps, identify women selling food within the camps by local headmen in order to control who enters the camps, ask these women to go for HIV Voluntary Counseling and Testing (VCT) to know their HIV status.

#### 7.6.3.5 ACCESS TO ELECTRICITY

- Many stakeholders expected the Project could contribute to lowering the price of electricity in rural communities.
- They also expected the Project to facilitate access to rural electricity for PAPs.

#### 7.6.3.6 PRESENCE OF WORKERS

- A participant recommended that local workers come from their home because once on the camp, their girlfriends may visit them and, at the same time, bring other women along. She said that this would encourage new relationships between local women and foreign workers.
- Generally, meeting participants agreed that the 1 km distance between the workers' camp and local communities recommended by the Environmental and Social Impact Assessment (ESIA) would not prevent interactions between the workers and the community members. However, according to the participants, there are few mitigation measures that could be implemented in that regard except to promote behavior change through communication and awareness, especially to prevent Sexually Transmitted Infections (STIs) and HIV-AIDS.

#### 7.6.3.7 INFORMATION AND COMMUNICATION

- Several stakeholders asked about the methods of information that will be used to disseminate information on the RAP process, training, and job recruitment, especially for the residents of the villages far from the cities for whom it may be hard to access information.
- Some stakeholders requested that the information meetings planned for the Project be planned and announced in advance.

#### 7.6.3.8 TERRITORY FRAGMENTATION

- Some participants in the meetings asked why the option of a double-circuit line was not preferred as it is the case in Tanzania since it would limit encroachment on the territory.

#### 7.6.3.9 COMPENSATION FOR NATURAL TREES

- The compensation for natural (indigenous) trees is a question that was asked by some participants at the meetings. One of them was concerned about the impact of tree clearing on climate change.

#### 7.6.3.10 SAFETY/ENCROACHMENT

- In districts where there are no transmission lines, stakeholders highlighted the security issue related to the presence of pylons and powerlines.
- Some participants were worried about people being uninformed regarding the allowed land uses under the powerline, who would decide to move into the wayleave after the line was built.

#### 7.6.3.11 INVOLVEMENT OF LOCAL ORGANIZATIONS

Several stakeholders stressed the importance of involving agencies (governmental and non-governmental) in carrying out the Project.

#### 7.6.3.12 CONSIDERATION OF GENDER ISSUES

During village assemblies, several women mentioned their concern about their participation in employment rather than men as many of them use their income to drink alcohol while women are more likely to use their income to take care of their family. As presented above, many women have expressed fears and concerns on Project-induced GBV.

#### 7.6.3.13 COMPLIANCE WITH COMMITMENTS

Stakeholders have repeatedly indicated the importance of complying with commitments announced during the meetings so that the Project goes well, and community benefits materialize.

## 7.7 CONSULTATIONS ROUND 6 – PROJECT UPDATE AND EIA & RAP DATA COLLECTION

This section summarizes the activities conducted as part of the sixth round of consultations and the key concerns and recommendations expressed by stakeholders. Minutes of meetings are provided in Appendix 7-9.

### 7.7.1 ACTIVITIES PERFORMED

A sixth round of consultations involved the completion of two separate missions aimed at providing Project design updates and collecting supplementary information regarding the biological (September 5 to 17, 2019) and socioeconomic (September 23 to October 13, 2019) environments, details of which are provided below.

The following consultations and engagement activities where completed:

- Meetings with Department of National Parks and Wildlife (DNPW) to confirm park boundaries, gather information on wildlife and discuss concerns regarding recent alignment changes.
- Meetings with the Forestry Departments to confirm forest reserve boundaries, collect information on habitats within these areas and discuss concerns and requirements regarding recent alignment changes.
- Meeting with the Northern Province NHCC to discuss concerns and requirements regarding passage in the Mwela Rock Heritage Site.
- Meetings with relevant conservation NGOs (Kasanka Trust and Wildlife and Environment Conservation Society of Zambia (WECSZ), and World Wildlife Fund (WWF) Zambia, to gather information on habitats and wildlife and discuss concerns regarding recent alignment changes.
- Meetings with NGOs at their headquarters in Lusaka and on the field where they conduct anti-GBV programs.
- Meetings with ZESCO to obtain their new 2019 census data on PAPs and to discuss the various compensation and resettlement methods (e.g., eligibility, assistance, etc.) since the scope of resettlement has changed because of the new alignment.
- Meetings with district level agencies working in many sectors, with a focus on GBV and possible ways of implementing a Grievance Redress Mechanism (GRM).
- Meetings with Chiefs to discuss resettlement, GRM, and GBV.
- Focus group meetings with community members from a selected sample of 17 villages to discuss GBV and resettlement risks.

### 7.7.2 STAKEHOLDERS REACHED

The Table 7-6 summarizes all the meetings held during stakeholders' consultations round 6, along with the date, location, and participants for each meeting.

**Table 7-6 List of Stakeholders Met during Consultations Round 6**

| Date (2019) | Location | Stakeholder Organization or Group | Description of Participants |
|---|---|---|---|
| Sept. 5 | Lusaka | MLNREP, Forestry Department, National Office | Chief Extension Officer |
| Sept. 6 | Lusaka | Wildlife and Environmental Conservation Society of Zambia | Wildlife and Environmental Conservation Society Executive Director |
| Sept. 9 | Kasanka National Park – Wasa Headquarters | Kasanka Trust | General Manager and Knowledge Manager |
| | Serenje | Forestry Department - Serenje District - Office | 2 Technicians, 1 Forestry Ranger, 1 General Worker, 1 Forestry Officer, and 2 Forestry TFEs |

| Date (2019) | Location | Stakeholder Organization or Group | Description of Participants |
|---|---|---|---|
| Sept. 10 | Mpika | Forestry Department -Mpika District Office | District Forestry Officer |
| | Mpika | Department of National Parks and Wildlife Mpika Office | 3 Department of National Parks and Wildlife employees |
| Sept. 12 | Kasama | National Heritage Conservation Commission | NHCC Site Manager, Architect, and Archaeologist |
| | Kasama | Forestry Department - Northern Province Office | Provincial Forestry Official – Northern Province and Kasama District Officer, Forestry Department |
| Sept. 13 | Kasama | Department of National Parks and Wildlife Northern Province Office | Senior Wildlife Ranger and Senior Wildlife Officer |
| | Mungwi | Forestry Department Mungwi District Office | 2 Forestry Department employees |
| Sept. 16 | Lusaka | WWF Zambia | Coordinator – Climate Change and Energy team, GIS expert – Freshwater team, and Wildlife Officer |
| Sept. 17 | Lusaka | Department of National Parks and Wildlife, National Office | DPNW Principal Planner |
| Sept. 25 | Lusaka | CARE | Member of CARE |
| | Lusaka | CARITAS | Programme Officer Knowledge Management |
| | Lusaka | World Vision | Grants Acquisition & Management of World Vision |
| Sept. 26 | Lusaka | ZESCO | 9 Environmental and Social Scientists |
| | Lusaka | ZESCO | 9 Environmental and Social Scientists |
| Sept. 27 | Lusaka | Ministry of Gender | Assistant Director Ministry of Gender |
| | Lusaka | YWCA | Executive Director |
| | Lusaka | The Victim Support Unit (VSU) | National VSU Coordinator |
| Sept. 30 | Serenje | Serenje District | District Commissioner |
| | Chitambo | Chitambo District Council | 11 Chitambo District Council representatives |
| Oct. 1 | Mpika | Mpikca District | 15 District representatives |
| | Mpika | Development of People's Empowerment | Coordinator of Development of People's Empowerment |
| | Mpika | One-Stop Centre Mpika | One-Stop Centre Coordinator |
| Oct. 2 | Kasama | YWCA | 7 YWCA representatives |
| | | Paramount Chief Chitimukulu acting Chief | Acting Chief |
| | | Chief Mpepo | Chief Mpepo |
| | Kasama | Kasama District | District Administrative Officer |
| | Kasama | One-Stop Centre Kasama | One-Stop Centre Coordinator |
| Oct. 3 | Mungwi | Mungwi District | 16 District representatives |
| Oct. 4 | Chieftainess Nawaitwika Palace, near Nakonde | Chieftainess Nawaitwika | Chieftainess Nawaitwika |
| | Nakonde | Nakonde District | 2 Nakonde District officials |
| | Nakonde | One-Stop Centre Nakonde | One-Stop Centre Coordinator |
| Oct. 5 | Chief Chikwanda Palace, near Mpika | Chief Chikwanda | Chief Chikwanda |

### 7.7.3 KEY CONCERNS, EXPECTATIONS, AND ISSUES RAISED BY STAKEHOLDERS

During consultations, stakeholders raised issues and concerns, and outlined Project expectations. The following outlines the key items raised during round 6 of the public consultations:

- General support for the Project: the Project is considered of national interest, but some compensation would be required.
- Payment for lost stumpage within forest reserves: a forest inventory to assess stumpage value in areas to be cleared for the Project will be required directly ahead of Project implementation. Payment to the Forestry Department will be required for lost stumpage within the Forest Reserves. The requirement for an assessment of stumpage value at the district level would come as a directive from the National Offices to the Provincial offices. The ESIA should specify what is done with trees once they are cut.
- Importance of engaging with traditional Chiefs: concerned ministries and agencies reiterated the importance of including traditional leaders in the Project, even for portions of the line that will fall within forest reserves.
- Forest preservation: encouraged forest protection awareness programs, and the protection of forests in general, not only within forest reserves. In addition to payments made to the Department of Forestry for lost stumpage, compensation for the loss of trees due to the Project could take the form of plantations in other areas. These plantations could be planned to complement existing reforestation efforts by the Department of Forestry.
- Potential wildlife conflicts during construction: suggested that scouts be involved during construction, especially near Lavushi Manda National Park, due to the possible presence of dangerous animals.
- Mwela Rock Art site: the Project crosses the Mwela Rock Art site which has legal protection. It is one of 5 national sites on the UNESCO World Heritage pending list. Project impacts on the site will be documented within a heritage assessment to be completed by the NHCC and funded by the proponent. Communication with the Kasama District Forestry office and the National Heritage Conservation Commission regarding the site is required.
- Provisions for transmission line wayleave: the forest reserve is not degazetted in the case of a wayleave, it is only stated as a change of use.
- Consultations with communities illegally settled in forest reserves: recommended that consultations with communities who have illegally settled in forest reserves take place.
- Potential impacts on bats: main impacts of the Project would be the loss of certain feeding grounds. Recommended that habitat surveys be conducted within the ROW to identify presence of fruit trees used by bats and assess habitats for feeding.
- An efficient GRM needs to mobilize, on the field, a focal point to collect and record grievances, and bring him to the appropriate institutions for answers (without intermediaries). This focal point should be a well-respected person from outside the community, and someone who has no personal interest in the Project. Selected local community-based champions could be used as informants of the focal point.
- The main existing type of GBV and the main risk related to the Project is child marriage. With the arrival of workers with high paid wages, many families will push for their daughters to get married (although they are sometimes minors). Typically, after the construction is over, the worker will disappear, and the girl is left pregnant and alone and drops out of school. To remedy this situation, it was recommended that sensitization of community members and awareness for workers be implemented.
- A GBV action plan was designed in close collaboration with stakeholders. The goal of the action plan is to provide both awareness to workers and sensitization to community members and to provide support to victims in case of GBV. The GBV action plan is detailed in the ESMP.
- There are many anti-GBV NGOs and district level actors in the Project area. However, in some districts, such as Chitambo District, there are no service providers.

- In the past year, ZESCO has met with most Chiefs to obtain their signed consent to access land (see Appendix 7-9 for signed consents). The consultant met with certain Chiefs to present the Project and discuss resettlement, the GRM, and GBV. Regarding GBV, some are championing anti-GBV measures others are not.
- Few people asked questions about resettlement during stakeholder meetings. During social surveys, affected people raised their concerns and presented their perception of risks. These risks are addressed in the RAP report. From discussions, some consider resettlement as an opportunity to start a better life, for some, such as women, there is fear that men run away with the compensation money.

## 7.8 CONSULTATIONS ROUND 7 – LATEST PROJECT UPDATE AND ASSOCIATED ESIA UPDATE

This section summarizes the activities conducted as part of the seventh round of public consultations under the latest Project and ESIA update and the key concerns and recommendations expressed by stakeholders. Detailed minutes of all meetings held are provided in Appendix 7-11.

### 7.8.1 ACTIVITIES PERFORMED

A seventh round of informative and consultative meetings with Project stakeholders occurred from April to May 2024. The aim was to disclose the changes to the original line route, provide updates on the ESIA, ESMP and RAP, identify key concerns related to Project implementation, collect available socio-economic and biodiversity data and support the RCAP audit for the Kasama-Nakonde section. The target groups for this consultation effort were representatives from the districts and municipalities affected by the revised line route, such as local authorities and district officials.

The activities performed during consultations round 7 include:

- Meetings with affected district authorities (councilors and technical officers) along Meetings with affected towns council and municipal councils;
- Meeting with the Department of National Parks and Wildlife at national level.

Specific meetings were held in April to discuss RCAP implementation along the Kasama-Nakonde section in order to support the associated implementation audit.

The meetings held with district officials in May 2024 aimed to receive updates on the proposed and future Projects to come to the districts, general concerns and recommendations associated with the Project, land planning, socioeconomic data, biodiversity data and discuss Project corridor encroachments with forest reserves and planned mitigation measures.

### 7.8.2 STAKEHOLDERS REACHED

Table 7-7 summarizes all the meetings held during stakeholders' consultations round 7, along with the date, location, and participants for each meeting.

**Table 7-7 List of Stakeholders Met during Consultations Round 7**

| Date (2024) | Location | Stakeholder Organization or Group | Description of Participants |
|---|---|---|---|
| April 12 | Lusaka | ZESCO head office | ZESCO social and technical Team and WSP |
| April 15 | Kasama | Kasama Department of Agriculture | 6 participants, including 4 representatives from ZESCO, 1 from WSP and 1 District Agricultural Officer |
| | | ZESCO (North Region) | 6 participants, including 4 representatives from ZESCO, 1 from WSP and Senior Regional Manager - Northern Region, ZESCO |
| | | ZESCO (Kasama Regional) | 6 participants, including 4 representatives from ZESCO, 1 from WSP and ZESCO Northern Region Director |
| | | Kasama Lands Department | 6 participants, including 4 representatives from ZESCO, 1 from WSP and 1 District Lands Officer |
| | | Resettlement Office Kasama | ZESCO Social and Technical Team, WSP, Resettlement Office - Junior Officer |
| | | Kasama Department Social Welfare | 6 participants, including 4 representatives from ZESCO, 1 from WSP and 1 Kasama Chief Social Welfare Officer |
| April 16 | Mungwi | Mungwi District Commissioner | 13 participants, including 4 representatives from ZESCO, 1 from WSP, 1 from District Commissioner (DC), 1 from District Administrative Officer (DAO), 1 from Dept Agriculture, 1 from Town Council, 1 from Lands Department, 1 from Resettlement – Vice presidents Office, 1 from Social Welfare, 1 from Forestry Department |
| April 17 | Nakonde | Nakonde District Commissioner | 12 participants, including 4 representatives from ZESCO, 1 from WSP and 1 from District Commissioner (DC), 1 from District Administrative Officer (DAO), 1 from Dept Agriculture, 1 from En Town Council, 1 Kamweka Public Infrastructure and also representing Lands, 1 from Social Welfare, 1 from Forestry Department |
| May 20 | Nakonde | Nakonde Town Council | 24 participants, including 4 representatives from ZESCO, 2 from AMC and 17 from the Nakonde Council and 1 from the Department Of Heritage Services |
| May 21 | Senga Hill | Senga Hill City Council | 15 participants, including 2 from AMC and 13 from the Senga Hill Town Council |
| May 22 | Kasama | Kasama Municipal Council | 23 participants, including 4 representatives from ZESCO, 2 from AMC and 17 from the Kasama Municipal Council |
| | Kasama | Provincial Forest Officer | 7 participants, including 4 representatives from ZESCO, 2 from AMC and 1 from the Kasama Forestry Department |
| May 23 | Mungwi | Mungwi Forestry Department | 10 participants, including 4 representatives from ZESCO, 2 from AMC and 4 from the Mungwi Forestry Department |
| | Mungwi | Mungwi Municipal Council | 12 participants, including 4 representatives from ZESCO, 2 from AMC and 6 from the Mungwi Town Council |
| May 24 | Mpika | Mpika Town Council | 12 participants, including 4 representatives from ZESCO, 2 from AMC and 6 from the Mapika Town Council |
| May 25 | Chitambo | Chitambo District Forestry Officer | 7 participants, including 4 representatives from ZESCO, 2 from AMC and 1 from the Chitambo Forestry Department |
| | Kanchibiya | Kanchibiya Town Council | 9 participants, including 4 representatives from ZESCO, 2 from AMC and 3 from the Kanchibiya Town Council |
| May 27 | Lavushimanda | Lavushimanda Town Council | 15 participants, including 4 representatives from ZESCO, 2 from AMC and 9 from the Lavushimanda Town Council |
| May 28 | Serenje | Chitambo District Forestry Officer | 7 participants, including 4 representatives from ZESCO, 2 from AMC and 1 from the Chitambo Forestry Department |
| | | Serenje Town Council and the Serenje District Forestry Department | 13 participants, including 5 representatives from ZESCO, 2 from AMC and 6 from the Serenje Council |

Meeting Nakonde City Council officials on May 20

Meeting Senga Hill City Council officials on May 21

Meeting Kasama Municipal Council officials on May 22

Meeting Kasama Forestry Department officials on May 22

Meeting Mungwi Forestry Department officials on May 23

Meeting Mungwi Council officials on May 23

Meeting Mpika Town Council officials on May 24

Meeting with Lavushimanda Town Council officials on May 27

Meeting with Serenje Council officials on May 28

Meeting with Chitambo District Forestry officials on May 28

### 7.8.3 KEY CONCERNS, EXPECTATIONS, AND ISSUES RAISED BY STAKEHOLDERS

During consultations, stakeholders raised the Project's issues, concerns, and expectations. Table 7-8 presents the key items raised during round 7 of consultations. Questions were answered during consultation meetings, but Table 7-8 outlines how concerns were taken into consideration in the update of studies.

**Table 7-8 Concerns Raised during Round 7 and Response**

| Theme | Concerns, expectations, and issues | Response and consideration in studies |
|---|---|---|
| Environmental and social management | – Stakeholders asked questions about the expected benefits of the Project to Zambia and affected regions and districts.<br>– Stakeholders inquired about the involvement of local authorities in the Project grievance management committee.Stakeholders requested the disclosure of the approved ESIA report. | Positive impacts are detailed in the updated ESIA (Chapter 6).<br>As per ZESCO's SEP, local authorities will be involved in the GRM Committee.<br>The disclosure of ESIA results is planned as part of ZESCO's SEP. |
| Resettlement and compensation | – The Kasama Lands Department indicated that ZESCO was not registering the land they had compensated and that this was a risk.<br>– The Kasama DC stated that other than the single complaint, no other household had been in contact asking for compensation-related assistance.<br>– The Kasama Department of Social Welfare has worked with PAPs, mainly around Kasama, to offer guidance as to spending compensations properly.<br>– Questions about the issue of the affected households on the 8 km stretch from the Kasama substation to Mpika Road.<br>– It was requested by the Resettlement Offices to involve the Forestry Department to assist in the valuation of timber trees and use a market-based approach based on the value of timber, particularly within forest reserves.<br>More insights on the resettlement process were asked, such as who will need to be resettled and if displaced people will be compensated. | Concerns regarding resettlement and compensation are addressed in the RCAP Audit (stand-alone report) for the Kasama-Nakonde stretch and in the RAP (stand-alone report) for the Kasama-Pensulo stretch.<br>Regarding the issue for the 8 km stretch, it has been resolved in July 2024 when compensation was paid. This will be further detailed in the RAP.<br>A market study to value affected assets, including trees, will be conducted as part of the RAP. |
| Project components | – The details on the Project timeline, route, type of infrastructure to be built, and size of the way leave, several stakeholders asked for.<br>– The stakeholders were particularly interested in knowing if the Project would alleviate the loading shedding problem.<br>– Stakeholders questioned if the Project has a component to rehabilitate the roads and crossing points.<br>– Stakeholders expressed interest in the planned construction camps. They asked if the facilities could be kept and used after completing the Project. | All details on project components are presented in the updated ESIA (Chapter 3). |
| Health and safety | – Resettlement Offices asked about the safety of the wayleave as some people have moved back after compensation, which was completed some time ago.<br>– Advised was given to the Project team that activities for mitigating HIV and AIDS should be included in the Project budget and that the District Aids Task Force (DATF) should be involved in implementing HIV mitigation programs. Assurance of the mitigation implementation was pointed out as a concern by stakeholders. | A Community Health and Safety Management Plan was developed as part of the ESMP's specific management plan to ensure the safety of communities in the presence of a high voltage transmission line as well as in the case of increased exposure to communicable diseases.<br>A measure was added to the specific plan to encourage the involvement of the DATF in the implementation of HIV mitigation programmes. |

| Theme | Concerns, expectations, and issues | Response and consideration in studies |
|---|---|---|
| Environment | – Stakeholders questioned if the Project would pay for the trees lost in Kanona Forest Reserve and if the reforestation sites have already been identified. Details were asked on the mitigation measures the Project foresees to reduce the impacts on the reserves.<br>The stakeholders' keen interest in understanding the Project's plans to mitigate potential environmental impacts, such as stream contamination, waste management, vegetation clearance, and biomass loss, was evident. They also sought clarity on the responsible entity for monitoring these measures; It was mentioned that the district forest office does not have adequate space to grow large quantities of seedlings. Therefore, the Project proponent was requested to support the construction of the district forest offices. | Several mitigation measures are provided to reduce the impacts of the Project on forest reserves, water contamination, and other key physical and biological components. Furthermore, specific management plans were developed to address those impacts and risks, including a Residual Material and Hazardous Products Management Plan, a Pollution Prevention Management Plan and a Biodiversity Management Plan. |
| Local economy | The stakeholders showed a significant interest in the potential job opportunities that the Project would create for the districts, highlighting their concern for the local economy. | Mitigation measures are proposed to maximize the creation of jobs, especially at the local level (see Chapter 6). |

# 8 REFERENCES

## TECHNICAL DATA


- AECOM, 2017. *Feasibility Study and Conceptual Design of Tanzania-Zambia Power Interconnection Study*. Final Feasibility Report – Volume 1 Report. Ref.: 60309266 EX-00574 DOC. 425 p.
- WSP, 2020a. *Zambia Tanzania Interconnector Project*. Consulting Services for Final Design and Bidding Document. Line Route Report. 106 p.
- WSP, 2020b. *Zambia Tanzania Interconnector Project*. Consulting Services for Final Design and Bidding Document. Preliminary Overhead Line Design Report. 108 p.
- WSP, 2020c. *Zambia Tanzania Interconnector Project*. Consulting Services for Final Design and Bidding Document. Substations Scoping Report. 209 p.


## PHYSICAL ENVIRONMENT


- Aalde, H. et al., 2006. Generic methodologies applicable to multiple land-use categories. In Eggleston, S., Buendia, L., Miwa, K., Ngara, T. and Tanabe, K. (Eds). *2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 4. Agriculture, Forestry and Other Land Use* (pp. 2.1-2.59). IPCC, Switzerland.
- Andersen, L.S., R.Unrug, 1984. *Geodynamic evolution of the Bangweulu Block, northern Zambia*.
- Chen, C., Gao, Y., and Liu, S., 2014. *Study on Noise Prediction Model and Control Schemes for Substation*. The Scientific World Journal, 7 pages.
- Climate Temp, 2019. Serenje. Mbala, Mpika, Kasama Climate. Available online at: http://www.serenje.climatemps.com/ accessed on 10 October 2019.
- Domke, G. et al. 2019. Forest Land. In Calvo Buendia, E., Tanabe, K., Kranje, A., Baasansuren, J., Fukuda, M., Ngarize, S., Osako, A., Pyrozhenko, Y., Shermanau, P. and Federici, S. (Eds). *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* (pp. 4.1-4.70). IPCC, Switzerland.
- Drysdall et al., 1972. A.R Drysdall, R.L Johnson, T.A Moore, J.G Thieme. *Outline of the geology of Zambia*. Geologie Mijnb., 51 (1972), pp. 265-275.
- European Commission and UNEP Grid-Geneva, 2024. interactive Country Fiches – Pollution (Air). Available online at: https://dicf.unepgrid.ch/zambia/pollution
- Finney, D. L., Marsham, J.H., Wilkinson, J. M., Field, P. R., Blyth, A. M., Jackson, L. S., et al., 2020. *African lightning and its relation to rainfall and climate change in a convection-permitting model*. Geophysical Research Letters, 47, e2020GL088163. https://doi.org/10.1029/2020GL088163
- Gange, M., 2011. Low-frequency and Tonal Characteristics of Transformer Noise. *Proceedings of Acoustics 2011*. Available online at: https://www.acoustics.asn.au/conference_proceedings/AAS2011/papers/p23.pdf Consulted on November 19, 2019.
- Government of Zambia, 2011. *The Water Resources Management Act 2011*. Available online at: Water Resources Management Bill (zambialii.org), Consulted on June 5, 2024.
- Hydro-Quebec, 2019. *The Power System and Health, Electric and Magnetic Fields*. Available online at: http://www.hydroquebec.com/fields/pdf/pop_23_01.pdf Consulted on November 19, 2019.
- International Finance Corporation (IFC). 2007. *Environmental, Health, and Safety (EHS) Guidelines*. Available online at: https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-en.pdf Consulted on June 5, 2024.

- JAICAF., 2008. *Agriculture and forestry in Zambia: Present situation and issues for development*. Akasaka,
- Lehner, B., 2020. WRPA Zambia GIS Data base. *Input data and resulting GIS layers of the Water Resources Protection Area (WRPA) assessment for Zambia*. 23 p.
- Libanda, B., & Paeth, H., 2023. *Modelling wind speed across Zambia: Implications for wind energy*. International Journal of Climatology, 43(2), 772–786. https://doi.org/10. 1002/joc.7826
- Marten, B.E., 1968, *The geology of the Chalabesa Mission area; Explanation of degree sheet 1131*, NW quarter. 23, Geological Survey Department of Zambia, Lusaka. 25p
- Researchgate, 2024. Topography of Zambia. Available online at: https://www.researchgate.net/figure/Topographic-map-of-Zambia-Source-author_fig1_351843041 Consulted on June 5, 2024.
- Trisos, C.H., I.O. Adelekan, E. Totin, A. Ayanlade, J. Efitre, A. Gemeda, K. Kalaba, C. Lennard, C. Masao, Y. Mgaya, G. Ngaruiya, D. Olago, N.P. Simpson, and S. Zakieldeen, 2022: Africa. In: Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [H.-O. Pörtner, D.C. Roberts, M. Tignor, E.S. Poloczanska, K. Mintenbeck, A. Alegría, M. Craig, S. Langsdorf, S. Löschke, V. Möller, A. Okem, B. Rama (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 1285–1455, doi:10.1017/9781009325844.011.
- World Bank Groups, 2007. Environmental, Health, and Safety Guidelines, Electric Power Transmission and Distribution. Available online at: https://www.ifc.org/content/dam/ifc/doc/2000/2007-electric-transmission-distribution-ehs-guidelines-en.pdf Consulted on June 5, 2024.
- World Bank, 2024. World Bank Climate Change Knowledge Portal. Available online at: https://climateknowledgeportal.worldbank.org/country/zambia. Consulted on June15, 2024.
- World Health Organization (WHO), 2021. WHO global air quality guidelines. Available online at: https://iris.who.int/bitstream/handle/10665/345329/9789240034228-eng.pdf?sequence=1. Consulted on June 5, 2024.


## BIOLOGICAL ENVIRONMENT


- Abedi-Lartey M., Dechmann D.K.N, Wikelski M, Scharf A.K., Fahr J., 2016. Long-distance seed dispersal by straw-coloured fruit bats varies by season and landscape. Global Ecology and Conservation 7: 12–24.
- ACR, 2018. African Chiroptera Report 2018. AfricanBats NPC, Pretoria. i-xvi + 1-8028 pp.
- Anderson, M.D., 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.
- Ansell, WFH, 1978. The mammals of Zambia. Chilanga, Zambia. National Parks and Wildlife Services, Chilanga, Zambia.
- Avian Power Line Interaction Committee (APLIC), 2012. Mitigating Bird Collisions with Power Lines: The State of the Art in 2012. Edison Electric Institute. Washington D.C.
- Bevanger, K. (1998). Biological and conservation aspects of bird mortality caused by electricity power lines: a review. *Biological Conservation, 86,* pp. 67–76.
- Birdlife International, 2024. Mediterranean/Black Sea Flyway factsheet. Available online at: http://datazone.birdlife.org/userfiles/file/sowb/flyways/5_Mediterranean_Black_Sea_Factsheet.pdfFlywa Consulted on June 5, 2024.
- BirdLife International. 2016a. Circus ranivorus. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22695352A93504602.en. Accessed on June 25, 2024.

- BirdLife International. 2016b. Bucorvus leadbeateri. The IUCN Red List of Threatened Species . Available online at: https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22682638A92955067.en. Accessed on June 25, 2024.
- BirdLife International. 2020a. *Terathopius ecaudatus. The IUCN Red List of Threatened Species*. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22695289A174413323.en. Accessed on June 13, 2024.
- BirdLife International. 2020b. Polemaetus bellicosus. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T22696116A172287822.en. Accessed on June 13, 2024.
- BirdLife International. 2021a. Aquila nipalensis. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22696038A205452572.en. Accessed on June 13, 2024.
- BirdLife International. 2021b. Torgos tracheliotos. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22695238A205352949.en. Accessed on June 13, 2024.
- BirdLife International. 2021c. Trigonoceps occipitalis. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22695250A205380033.en. Accessed on June 13, 2024.
- BirdLife International. 2021d. Gyps africanus. The IUCN Red List of Threatened Specie. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22695189A204461164.en. Accessed on June 13, 2024.
- BirdLife International. 2021e. Circus macrourus. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T22695396A201209093.en. Accessed on June 13, 2024.
- Bösenberg, J.D. 2022. Encephalartos schmitzii (errata version published in 2023). The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2022-1.RLTS.T41938A243432447.en. Accessed on June 13, 2024.
- Cooper-Bohannon, R., Mickleburgh, S., Hutson, A.M., Bergmans, W., Fahr, J. & Racey, P.A. 2020. Eidolon helvum. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2020-2.RLTS.T7084A22028026.en. Accessed on June 14, 2024.
- Crook, V. 2013. Ansellia africana. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2013-1.RLTS.T44392142A44437667.en. Accessed on June 25, 2024.
- CURRY, C.J., 2019. *S*neaky lions are moving across areas thought to be inhabitable for them causing high genetic diversity. The conservation. Available online at: https://theconversation.com/sneaky-lions-in-zambia-are-moving-across-areas-thought-uninhabitable-for-them-123504
- Darwall, W.R.T., Smith, K.G., Tweddle, D. and Skelton, P. (eds) (2009). The Status and Distribution of Freshwater Biodiversity in Southern Africa. Gland, Switzerland: IUCN and Grahamstown, South Africa: SAIAB. viii+120pp.
- Elephant Database. (2023). Elephant estimates. Retrieved January 8, 2024, Available online at: https://africanelephantdatabase.org/. Accessed on June 14, 2024.
- Fanshawe, D. B. 1971. The vegetation of Zambia. Government Printer, Lusaka. 67 pp. http://www.fao.org/3/J0628E/J0628E66.htm.
- FAO, 2002. Tropical secondary forest management in Africa: Reality and perspectives. Zambia Country Paper.
- FISHBASE, 2024. Biodiversity Zambia (ZMB). Retrieved June 8th from : https://www.fishbase.se/country/CountryInfo_Biodiversity.php?c_code=894

- GBIF.org (21st March 2024) GBIF Occurrence Download https://doi.org/10.15468/dl.2xy8cl.
- Gerkmann B. Kaatz M. Riede K. and Van Den Elzen R., 2008. The Luangwa Valley, Zambia: flyway and stopover site for White Storks *Ciconia ciconia*. Ostrich 79(2): 171–176.
- Global Conservation, 2024. African Forest Elephant. Available online at: https://globalconservation.org/endangered-species/african-forest-elephant. Accessed on June 16, 2024.
- Gobush, K.S., Edwards, C.T.T, Balfour, D., Wittemyer, G., Maisels, F. & Taylor, R.D. 2022. Loxodonta africana (amended version of 2021 assessment). The IUCN Red List of Threatened Species. Available online at:https://dx.doi.org/10.2305/IUCN.UK.2022-2.RLTS.T181008073A223031019.en. Accessed on June 13, 2024.
- Härkönen M. *et al*., 2015. Zambian mushrooms and mycology. Helsinki: Finish Museum of Natural History. Norrlinia, 29.
- Harris G., Thirgood S., Hopcraft J.G.C., Cromsigt J.P.G. and Berger J., 2009. Global decline in aggregated migrations of large terrestrial mammals. Endang Species Res. Vol. 7: 55–76, 2009.
- Hockey, P.A.R, Dean, W.R.J and Ryan, P., 2005. *Robert's birds of southern Africa (Vii) edition*. The John Voelcker Bird Book Fund, Johannesburg.
- International Finance Corporation (IFC). (2019). Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources., Available online at: https://www.ifc.org/content/dam/ifc/doc/2010/20190627-ifc-ps-guidance-note-6-en.pdf. Retrieved January 12, 2024
- IUCN SSC Antelope Specialist Group. 2016. Kobus vardonii. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T11037A50189881.en. Accessed on June 25, 2024.
- IUCN SSC Antelope Specialist Group. 2017. Hippotragus equinus. The IUCN Red List of Threatened Species. Available online at: https://dx.doi.org/10.2305/IUCN.UK.2017-2.RLTS.T10167A50188287.en. Accessed on June 12, 2024.
- IUCN SSC East African Plants Red List Authority. 2019. Disa aequiloba. The IUCN Red List of Threatened Species Available online at: https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T179400A1577282.en. Accessed on June 16, 2024.
- Jachmann, H. (2000) Zambia's Wildlife Resources: A Brief Ecology. Wildlife Resource Monitoring Unit Handbook No. 2, Environmental Council of Zambia, Lusaka, Zambia.
- Jacques, H., Reed-Smith, J. & Somers, M.J. 2021. Aonyx capensis. The IUCN Red List of Threatened Species 2021: e.T1793A164575819. https://dx.doi.org/10.2305/IUCN.UK.2021-3.RLTS.T1793A164575819.en. Accessed on June 12, 2024.
- Jenkins, A.R., Smallie, J.J. & Diamond, M., 2010. *A*vian collisions with powerlines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 20: 263-278.
- Kaseloo, P.A., 2006. *Synthesis of noise effects on wildlife populations*. In: Proceedings of the 2005 International Conference on Ecology and Transportation; Irwin, C.L., Garrett, P. & McDermott, K.P. (eds). Centre for Transportation and the Environment: North Carolina State University, Raleigh, North Carolina. pp. 33-35.KEMP, L. V. *Conservation biology and molecular ecology of the Southern Ground-Hornbill* (Bucorvus leadbeateri). (University of the Free State, 2017).
- King, S.R.B. & Moehlman, P.D. 2016. Equus quagga. The IUCN Red List of Threatened Species 2016: e.T41013A45172424. https://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T41013A45172424.en. Accessed on June 12, 2024.
- Kingdon, J., Happold, D.C., D., Butynski, T.M.., Hoffmann, M., Happold, M. And Kalina, J., 2013a. Mammals of Africa Volume V: Carnivores, Pangolins, Equids and Rhinoceroses. Bloomsburg Publishing, London.

- Kingdon, J., Happold, Dc D., Butynski, Tm., Hoffmann, M., Happold, M. and Kalina, J., 2013b. *M*ammals of Africa Volume VI: Pigs, Hippopotamuses, Chevrotain, Giraffes, Deer and Bovids. Bloomsburg Publishing, London.
- Lindsey, P., Nyirenda, V., Barnes, J., Becker, M., Tambling, C., Taylor, A., Watson, F. (2009). *Z*ambian Game Management Areas: The reasons why they are not functioning as ecologically or economically productive buffer zones and what needs to change for them to fulfil that role, Lusaka, Zambia.
- Lindsey, P.A., V. R. Nyirenda, Barnes, J.I., Becker,M.S, Mcrobb, R., Tambling, C.J., Taylor, W.A. [9] Watson, F.G., Sas-Rolfes, M., 2014. Underperformance of African Protected Area Networks and the Case for New Conservation Models: Insights from Zambia. Published online May 21, 2014. doi: 10.1371/journal.pone.0094109.
- Malambo and Syampungani, 2008. Opportunities and challenges for sustainable management of miombo woodlands: the Zambian perspective.
- Martin, G.R., Shaw, J.M., 2010. Bird collisions with powerlines: Failing to see the way ahead? Biol. Conserv. (2010), doi:10.1016/j.biocon.2010.07.014.
- Mayaux, P., Gond, V., Massart, M., Pain-Orcet M. and Achard, F., 2003. Évolution du couvert forestier du bassin du Congo mesurée par télédétection spatiale, Bois et Forêts des tropiques, 277 : 45-52.
- Mickels-Kokwe, G., 2006. Small-scale woodland based enterprises with outstanding economic potential: the case study of honey in Zambia. CIFOR, Bogor, Indonesia.
- Millennium Ecosystem Assessment (MEA). (2005). Ecosystems and Human Well-Being: Synthesis. Retrieved April 10, 2023, from Millennium Ecosystem Assessment: https://www.millenniumassessment.org/documents/document.356.aspx.pdf/.
- Ministry of Lands, Natural Resources and Environmental Protection Zambia (MLNREP), 2012 : Forestry department. Available online : http://theredddesk.org/countries/actors/forestry-department-zambia. Consulted on June 5, 2024.
- Moelants, T. 2010. Chiloglanis elisabethianus. The IUCN Red List of Threatened Species Available online at: https://dx.doi.org/10.2305/IUCN.UK.2010-3.RLTS.T181615A7689869.en. Accessed on June 12, 2024.
- Monadjem A, Cohen L, Jacobs D, Macewan K, Richards Lr, Schoeman C, Sethusa T, Taylor Pj., 2016. A conservation assessment of Eidolon helvum. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
- Monadjem A, Taylor Pj, Cotterill Fpd, & Schoeman Mc., 2010. Bats of Southern and Central Africa: A Biogeographic and Taxonomic Synthesis. University of Witwatersrand Press, Johannesburg.
- Morkill, A.E. and S.H. Anderson. 1991. Effectiveness of Marking Powerlines to Reduce Sandhill Crane Collisions. Wildlife Society Bulletin 19:442-449MUNDY P, BUTCHART D, LEDGER J, and S PIPER, 1992. The vultures of Africa. Acorn Books. Randburg.
- Ogle, S. et al. (2019). Cropland. In Calvo Buendia, E., Tanabe, K., Kranje, A., Baasansuren, J., Fukuda, M., Ngarize, S., Osako, A., Pyrozhenko, Y., Shermanau, P. and Federici, S. (Eds). *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories* (pp. 5.1-5.102). IPCC, Switzerland.
- One Earth (2024). Zambezian Flooded Grasslands. Available online at: https://www.oneearth.org/ecoregions/zambezian-flooded-grasslands/ Consulted on June 5, 2024.
- One Earth (2024a). Greater African Subequatorial Savannas & Mixed Woodlands Bioregion. Available online at: https://www.oneearth.org/bioregions/greater-african-subequatorial-savannas-mixed-woodlands-at11/. Consulted on June 5, 2024.
- One Earth (2024b). Central Zambezian Wet Miombo Woodlands. Available online at: https://www.oneearth.org/ecoregions/central-zambezian-wet-miombo-woodlands. Consulted on June 5, 2024.

- Phiri, P.S.M. 2005. A checklist of Zambian vascular plants. Southern African Botanical Diversity Network Report No. 32. SABONET, Pretoria.
- Pietersen, D., Moumbolou, C., Ingram, D.J., Soewu, D., Jansen, R., Sodeinde, O., Keboy Mov Linkey Iflankoy, C., Challender, D. & Shirley, M.H. 2019. Phataginus tricuspis. The IUCN Red List of Threatened Available online at: https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T12767A123586469.en. Accessed on June 13, 2024.
- Pocock, Z. & Lawrence, R.E., 2006. *H*ow far into a forest does the effect of a road extend? Defining road edge effect in eucalypt forests of South-Eastern Australia. In: Proceedings of the 2006 International Conference on Ecology and Transportation; Irwin, C.L., Garrett, P. & McDermott, K.P. (eds). Centre for Transportation and the Environment: North Carolina State University, Raleigh, North Carolina. pp. 397-405.
- Richter HV, Cumming GS, 2008. First application of satellite telemetry to track African straw-coloured fruit bat migration. Journal of Zoology 275:172–176.
- Richter, H. V. & Cumming, G. S., 2006. Food availability and annual migration of the straw-colored fruit bat (Eidolon helvum), Journal of Zoology 268 (2006) 35–44.
- Roach, G.L. & Kirkpatrick, R.D., 1985.Wildlife use of roadside woody plantings in Indiana. Transp. Res. Rec. 1016: 11-15.
- Shaw, J.M. 2013. *Powerline collisions in the Karoo: Conserving Ludwig's Bustard. Unpublished PhD thesis*. Percy FitzPatrick Institute of African Ornithology, Department of Biological Sciences, Faculty of Science University of Cape Town May 2013.
- Simasiku, P., Simwanza, H.I. Tembo G., Opadhyay, S.B. and Pavy, J-M., 2008. *T*he impact of wildlife management policies on communities and conservation in Game Management Area in Zambia, Lusaka, Zambia, Natural Resources Consultative Forum (NRCF). 48 p.
- Skinner, J.D., Chimimba, C.T. (Eds), 2005. The Mammals of the Southern African Subregion. 3rd Edition. Cambridge University Press, Cambridge.
- Southern African Bird Atlas Project 2 (SABAP2). http://sabap2.adu.org.za. Accessed 24 September 2019.
- Sundar, K.S.G. & Choudhury, B.C. (2005). Mortality of Sarus Cranes (Grus antigone) due to electricity wires in Uttar Pradesh, India. Environ. Conserv. 32, 260-269.
- Thiollay, J.M. (2006). The decline of raptors in West Africa: long-term assessment and the role of protected areas. *Ibis, 148*, 240-254.
- Thouless, C.R., H.T. Dublin, J.J. Blanc, D.P. Skinner, T.E. Daniel, R.D. Taylor, F. Maisels, H. L. Frederick and P. Bouché (2016). African Elephant Status Report 2016: an update from the African Elephant Database. Occasional Paper Series of the IUCN Species Survival Commission, No. 60 IUCN / SSC Africa Elephant Specialist Group. IUCN, Gland, Switzerland. vi + 309pp.
- United Nations Environment Program (UNEP)/Convention On Migratory Species (CMS), 2012. *A* Bird's Eye View on Flyways: A brief tour by the Convention on the Conservation of Migratory Species of Wild Animals. Second Edition. UNEP / CMS Secretariat. Bonn.
- USFWS, 2002. Migratory bird mortality. US Fish and Wildlife Service, Arlington, Virginia. (Avian mortality fact sheet: http://birds.FWS.gov/ mortality-fact-sheet.pdf).
- Van Rooyen, C.S., 2004a. *The Management of Wildlife Interactions with overhead lines*. In The fundamentals and practice of Overhead Line Maintenance (132kV and above), pp217-245. Eskom Technology, Services International, Johannesburg.
- Van Rooyen, C.S., 2004b. Investigations into vulture electrocutions on the Edwardsdam-Mareetsane 88kV feeder, Unpublished report, Endangered Wildlife Trust, Johannesburg.
- Weaver Watch, 2024. Bar winged Weaver. Available online at: https://weavers.adu.org.za/sp.php?spp=795. Consulted in June 2024.

- Webala Pw, Musila S, Makau R., 2014. Roost occupancy, roost site selection and diet of straw-coloured fruit bats (Pteropodidae: Eidolon helvum) in western Kenya: the need for continued public education. Acta Chiropterologica 16:85–94.
- Willems, F. and Leonard, P., 2019. Zambian IBA & NP checklists. BirdWatch Zambia.
- Wolter, K. Phipps, L. & Naidoo, V. 2010. Foraging and distribution ranges of Cape Vultures (Gyps coprotheres) in the Greater Pilanesberg region. Report NR: RES/RR/09/31609. Eskom Research and Innovation Department.
- World Bank Group (WBG). (2017). World Bank Environmental and Social Framework. World Bank Group: Washington, D.C., United States. 106 pages.
- World Bank, 2009. *C*ommunity Consultation Report and Community Stakeholders Profile for: Extension of Kasanka Management System to Lavushi Manda National Park. Serenje, Kasanka Trust limited.
- World Wildlife Fund (WWF), 2024. *Miombo woodlands*. Retrieved from: https://wwf.panda.org/knowledge_hub/where_we_work/miombo_woodlands/s.
- ZAMBIA WILDLIFE AUTHORITY (ZAWA) And KASANKA TRUST LTD, 2014. Lavushi Manda National Park General Management Plan 2014-2024 *FIRST DRAF*T.


## SOCIAL ENVIRONMENT


- African Development Bank (AfDB). 2013. Integrated Safeguards System: Policy Statement and Operational Safeguards. African Development Bank Group: Tunis, Tunisia. 51 pages.
- Avert, 2019. Hiv and aids in Zambia. Available online at: https://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/zambia. Consulted on June 5, 2024
- Central Statistical Office (CSO), 2012. Zambia 2010 Census of Population and Housing, National Analytical Report. 117 pages. Available online at: http://www.zamstats.gov.zm/phocadownload/2010_Census/2010%20Census%20of%20Population%20National%20Analytical%20Report.pdf. Consulted on October 16, 2017
- Central Statistical Office (CSO), 2011. Living Conditions Monitoring Survey, 2006 and 2010. 282 pages.
- Central Statistical Office (CSO), 2016. Living Conditions Monitoring Survey, 2015.
- CommonWealth war graves, 2023. The final hour: the end of the first world war in Africa. Available online at: https://www.cwgc.org/our-work/blog/the-final-hour-the-end-of-the-first-world-war-in-africa/. Consulted on June 5, 2024
- FAO. 2018. Zambia: National gender profile of agriculture and rural livelihoods Zambia.
- FIG Congress (author: Nsama Nsemiwe). 2006. Gender Dimension of Land Customary Inheritance under Customary Tenure in Zambia. Shaping th Change XXIII FIG Congress. Munich, Germany October 8-13, 2006. Available online at: Microsoft Word - ps07_04_nsemiwe_0731.doc (fig.net). Consulted in May 2024
- Food and Agriculture Organization of the United Nations/ United Nations Educational, Scientific and Cultural Organization (FAO/UNESCO), 1974. Key to the FAO Soil Units. Available online at: https://www.fao.org/soils-portal/data-hub/soil-classification/fao-legend/key-to-the-fao-soil-units/ru/. Retrieved January 15, 2024,
- Freeman, E., Coast, E., & Murray, S. (2017). Men's Roles in Women's Abortion Trajectories in Urban Zambia. International Perspectives on Sexual and Reproductive Health, 43(2), 89-98. doi:10.1363/43e4017
- Freeman, E., Coast, E., & Murray, S. (2017). Men's Roles in Women's Abortion Trajectories in Urban Zambia. International Perspectives on Sexual and Reproductive Health, 43(2), 89-98. doi:10.1363/43e4017.
- International Labour Organization, 2008. HIV/AIDS and the construction guidelines / International Labour Office, Sectoral Activities Branch, ILO Programme on HIV/AIDS and the World of Work.

- Jayachandran, S., 2014. *The Roots of Gender Inequality in Developing Countries*. Annual Review of Economics. Available online at: http://faculty.wcas.northwestern.edu/~sjv340/roots_of_gender_inequality.pdf. Consulted on October 16, 2017.
- Ministry of Education, 2020. Education Statistics Bulletin. Available online at: EDUCATION-STATISTICS-BULLETIN-2020.pdf. Consulted on June 19, 2024.
- Ministry of Health, 2018. Zambia Demographic and Health Survey. Zambia Demographic and Health Survey 2018 - Available online at: Key Indicators Report [PR113] (zamstats.gov.zm). Consulted on June 19, 2024.
- Ministry of Health, 2021. Zambia Population based HIV Impact Assessment Report. Available online at: ZAMPHIA-2021-Final-Report-December-2023.pdf (zamstats.gov.zm). Consulted on June 19, 2024.
- Ministry of Health, 2024. Zambia Master Facility List. Available online at: MFL | Home (moh.gov.zm). Consulted on June 19, 2024.
- Ministry of Health, Zambia. Zambia Population-based HIV Impact Assessment (ZAMPHIA) 2021: Final Report. Lusaka, Ministry of Health, DECEMBER 2023.
- Ministry of Health, Zambia. Zambia Population-based HIV Impact Assessment (ZAMPHIA) 2021: Final Report. Lusaka, Ministry of Health, DECEMBER 2023.
- Ministry of Youth, Sport and Child Development, Ministry of Community Development and Social Services, University of Zambia, United Nations Children's Fund, Save the Children International, United States Centers for Disease Control and Prevention, Violence against Children in Zambia, 2018. Findings from a national survey, 2014, Ministry of Youth, Sport and Child Development, Lusaka, 2018.
- Mutinondo Wilderness, 2024. "Mutinondo Wilderness". Available online at: http://www.mutinondozambia.com/main_frame.htm. Consulted on June 22, 2024.
- National Aids Council, 2016. Planning and Implementation Guidelines of HIV&AIDS Component in Road Contracts.
- National Aids Council, 2022. Community management of HIV and AIDS, TB, Gender and Human Rights coordination tool kit for local authorities
- National Heritage Conservation Commission, 2020. Heritage Impact Assessment for the Extension of the Wayleave of the 330 kV Transmission Line at the Mwela Rock Art National Monument, Kasama.
- National Heritage Conservation Commission, nd. Draft Landscape and Visual Impact Assessment for the proposed ZESCO Transmission Line Project, Tanzania-Zambia A Component of Mwela Rock Art National Monument Heritage Impact Assessment.
- Norway, 2012. "10 Norway's support to Zambia's natural and cultural heritage and museums made positive impact". Available online at: http://www.norway.org.zm/News_and_events/norwayzambia/Project-Archives/Visit-to-Heritage-Sites---Northern-Province-Zambia/#.U1asg_l5N8E. Consulted on April 22, 2014.
- Population Council, UNFPA, Government of Zambia Human Rights Commission, and WLSA. 2017. "The Status of Sexual and Reproductive Health and Rights in Zambia: Contraception and Family Planning, Preventing Unsafe Abortion and Accessing Postabortion Care, and Maternal Health Care." Lusaka, Zambia.
- Republic of Zambia. Ministry of Gender. 2019. GENDER STATUS REPORT 2017-19. Available online at:: giz2021_en_zambia_gender_report_2017-2019.pdf.
- Swedish International Development Cooperation Agency (SIDA), 2008. *SIDA* Gender Country Profile – Zambia. 64 pages
- UNESCO, 2015. "*Mwela Rock Paintings*". Available online at: http://whc.unesco.org/fr/listesindicatives/5425/. Consulted on 22nd April 2014.

- USAID, n.d. "*Zambia property rights and resource governance*". http://pdf.usaid.gov/pdf_docs/PA00J7TX.pdf. Consulted on June 22, 2024.
- USAID/Zambia, 2010. Gender-Based Violence Programming Evaluation Available online: https://pdf.usaid.gov/pdf_docs/pdacr569.pdf.
- WIKIPEDIA, 20124a "Zwangendaba". http://en.wikipedia.org/wiki/Zwangendaba. Consulted on June 15, 2024.
- Word Bank (WB), 2022. World Bank Guidance Good Practice Note on Sexual Exploitation and Abuse and Sexual Harassment in Investment Project Financing involving Major Civil Works. Available online at : https://thedocs.worldbank.org/en/doc/e2ff01be0f07c82d73bc0c5e7ddf394f-0290032022/original/ESF-Good-Practice-Note-on-Addressing-SEA-SH-in-HD-Operations-First-Edition-September-16-2022.pdf
- World Bank, 2022. Environmental & Social Framework for IPF Operations: Addressing Sexual Exploitation and Abuse and Sexual Harassment (SEA/SH) in Investment Project Financing Involving Major Civil Works. Third Edition. October 2022.
- World Bank Group. 2017. World Bank Environmental and Social Framework. World Bank Group: Washington, D.C., United States. 106 pages.
- WORLD BANK, 2009. Environmental and social impact assessment. Zambia. Available online at: http://documents.worldbank.org/curated/en/542031468340155638/Zambia-Extension-of-Kasanka-Management-System-to-Lavushi-Manda-National-Park-Project. Consulted on June 5, 2024.
- World Bank. 2023. Zambia Gender Assessment. The International Bank for Reconstruction and Development/THE WORLD BANK. Washington, DC, USA.
- World Health Organization Statistics, 2019. Health data overview for the Republic of Zambia. Zambia Available online at: (who.int). Consulted on June 19, 2024.
- World Health Organization, 2019. Health data overview for the Republic of Zambia. Available online at: Zambia (who.int). Consulted on June 19, 2024.
- World Health Organization, 2016. Radiation: Electromagnetic fields. Available online at https://www.who.int/news-room/questions-and-answers/item/radiation-electromagnetic-fields. Consulted June 20, 2024.
- Zambia Forestry Forest Industries Corporation, 2024. Company website. ZAFFICO – Timber is Our Business!. Consulted on June 19, 2024.
- Zambia Statistics Agency, 2015. Zambia Living Conditions Surveys Report.
- Zambia Statistics Agency, 2016. Living Condition Monitoring Survey Report 2015.
- Zambia Statistics Agency, 2019. Labour Force Survey Report. Available online at:2019-Labour-Force-Report.pdf (mlss.gov.zm). Consulted on June 19, 2024.
- Zambia Statistics Agency, 2022. Highlights of the 2022 Poverty Assessment in Zambia. Available online at: Highlights-of-the-2022-Poverty-Assessment-in-Zambia-2023.pdf (zamstats.gov.zm). Consulted on June 19, 2024.
- Zambia Statistics Agency, 2022. Zambia Census of population and Housing: Preliminary Report. 2022-Census-of-Population-and-Housing-Preliminary.pdf (zamstats.gov.zm). Consulted on June 19, 2024.
- Zambia Statistics Agency, 2022. Zambia Demographic and Health Survey.
- Zambia Statistics Agency, Ministry of Labour and Social Security Zambia. 2020. *2019 Labour Force Survey Report*. Lusaka, Zambia.
- Zambia Statistics Agency. 2022. *Preliminary Report: 2022 Census of Population and Housing*. Lusaka, Zambia.
- Zambia Statistics Agency. 2023. *2022 Poverty Assessment in Zambia: Key Highlights*. Lusaka, Zambia.

- ZAMBIA TOURISM, 2015. “Monuments and Historic Sites”. Available online at: http://www.zambiatourism.com/destinations/historic/monuments. Consulted on April 21, 2014.
- ZamStats, Ministry of Community Development and Social Services. 2018. Zambia National Disability Survey 2015: The second national study on disability in Zambia.
- ZESCO, 2024. Zambia - Tanzania Interconnector Project Stakeholder Engagement Plan. 29 p.