ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

TRANSMISSION LINE FOR UNIKA I WIND FARM PROJECT

Katete, Eastern Province, Zambia

Prepared for: Mphepo Power Limited

MPHEPO POWER

SLR Project No.: 710.13089.00001
Report No.: 004
Revision No.: 02
February 2022

SLR

DOCUMENT INFORMATION

Title	Environmental and Social Impact Assessment: Transmission Line for the Unika I Wind Farm, Zambia
Project Manager	Conroy van der Riet
Project Manager Email	cvanderriet@slrconsulting.com
Author	Conroy van der Riet
Reviewer	Stuart Heather-Clark
Keywords	Mphepo, Transmission, Zambia
Status	Draft
Report No.	004
SLR Company	SLR Consulting (Africa) (Pty) Ltd

DOCUMENT REVISION RECORD

Rev No.	Issue Date	Description	Issued By
001	20 September 2021	Draft report for Client Comments	CvdR
002	03 February 2022	Draft report for Public Review	CvdR

BASIS OF REPORT

This document has been prepared by an SLR Group company with reasonable skill, care and diligence, and taking account of the manpower, timescales and resources devoted to it by agreement with **Mphepo Power Limited** (the Client) for part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid. SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work. The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise. This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

NON-TECHNICAL SUMMARY

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

TRANSMISSION LINE FOR THE UNIKA 1 WIND FARM, ZAMBIA

NON-TECHNICAL SUMMARY

INTRODUCTION

Mphepo Power Limited ("Mphepo") is a registered company in Zambia .

Mphepo will be the Development Company while "Unika I" will be the Special Purpose Vehicle (SPV) to be established for the Project.

Mphepo proposes to develop a wind farm facility near Katete, Eastern Province, Zambia (Unika I Wind Farm), which is covered in a separate Environmental and Social Impact Assessment (ESIA). As part of this Unika I Wind Farm project it is also proposed to build a 330 kV transmission line (TL) running from the on-site Unika substation (to be built) to the existing Msoro substation located approximately 30 km north-west of the wind farm site.

SLR Consulting (Africa) (Pty) Ltd (SLR), in collaboration with DH Engineering Consultants Ltd, has been appointed as the independent Environmental Assessment Practitioner to compile an ESIA for this project.

PURPOSE AND SCOPE OF THIS DOCUMENT

This Non-Technical Summary has been compiled as a summary of the ESIA Report. It summarises the following:

- The impact assessment process including the stakeholder engagement undertaken;
- The relevant environmental laws and regulations, including international requirements;
- The project site and associated environmental and social features;
- The proposed project components and activities;
- The predicted impacts and their significance ratings; and
- The proposed mitigation and enhancement measures to mitigate and optimise the identified impacts.

ENVIRONMENTAL ASSESSMENT AND AUTHORISATION

The Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, 1997 provides the rules, regulations, and procedures for conducting Environmental Impact Assessments (EIAs).

In terms of the Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, 1997 the submission of an "Environmental Impact Statement" (EIS) is required following the Scoping Phase.

The project must also be designed and implemented in accordance with International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012), which includes IFC Performance Standards 1 to 8 and relevant World Bank Environment Health and Safety (EHS) Guidelines.

As this process is required to follow local as well as international standards in order to access funding, the EIS will be referred to as an "Environmental and Social Impact Assessment Report" (ESIA Report) and be aligned with local legislation as well as the International Finance Corporation (IFC) Performance Standards (PSs). The Scoping Report was approved by ZEMA in November 2019 (Ref No. ZEMA/INS/101/4/1) and the Terms of Reference for the ESIA for the transmission line was approved by ZEMA in November 2020 (ZEMA/FAC/105/12/05/M/45). As separate ESIA has been compiled for the Wind Farm.

The ESIA process involved specialist data gathering, site visits and consultation with affected stakeholders to identify issues of concern that need to be addressed as part of the ESIA.

PROJECT DESCRIPTION

Overview of the Project

The TL will start at the proposed Unika 1 Wind Farm (at the substation to be built). The Unika Wind I Farm site is located directly north of Katete (Eastern Province, Zambia), and ± 440 km east of Lusaka, Zambia (refer to Figure 1). The TL will terminate at the Msoro Substation located approximately 30 km north of the wind farm site (see Figure 2). A typical 330 kV TL tower design is shown below:

The TL is required to enable the proposed Unika I Wind Farm to export the generated electricity to the National Grid. The need to meet the growing energy demand from Zambia's growing economy and the large number of un-electrified households (especially in rural areas) has been the major driver towards the introduction of renewable energy technology in the country. The Wind Farm project would provide significant support to the area as infrastructure in the area is limited and the Eastern Province currently contributes less than 5 % to the GDP. The Wind Farm project could also contribute to stabilising the power grid, reduce losses and provide power in provinces within Zambia that currently do not have significant generation capacity. The Wind Farm project would also assist in power supply during periods when hydroelectric resources are low (particularly during the drier season).

Consideration of Alternatives

During the planning phase of the Project a number of transmission line alternatives were considered. Throughout the assessment of these alternatives the following criteria were used:

- Ecological sensitivity including priority fauna and flora, and habitats;
- Social and community sensitivity, including land ownership, land use and proximity to communities;
- Financial criteria, including life cycle costs balanced against initial capital expenditure and operational costs; and
- Technical criteria, including whether the options can be efficiently implemented, maintained and operated.

A total of six transmission line route alternatives to connect the Unika I Wind Farm site to the Msoro Substation were considered initially. This was refined based on environmental, social and technical constraints, and currently there are two transmission line route alternatives that are considered, shown by the red (Option 01) and blue dashed (Option 2) lines in Figure 2.

No Go alternative: The no-go alternative is for the Project (i.e. the Transmission Line) is not to be developed. This would prevent the implementation of the Unika Wind Farm Project and the generation and transmission of power supply into the national grid. Should the Project not move forward, then the benefits of improved power supply and associated positive environmental, social and economic benefits of the Unika Wind Farm would not be realised. This is not a preferable option.

Figure 1: Location of the Unika Wind Farm Project Site (starting point of the TL)

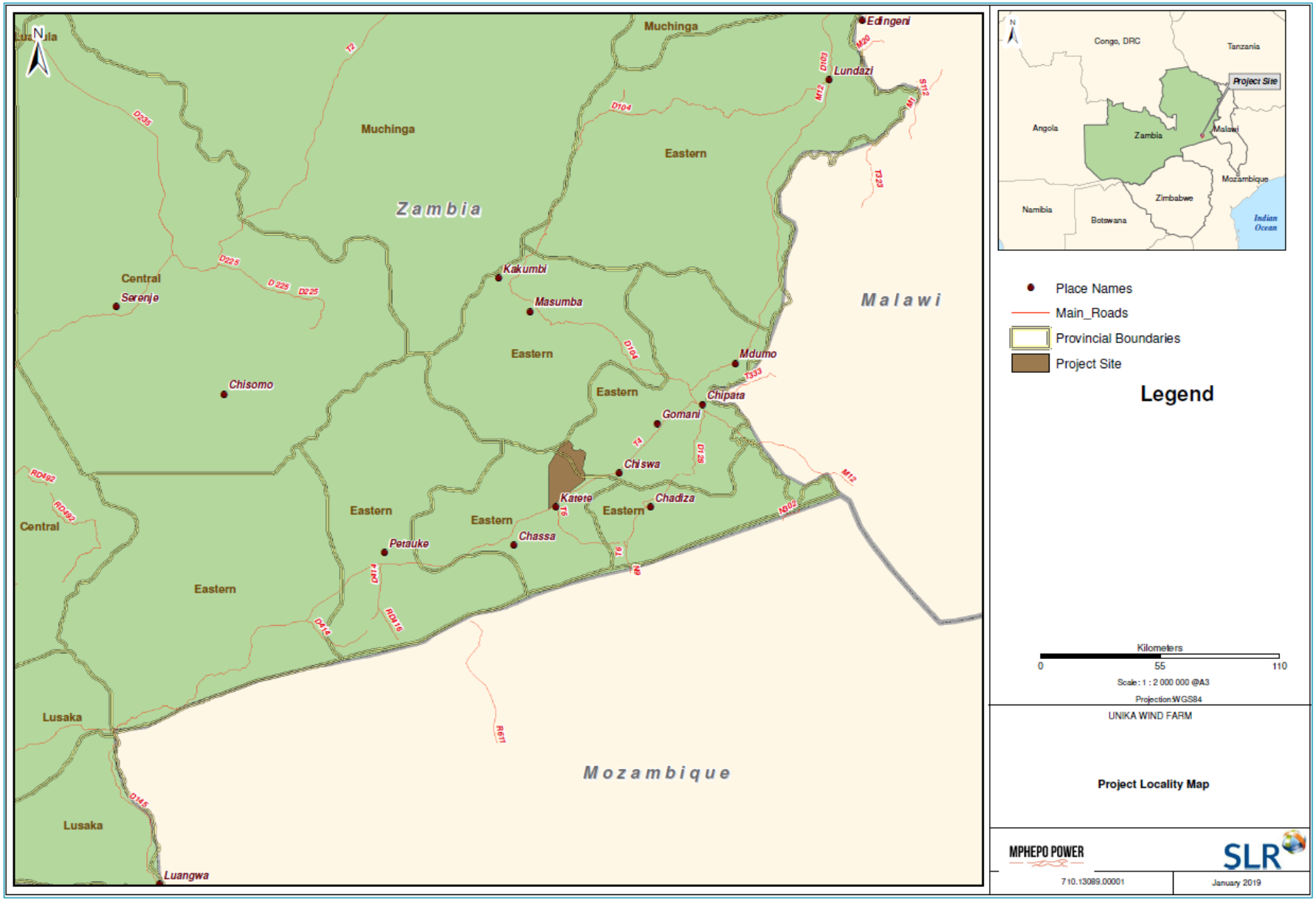
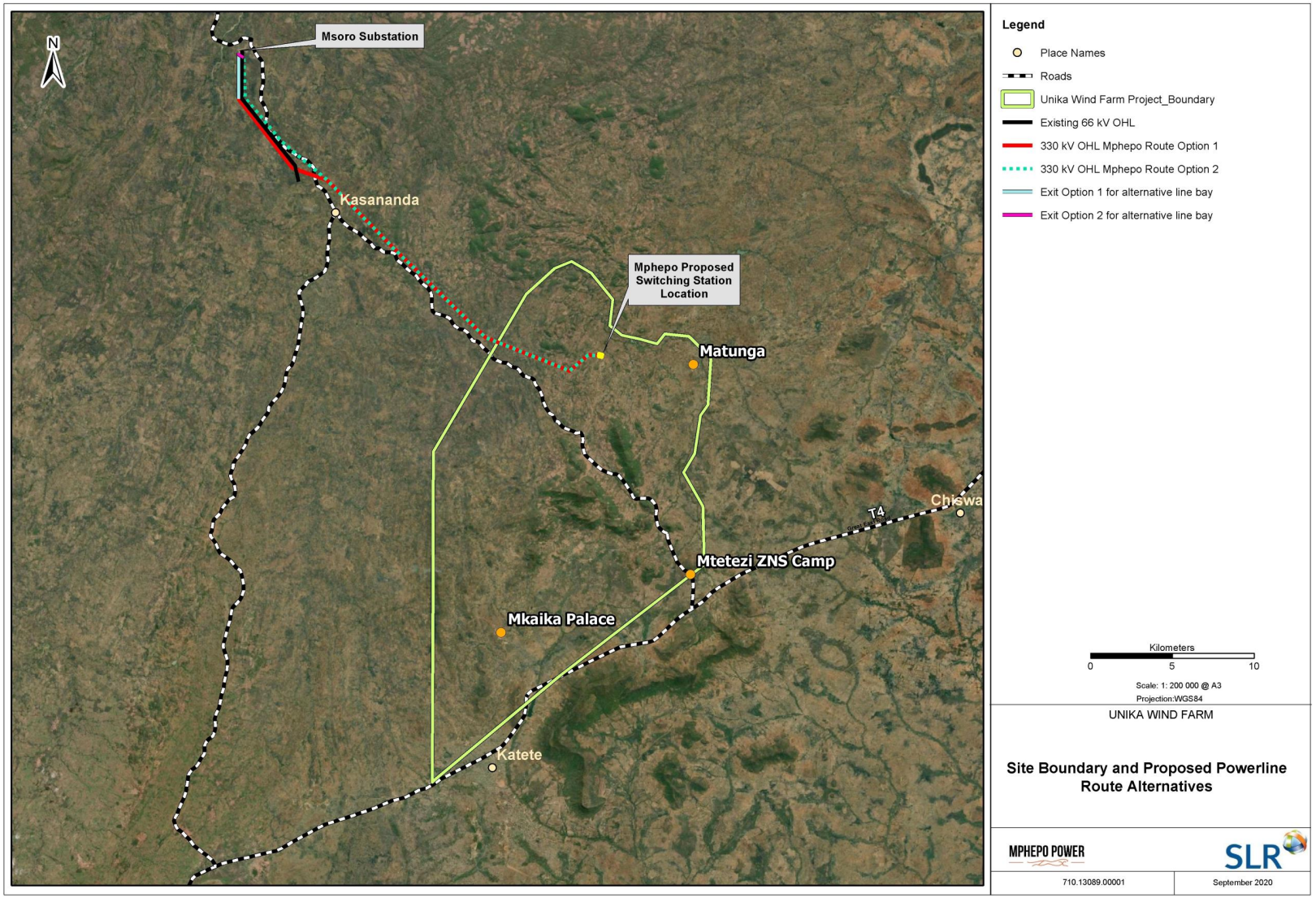


Figure 2: The Unika Wind Farm Project Site and Transmission Line Route Options



Description of the Project

The project entails the construction of a 330 kV Transmission Line (TL). The TL will start at the proposed wind farm site substation. The wind farm site is located directly north of Katete (Eastern Province, Zambia), and ± 440 km east of Lusaka, Zambia. The TL will terminate at the Msoro Substation located approximately 30 km north of the Wind Farm site. The main access road is the T4 National Road (Great East Road), which is main route connecting the Zambian capital of Lusaka to the smaller towns of Nyimba, Katete and Chipata in the east.

The Project will need to secure all land required for the establishment of a 55.2-m wayleave (including the Feeder Bay and Exit Routes). The total land requirements are estimated to be 173 hectares on both the TL route options, and in both TL options it comprises of communal land or land under small-scale agriculture.

Site Preparation and Construction Phase

Prior to initiating construction, a number of other surveys may also be required including, but not limited to, topographic surveys, surveys to confirm the tower locations and footprint, and wayleave surveys to confirm land-use, number of trees to be removed and affected communities.

Vegetation clearance along the TL wayleave will be required to facilitate access, construction and the safe operation of the TL. A Forest Resource Assessment has been completed by the by the Forestry Department. Vegetation removal and excavations are also required at the footprints of the tower foundations. Excavation activities will require the stripping of topsoil, which will need to be stockpiled for rehabilitation later on. Site preparation will be undertaken in a systematic manner to reduce the risk of erosion. In addition, site preparation will include search and rescue of floral species of concern (where required).

The construction phase will be initiated following the completion of site preparation activities. The construction phase mainly will include the following activities:

- Construction of site substation foundations and installation of site substation plant and equipment;
- Construction of tower foundations;
- Assembly and erection of towers;
- Stringing and regulation of conductors;
- Site de-establishment and clean up;
- Progressive rehabilitation of disturbed areas;
- Final inspection of the transmission line and handover to ZESCO.

The construction phase is estimated to take approximately 18 months to complete

Operational Phase

The transmission line will be in operation immediately after completion of successful testing and will remain operational for the lifetime of the Unika Wind Farm project (expected to be at least 25 years). Subsequent maintenance and refurbishment would normally occur during the operational lifetime of the transmission line. Operation of the transmission line will require routine maintenance work that necessitates the utilisation of access roads that will be created mostly along the wayleave of the TL.

From time to time it may be necessary to clear vegetation to facilitate access for maintenance and the safe operation of the transmission line.

Decommissioning

When the TL is decommissioned (expected to be over 25 years at this stage), all components will be removed and the site rehabilitated. Where possible all materials will be recycled, otherwise they will be disposed of in accordance with local regulations and international best practice in force at that time.

AFFECTED ENVIRONMENT

Biophysical Environment

In general the Project Site is comprised of a landscape of tall forested hills, elevated ridges and low-undulating hills, with broad, flat valleys extending between the hills. The valleys in-turn supports a number of ephemeral streams and well as seasonally flooded wetlands.

Various small passerine birds, large terrestrial birds and raptors were identified. one raptor species (Common or Steppe Buzzard) and at least 6 passerines (European Bee-eater, Southern Carmine Bee-eater, Barn Swallow, House Martin, Brown-throated Martin, African Palm Swift) showed signs of migrating over the area. In the case of Steppe Buzzard this presents increased transmission line collision risk as compared to the remainder of the year, but not to the extent typically associated with migration events. Small passerines do not pose a high risk of collision with transmission lines. The species listed below have been identified as being of topmost priority, based on records showing flight over the project area in excess of twenty times each during the year.

- Steppe (Common) Buzzard (IUCN – LC)
- Augur Buzzard (IUCN – LC)
- Brown Snake-Eagle (IUCN – LC)
- Black-chested (breasted) Snake-Eagle (IUCN – LC)
- Wahlberg's Eagle (IUCN – LC)
- African Harrier-Hawk (IUCN – LC)
- Martial Eagle (IUCN – EN)

Most of these species are not Red Listed. The only Globally Red Listed species recorded on site, Martial Eagle, did not fly frequently but is included as a precaution.

Freshwater Habitats (dambos and streams) were observed at a few limited sections along the TL routes. The dambos and riparian areas were noted to have increased floral species diversity, as is to be expected, with many of the floral species observed in these areas not occurring within the other habitat units, particularly orchid species. The riparian areas are still largely intact and of moderately high integrity, although the agricultural lands encroach extensively on the riparian vegetation. The dambos located around the villages have been significantly impacted upon as a result of vegetation clearance and crop cultivation, leading to species diversity and habitat loss in these areas. The freshwater habitat unit is considered important for species diversity and habitat provision, as well as ecological functions. Although the freshwater habitat has been subjected to several anthropogenic impacts, its biodiversity importance is still considered Moderately High).

The following terrestrial habitat units were identified within the Project Site:

- Degraded Forest Habitat, comprising several forest tree species, where trees exceeded 8 m in height with large, predominantly interlinking canopies. This habitat unit was observed primarily in the upper reaches of the large inselbergs and central mountainous areas of the Project Site. This habitat is under threat due to the harvesting of timber for charcoal production, leading to the encroachment of miombo woodland species;
- Degraded Miombo Woodland Habitat, the dominant vegetation type within the Project Site and that of southern Zambia. The characteristics of this habitat unit were varied, with some of the more degraded areas being noted to have fewer characteristic/typical miombo floral species. The woodlands typically comprised trees varying between 4 – 8 m in height but without densely interlocking canopies;
- Freshwater Habitat, comprising streams and dambos (wetlands). This habitat unit has been notably impacted upon as a result of vegetation clearance for agriculture (grazing and crop cultivation). The dambos and streams convey large amounts of water through the Project Site, however the large-scale removal of vegetation has resulted in increased peak water flows leading to erosion within the dambos and that of the stream banks; and
- Transformed Habitat, associated with cultivated fields and areas where vegetation has been cleared in order to provide increased grazing for livestock, both in association with the areas surrounding the villages and at some distance from villages where new fields are being cleared.

The Chiulukire West and Chivuna Hills Forest Reserves are located along the southern portions of the TL Routes (Figure 13). Approximately 8 km of the TL route would need to be located within these Forest Reserves (5 km through Chivuna Hills and 3 km through Chiulukire West). These Forest Reserves have already been subjected to continuous wide scale impacts. The habitat degradation comes largely from collection of firewood, wood used for structures, the charcoal trade in rural areas in order to generate an income and agricultural activities.

No Critical Habitat occurs in the study area as no populations of threatened, restricted range or migratory/congregatory species occur that meet IFC PS6 thresholds, and the habitats are not threatened or unique and do not have key evolutionary processes.

The project site includes a combination of Modified and Degraded Natural Habitat covering 93% and 7% respectively for Route Option 01, and 89% and 11% respectively for Route Option 02. It will be important to avoid placing pylons within Degraded Forest and Freshwater habitats.

Social Environment

The project area covers a total area of approximately 336 km2 and is comprised of several different land-uses, and dominated by (i) rural settlements, (ii) urban and peri-urban settlement at Katete Town, (iii) small-scale agriculture, and (iv) open public/communal land.

There was limited electrical infrastructure in the Project area in 2010, and there has been little further development of infrastructure outside of Katete Town. Candles, paraffin and other fuels sources are primarily used by district households for lighting, while only 3.4 % of households have access to electricity.

A total of 11 cultural heritage sites were found within the wider area along the TL Route Options; however, none were located within the 55 m RoW (i.e. within 27.5 m from the TL centre line in both directions). The closest site found was MP7 (inactive graveyard), which is located approximately 40 m from the TL centre line.

All land located along the TL route falls under Customary Land which is legally recognised and protected under the Lands Act (Chapter 184), and any customary land vested in or held by any person under customary tenure is similarly recognised. The transmission line route alternatives are located partly on traditional land, controlled by Kalonga Gawa Undi Mkhomo V (the King of the Chewa people), partly on land managed as a Forest Reserve, and partly on traditional land controlled by Chieftainess Msoro.

The average farmland holdings is 2 hectares per household, and is allocated by major land-holdings clans and headmen/headwomen to individuals, and these holdings

are inherited from father to sons. In many cases, any inherited land is granted equally to all sons (but excludes sisters) rather than the eldest. This has resulted in the division of land-holdings into smaller plots through multiple generations. The farmland is usually farmed in its entirety, and little land is left fallow or under some form of rotation. Staple crops for local households are maize, with sunflower, cotton and groundnuts functioning as important secondary crops.

Natural resource harvesting is common for rural communities within the area, and there is a rich diversity or materials and locations from which such materials are collected. The most common form of natural resource harvesting is firewood collection, which is usually undertaken by women and children and is the most common fuel for cooking. Firewood is generally collected from the open bush/community land in and around the household.

The majority of households (75%) are constructed of traditional or natural materials, or a mix of modern and natural materials. This includes mud and clays for mud-bricks, cut lumber and poles for the frames of traditional homes, as well as reeds and grasses for thatching. All materials are sourced locally on communal land. Interviews suggest that a key natural resource is the local streams which provide clays, reeds for thatching and fishing. Charcoal production is also commonly undertaken, mostly by males. Charcoal may be used as household fuel; however, it is more commonly sold along roadsides or to local buyers.

KEY ISSUES AND IMPACTS

The key positive and negative impacts of the development of the proposed TL for the Unika 1 Wind Farm are summarised in Table 1 below.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

An ESMP has been prepared as an annex to the ESIA which provides a framework for the implementation of environmental and social management measures for construction and operation that are required to minimise impacts to an acceptable level.

The ESMP will be reviewed annually to provide for adaptive management based on impacts that are identified or new information that may influence detailed design or project implementation. The ESMP sets out the roles and responsibilities of the developer and contractor's staff to implement the provisions of the ESMP and to report results.

It also provides an overview of training, communications, and monitoring and review (i.e. inspections, audits, corrective actions) and emergency planning and response requirements.

The ESMP also describes the grievances and issues redress mechanism that will be implemented throughout the project to collect and handle any community concerns that are raised.

Table 1. Impacts of Construction and Operation of the Transmission Line for the Unika 1 Wind Farm

Environmental component	Impact during construction & operation phase of the **Solar PV plant**	**CONSTRUCTION PHASE** Significance without mitigation		**OPERATIONAL PHASE** Significance with mitigation	
		Without mitigation	With mitigation	Without mitigation	With mitigation
Biophysical and Ecological Impacts	Landscape and Topography	Very Low	**Very Low**	Low	**Very Low**
	Terrestrial Ecology	Low	**Very Low**	Very Low	**Insignificant**
	Aquatic Ecology	Low	**Very Low**	Very Low	**Insignificant**
	Avifauna/Birds - Collision of birds with the 330 kV overhead transmission line	-	-	High	**Medium**
	Avifauna/Birds - Electrocution of birds: 330 kV overhead transmission line	-	-	Medium	**Insignificant**
Socio-economic Impacts	Physical and Economic Displacement	High	**Low**	-	-
	Communal Land and Natural Resources	Medium	**Low**	Medium	**Low**
	Local Economic and Community Development	Very Low Benefits	**Medium Benefits**	Very Low Benefits	**Medium Benefits**
	Impact of Access and Traffic Mobility	Low	**Low Positive**	Low	**Low Positive**
	Labour, Working Conditions and Worker-Seeker Influx	Very Low Positive	**Very Low Positive**	Insignificant Positive	**Insignificant Positive**
	Community Health and Safety	Medium	**Low**	Medium	**Low**
	Cultural Heritage - Disturbance or destruction of known grave sites	High	**Very Low**	Low	**Insignificant**
	Cultural Heritage - Disturbance or destruction of unknown/discovered Archaeological Sites/Artefacts or Cultural Heritage Sites	High	**Very Low**	Low	**Insignificant**
	Visual Amenity	Very Low	**Very Low**	Low	**Low**
	Air Emissions	Very Low	**Insignificant**	Very Low	**Insignificant**
	Noise & Vibrations	Low	**Very Low**	Insignificant	**Insignificant**

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 PROJECT BACKGROUND

Mphepo Power Limited ("Mphepo") proposes to develop a 200 MW wind farm facility near Katete, Eastern Province, Zambia (Unika I Wind Farm). The proposed facility would utilise wind turbines to generate electricity that will be fed into the National Power Grid via a transmission line. The Unika I Wind Farm project site is located directly north of Katete (Eastern Province, Zambia), and ± 440 km east of Lusaka, Zambia.

Mphepo will be the Development Company while Unika I will be the Special Purpose Vehicle (SPV) for the Project.

As part of this Unika I Wind Farm project it is also proposed to build a 330 kV transmission line running from the on-site Unika substation (to be built) to the existing Msoro substation located approximately 30 km north-west of the wind farm site. This transmission line will have the capacity to cater for the future Unika Wind Farm Phases if needed.

This transmission line will be constructed by Mphepo and then either handed over to ZESCO or a Private Developer for ownership, operation and maintenance. Mphepo Power Limited is the developer and will appoint an Engineering, Procurement and Construction (EPC) Contractor to construct the transmission line. After construction, the transmission line and approvals will be transferred to ZESCO or Private Developer for ownership, operation and maintenance.

The Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations, 1997 refer to the preparation of an "Environmental Impact Statement" (EIS). As this process is required to follow local as well as international standards in order to access funding, the EIS is referred to in this document as an "Environmental and Social Impact Assessment" (ESIA) and is aligned with Zambian legislation as well as the International Finance Corporation (IFC) Performance Standards (PSs).

A detailed Scoping Phase was undertaken for both the wind farm and the transmission line, including an additional public participation process along the transmission line route alternatives to identify key environmental and social issues for further assessment. Based on the meeting with the Zambian Environmental Management Agency (ZEMA) during November 2019 it was confirmed that ZEMA required a separate Terms of Reference for the transmission line if it is to be handed over to ZESCO or Private Developer after construction. The Scoping Report was approved by ZEMA in November 2019 (Ref No. ZEMA/INS/101/4/1) and the Terms of Reference for the ESIA for the transmission line was approved by ZEMA in November 2020 (ZEMA/FAC/105/12/05/M/45). A separate ESIA has been compiled for the Wind Farm.

This Environmental and Social Impact Assessment (ESIA) process seeks to obtain approval from ZEMA for the 330 kV transmission line.

This ESIA has been prepared by SLR Consulting (Africa) (Pty) Ltd on behalf of Mphepo Power Limited and is applicable to the 330 kV transmission line (the 'Project'). The ESIA describes the project and its components, provides an overview of the legal framework, and describes project alternatives, stakeholder engagement undertaken, environmental and social baseline conditions; assesses the environmental and social impacts, and presents an environmental and social management plan (ESMP).

1.2 SUMMARY PROJECT DESCRIPTION AND RATIONALE

1.2.1 Summary Description

The Project entails the construction of a 330 kV overhead transmission line (TL) from a new on-site substation to be built at the proposed Unika I Wind Farm site to the existing Msoro Substation located approximately 30 km north-west of the wind farm project site. Some improvements (new feeder bay and exit line) will also be required at the Msoro substation to accommodate the new TL. Please refer to Section 3 below for further details on the proposed Project.

1.2.2 Rationale

The TL is required to enable the proposed Unika I Wind Farm to export the generated electricity to the National Grid.

The need to meet the growing energy demand from Zambia's growing economy and the large number of un-electrified households (especially in rural areas) has been the major driver towards the introduction of renewable energy technology in the country. The project is in line with Zambia's National Energy Policy (2008) (NEP) sets out a number of policy measures for electricity and renewable energy. The overall objective of the NEP is '*to ensure availability of dependable, affordable energy to support poverty reduction and sustained economic growth in an environmentally sound manner by encouraging the economically efficient supply and consumption of energy'*. Policy measures to address energy and environmental issues include increasing the utilisation of renewable energy sources. The NEP recognises that accessibility to electricity by the majority of Zambians remains low and increasing access is a priority, and that renewable energy represents one of the most sustainable sources of electricity supply. Policy measures to address energy and environmental issues include increasing the utilisation of renewable energy sources.

All the power produced by the Unika 1 Wind Farm is intended to be delivered to the national grid, for the benefit of all Zambians. As an investment, the wind farm project, and therefore the associated transmission line, would be transformative to the Katete region mainly through job creation and providing economic opportunities for local businesses. It would also provide significant support to local people as infrastructure in the area is limited and the Eastern Province currently contributes less than 5% to the GDP. It would also help to stabilise the power grid and assist in power supply during periods when hydroelectric resources are low (particularly during the drier season).

1.3 PROJECT OBJECTIVES

The main objective of the Project is to enable the proposed Unika I Wind Farm to export the generated electricity to the National Grid to meet existing and future demands. Other objectives include:

- Improving electricity supply distribution at district and national levels;
- Creating local employment and business opportunities;
- Improving the local economy of the Eastern Province; and
- Supporting local people (and associated socio-economic initiatives).

1.4 BRIEF DESCRIPTION OF THE PROJECT LOCATION

The TL will start at the proposed Unika I Wind Farm site substation. The wind farm site is located directly north of Katete (Eastern Province, Zambia), and ± 440 km east of Lusaka, Zambia (refer to Figure 2). The Transmission Line will terminate at the Msoro Substation located approximately 30 km north-west of the wind farm site (see Figure 3).

The Project site is strongly rural and a number of small communities are located near to the Wayleave.

Please refer to Section 3.1 for more detail on the Project location.

1.5 PARTICULARS OF PROJECT COMPANY, ADDRESS, CONTACT DETAILS, SHAREHOLDERS AND DIRECTORS

Mphepo is a Zambian renewable energy company (Company Number 120170003750), focussed on the development of wind power in the Eastern Province of Zambia. Mphepo is the Development Company and consists of a consortium of companies including, Buffalo Energy Ltd., Oswald and Kapata CC, Leighton Power Ltd. and the Chewa Development Trust.

Mphepo's office (and postal address) is Figtree Office Park, 17 Warthog Road, Lusaka, Zambia.

The developer's contact details are as follows:

Name: Ms. Linda Thompson

Title: Managing Director

Tel: +260 96 070 7388

Email: linda.thompson@mphepopower.com

Further information on the companies, their directors and shareholding within Mphepo is provided in Table 1.

Table 1: Shareholding and Directors

Company	*Directors*	*Shareholding in Mphepo*
Buffalo Energy Ltd	Charlie Troughton and Will Dryer	30%
Oswald and Kapata CC	Linda Thompson	30%
Leighton Power Ltd	Sipho Phiri, Guy Phiri, Grant Henderson and Sundip Bhundia.	30%
Chewa Development Trust	Set up by Kalonga Gawa Undi on behalf of the Chewa People, the Chewa Development Trust, is managed by the Chewa Investment Committee	10%

As noted above, the TL will be handed over to ZESCO or Private Developer once construction is completed. ZESCO is a vertically integrated electricity utility, which generates, transmits, distributes and supplies electricity in Zambia. It is a public utility, with the Government of the Republic of Zambia being the sole shareholder. ZESCO is governed by the Board of Directors who are appointed by the Government of the Republic of Zambia through the Industrial Development Corporation Limited. The organisational structure of ZESCO is presented in Figure 1 below.

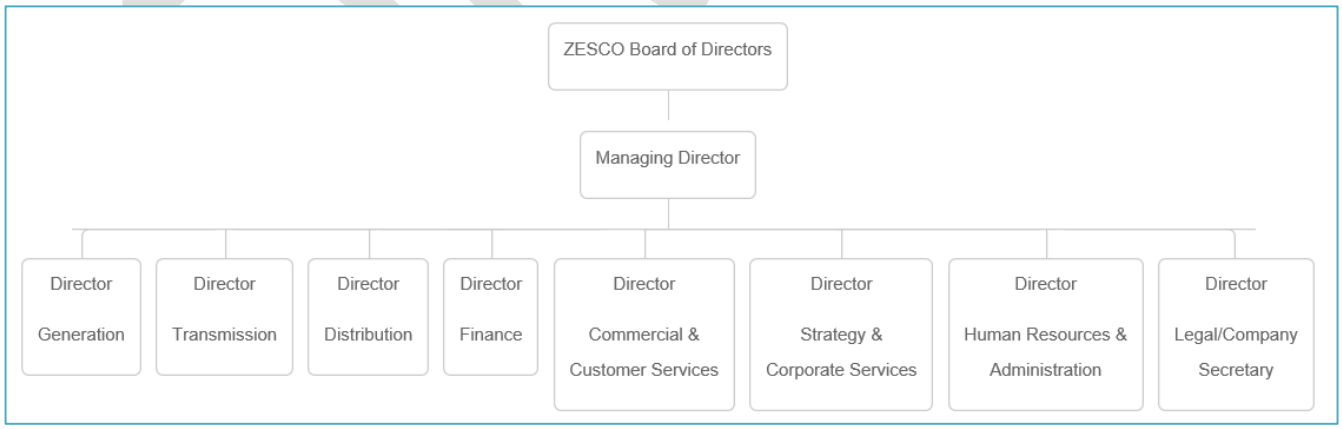


Figure 1: The Organisational Structure of ZESCO

1.6 TRACK RECORD & PREVIOUS EXPERIENCE OF ENTERPRISE ELSEWHERE

Various companies and individuals within Mphepo have the following track record and experience:

- Buffalo Energy are based in Lusaka and have focused on solar and biomass development in Zambia. They submitted a solar PV project into the GET FiT Zambia scheme alongside Enel Green Power and have a number of other projects in development stage. With WRP they have developed a 50 MW solar PV project in the Western Province of Zambia. The project is a joint venture with *responsAbility Renewable Energy Holding*, with technical feasibility being completed.

- Oswald & Kapata CC is registered in South Africa, but currently based in Zambia in order to develop the Unika I Wind Farm Project. The company holds extensive expertise in both wind and solar development through its owner who has over 16 years of renewable energy development experience, incorporating a Joint Venture (via a South African development company that Oswald and Kapata was a shareholder in) with Mainstream Renewable Power and 9 years working for Mainstream. This includes heading up Mainstream's solar development in South Africa, winning two 50 MW solar projects, and developing large scale wind projects on the African continent.

An EPC Contractor with a proven track record and experience in transmission line projects will be appointed by Mphepo to design and construct the TL.

1.7 TOTAL PROJECT COST/INVESTMENT

The total project investment cost is estimated to be in the order of USD 10 - 12 million.

1.8 PROPOSED PROJECT IMPLEMENTATION DATE

The construction phase of the project is anticipated to commence during Quarter 1 of 2023.

2. REGULATORY FRAMEWORK AND CORPORATE REQUIREMENTS

2.1 POLICY FRAMEWORK

2.1.1 National Policy on the Environment (NPE)

The National Policy on Environment (NPE), which was officially launched in 2009, is the overarching policy on environment and provides the framework to address current and future threats to the environment and to human livelihoods, and provides policy guidelines for sustainable development. The NPE was preceded by the National Conservation Strategy (NCS), adopted in 1985, which saw the establishment of environmental legislation and institutions. The NCS was updated in 1992 through the National Environment Action Plan (NEAP) to meet the demands of economic liberalization and new technical information.

Amongst others, a specific objective of the NPE is to accelerate environmentally and economically sustainable growth in order to improve the health, sustainable livelihoods, income and living conditions of the poor majority with greater equity and self-reliance.

The development will be carried out in line with the energy sector objective of the NPE: 'to meet national energy needs with increased efficiency and environmental sustainability'.

A notable strategy relevant to the proposed Project includes promoting the use of environmental guidelines and EIA before sites are developed and ensuring application of a monitoring and auditing system for operating industries.

2.1.2 National Energy Policy

The Zambia National Energy Policy (2008) (NEP) sets out a number of policy measures for electricity and renewable energy (RE). The overall objective of the NEP is '*to ensure availability of dependable, affordable energy to support poverty reduction and sustained economic growth in an environmentally sound manner by encouraging the economically efficient supply and consumption of energy*'.

Policy measures to address energy and environmental issues include increasing the utilization of renewable energy sources.

The policy recognizes that accessibility to electricity by the majority of the Zambians remains low and increasing access is a priority, and that renewable energy represents one of the best sources of electricity supply. Policy measures to address energy and environmental issue include increased utilization of renewable energy sources.

2.1.3 National Policy on Climate Change

On the 3 March 2017, Zambia launched its National Policy on Climate Change (NPCC) aimed at stemming the impact of climate change on the country's annual economic growth, linked to energy generation and food security. The NPCC is an important policy development that introduces a well-structured and coordinated national strategy to effectively tackle the adverse effects of climate change.

The rationale for formulating the NPCC is to establish a coordinated national response to climate change. To date, climate change issues have been addressed in a fragmented manner using various sectoral policies, strategies and plans and these have had limited overall effect.

The following are some of the principles that guide the policy:

- *Sustainable Climate Change response:* All climate change actions shall be environmentally sustainable and positively contribute to national economic growth and social development objectives, including poverty alleviation, access to natural resources and basic amenities, gender equality and equity and infrastructure development.
- *Compliant with international obligations:* All climate change interventions shall promote and fulfill relevant international obligations as enshrined in various Multilateral Environmental Agreements on Climate Change.

The overall objective of the NPCC is to provide a framework for coordinating climate change programmes in order to ensure climate resilient and low carbon development pathways for sustainable development towards the attainment of Zambia's Vision 2030.

2.2 NATIONAL LEGAL FRAMEWORK

2.2.1 Environmental Management Act,2011

The Environmental Management Act (EMA) is the principal law on integrated environmental management and was enacted in April 2011 following adoption of the NPE. The EMA replaced and repealed the Environmental Protection and Pollution Control Act (EPPCA) of 1990, which was established under the NCS.

Relevant sections of the Act include:

- Part III: Integrated Environmental Management which requires the carrying out of Environmental Impact Assessments for certain types of projects;
- Part IV: Environmental Protection and Pollution Control which provides for the conservation of natural resources; and
- Part VII: Public Participation which gives the public the right to be informed and participate in environmental decision making.

Part IV, Division 6 of the EMA deals with Noise. According to the EMA "noise" means any undesirable sound that is intrinsically objectionable or that may cause adverse effects on human health or the environment. It prohibits the emission of noise in excess of the noise emission standards. It also allows the granting of a permit allowing excessive emission of noise.

2.2.2 The Environmental Protection and Pollution Control (Environmental Impact Assessment) Regulations,1997

As part of the implementation process the government through the EPPCA adopted a framework for environmental impact assessment for developmental projects in Zambia and the Environmental Impact Assessment (EIA) Regulations were established in 1997. These regulations continue to be in force under EMA.

2.2.3 Environmental Management (Licensing) Regulations, SI No. 112 of (2013):

Under this statutory instrument established in accordance with Section 43, the EMA controls and regulates the following areas relevant to the project:

Air and Water Pollution: Part II (Regulations 3-9) of SI 112 (2013):

These regulations (Statutory Instrument No. 72 of 1993) provide for ZEMA to regulate the treatment and discharge of sewerage and other effluents into the natural aquatic environment.

Waste Management: Part III (Regulations 10-15) of SI 112 (2013):

These regulations provide definitions of waste and sets out the licensing requirements for transporters of waste and waste disposal sites.

Hazardous Waste: Part IV (Regulations 18-30) of SI 112 (2013):

These regulations provide for the control of generation, collection, storage, transportation, pre-treatment, treatment, disposal, export, import and transboundary movement of hazardous waste as listed in Fifth Schedule or any waste specified in the Sixth Schedule, if that waste exhibits characteristics found in the Seventh Schedule to these Regulations.

2.2.4 Natural Resources Management

Provision is made by the EMA for ZEMA to develop regulations for the conservation and protection of natural resources (Part IV Division 8 of EMA). These are aimed at the sustainable management of natural resources to avoid their degradation or depletion.

In accordance with Section 77 of the EMA the project shall not introduce any invasive alien species into the environment. Should any land dereliction or contamination occur as a direct result of project activities, the project will be responsible for carrying out rehabilitation works within such period as the ZEMA inspectorate may specify.

In addition, and subject to the provisions of the EMA, various natural resources shall be managed in accordance with specific Acts pertaining to environmental protection and management. For example, in relation to the present project, water resources shall be managed in accordance with the *Water Resources Management Act, 2011*; regional and urban planning shall be managed in accordance with the *Town and Country Planning Act*, etc. These and other relevant acts relating to environmental protection and management with regards to the project, and the compliance thereof, are discussed further in Section 2.2.5 below.

Under the Act an inspector may carry out a survey to assist in the proper management and conservation of natural resources, inspect land uses to determine their impact on the quality and quantity of natural resources; and publicise land use guidelines and natural resources conservation regulations.

2.2.5 Other Relevant National Legislation

The Acts outlined in Table 2 below have also been reviewed in order to assess Project alignment with other relevant existing laws that have a bearing on environmental management and the project.

Table 2: Other relevant legislation

Ref	Legislative Instrument	Description	Relevance	Compliance
Constitution				
1	The Zambian Constitution	The Constitution of Zambia Act (as amended by Act No. 2 of 2016) is the fundamental law of the land and provides the framework on which all other laws stand. In particular, *Part IV – Bill of Rights* of the Constitution which enshrines fundamental human rights and protection of property, and *Part XIX: Land, Environment and Natural Resources* which establishes the principles of environmental and natural resources management and development and the protection and utilisation of environmental and natural resources. The Zambian Constitution recognises certain fundamental rights of relevance to the Project: **Article 11:** states that every person in Zambia irrespective of race, place of origin, political opinions, colour, creed, sex or marital status, is entitled to fundamental right to life, liberty, security of the person and the protection of the law, freedom of conscience, expression, assembly, movement, association, protection of young persons from exploitation, protection for the privacy of his home and other property and from deprivation of property without compensation. **Article 16:** provides that property of any description shall not be compulsorily taken possession of, and interest in or right over property of any description shall not be compulsorily acquired, unless by or under the authority of an Act of Parliament which provides for payment of adequate compensation for the property or interest or right to be taken possession of or acquired. **Article 23:** guarantees protection from discrimination on the ground of race, tribe, sex, place of origin, marital status, political opinions, colour or creed. **Article 24**: guarantees protection of young persons from exploitation including employment which interferes with their education and well-being, physical or mental ill treatment, all forms of neglect, cruelty or exploitation and trafficking.	The proposed project (transmission line) may involve the displacement and possible resettlement of persons or communities who may be found within the Wayleave.	Acquisition of land which will result in displacement and possible resettlement of persons or communities will be avoided as far as possible when choosing the route of the transmission line. However, some compensation may be required for land occupied by the transmission line, depending on the final route chosen and the land use restrictions within the Wayleave. In line with Article 16 (and international guidelines) there must be adequate compensation before any personal property is compulsorily acquired. In this context Article 23, which protects against all forms of discrimination, is also very important with regards to women or the vulnerable who may not have any title to land (and therefore not entitled to any compensation) in a traditional society.
Natural Resources/Heritage				
2	The Water Resources Management Act, 2011	This Act establishes the Water Resources Management Authority and provides for the integrated management, development, conservation, protection and preservation of the water resource and its ecosystems. The Act ensures the right to draw or take water	The Project may involve the abstraction of ground water or	A "Permit to Access Water" may be required.

Ref	Legislative Instrument	Description	Relevance	Compliance
		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 charges. It also provides for the constitution, functions and composition of catchment councils, sub-catchment councils and water users associations; repeals and replaces the Water Act, 1949; and provides for matters connected with, or incidental to, the foregoing.	surface water for the construction phase.	The developer will ensure that the Water Resources Management Authority and the Department of Water Resource Development are involved during the project planning and implementation stages as well as for all the water needs of the development.
3	Forestry Act (No. 4 of 2015)	This Act repeals and replaces the Forests Act, 1999. The Act provides for the establishment and declaration of National Forests, Local Forests, joint forest management areas, botanical reserves, private forests and community forests; provides for the conservation and use of forests and trees for the sustainable management of forests ecosystems and biological diversity; 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.	The Forestry Act is relevant to this Project because parts of the transmission line alternatives are proposed to run through some Forest Reserves and will involve the removal of trees.	The developer will ensure that the removal of trees on-site is compliant with the general principals of the Act in the conservation of trees and forest resources, and requirement to obtain consent.
4	The Noxious Weeds Act, Cap 343	This Act provides for the declaration, control and eradication of noxious weeds.	Under this Act the Project will be responsible for preventing the introduction and/or controlling the spread of common weeds along the Wayleave.	The developer will ensure that undesirable invasive species are not introduced. Species declared as noxious weeds under the act (such as *Lantana camara*) are prohibited.
5	National Heritage Conservation Commission (NHCC) Act (No. 23 of 1989) and National Heritage Conservation Commission Amendment Act (No. 13 of 1994)	This Act provides for the establishment of the National Heritage Commission responsible for the conservation, restoration, rehabilitation, reconstruction, adaptive use and good management of heritage conservation.	The proposed development involves the construction of the transmission line which may disturb cultural and natural heritage sites.	All measures will need to be undertaken to protect and conserve the cultural and natural heritage along the Wayleave. For any new discoveries made of items of historical or archaeological interest during implementation of the project, the provisions of the NHCC Act shall apply, and the required procedures for the reporting of such discoveries shall be followed.

Ref	Legislative Instrument	Description	Relevance	Compliance
Energy Regulation, Investment and Standards				
6	Energy Regulation Act No 23 of 2003	The Act of 1995 makes provision with respect to the production and distribution of energy in Zambia and establishes the Energy Regulation Board for purposes of control and licensing of energy undertakings. The Board shall, in conjunction with other Government agencies, formulate measures to minimize the environmental impact of the production and supply of energy and the production, transportation, storage and use of fuels and enforce such measures by the attachment of appropriate conditions to licences held by undertakings.	The project will involve the distribution of electricity. Mphepo is proposing to construct the transmission line and then hand it over to the ZESCO for operations and maintenance.	The operations of the proposed project will adhere to the Act
7	Petroleum Act No. 10 of 2008	The Act provides for the regulation of the importation, conveyance and storage of petroleum products and other inflammable oil and liquids (e.g. petrol and diesel) for the protection of the public and the environment.	Any bulk fuel storage facilities associated with the transmission line construction will be required to be constructed and operated in accordance with regulations as set out in the Act.	Petroleum products shall be transported to and/or stored on-site in compliance with the provisions of the Petroleum Act that is according to ZABS standards - ZS 385-3.
Land Use, Land Acquisition and Regional Planning				
8	The Urban and Regional Planning Act No. 3 of 2015	The Act provides for development, planning and administration principles, standards and requirements for integrated urban and regional planning processes and systems to ensure multi-sector and level cooperation and coordination. The Act endeavours to ensure 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. The Act repeals the Town and Country Planning Act, 1962, and the Housing (Statutory and Improvement Areas) Act, 1975.	The Project is a development project that needs to be implemented in compliance with this Act.	The necessary documentation will be submitted to the relevant authorities for approval for project implementation in accordance with the terms of the Act.
9	Lands Act No 20 of 1996	The Act provides for the continuation of Leaseholds and leasehold tenure; to provide for the continued vesting of land in the President and alienation of land by the President; to provide for the statutory recognition and continuation of customary tenure; to provide for the conversion of customary tenure into leasehold tenure; to establish a Land Development Fund and a Lands Tribunal; to repeal the Land (Conversion of Titles) Act; to repeal the Zambia (State Lands and Reserves) Orders, 1928 to 1964, the Zambia (Trust Land) Orders, 1947 to 1964, the Zambia (Gwembe District) Orders, 1959 to 1964, and the Western Province (Land and Miscellaneous Provisions) Act, 1970; and to provide for matters connected with or incidental to the foregoing.	All land located along the transmission line route alternatives falls under Customary Land which is legally recognised and protected under the Lands Act, Chapter 184, and any customary land vested in or held by any person under customary tenure is similarly recognised.	The Developer will develop a Resettlement Policy Framework as part of the ESIA, and ensure that a Resettlement Action Plan (RAP) is developed and implemented prior to commencement of construction.

Ref	Legislative Instrument	Description	Relevance	Compliance
10	Local Government Act No. 2 of 2019	The Act provides for an integrated local government system; gives effect to the decentralisation of functions, responsibilities and services at all levels of local government; and is designed to ensure democratic participation in, and control of, decision making by the people at the local level. It 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; and provides for matters connected with, or incidental to, the foregoing.	Implementation and operation of new development will be subject to the procedures laid out by the local authorities.	All applicable by-laws will be adhered to.
11	Electricity Act No. 11 of 2019	The Act regulates the generation, transmission, distribution and supply of electricity so as to enhance the security and reliability of the supply of electricity; provides for the sale and purchase of electricity within and outside the Republic; facilitates the achievement of the efficient, effective, sustainable development and operation of electricity infrastructure; provides the roles and responsibilities of various participants in the electricity sector; facilitates adequate levels of investment in the electricity sector; provides for a multi-year tariff framework; promotes transparency in the identification and allocation of risks, costs and revenues within and between participants in the electricity sector; ensures the protection and safety of consumers of electricity and the public; repeals and replaces the Electricity Act, 1995; and provides for matters connected with, or incidental to, the foregoing.	The Project will involve the construction of a transmission line which is envisaged to start at the Unika I Wind Farm substation (to be built) and will terminate at the Msoro substation.	The developer will ensure that the implementation of the Project is in compliance with this Act.
Employment, Health, Safety and Human Rights				
12	Employment Act No. 3 of 2019	The Act regulates the employment of persons; prohibits discrimination at an undertaking; constitutes the Skills and Labour Advisory Committees and provides for their functions; provides for the engagement of persons on contracts of employment and provides for the form and enforcement of the contracts of employment; provides for employment entitlements and other benefits; provides for the protection of wages of employees; provides for the registration of employment agencies; regulates the employment of children and young persons; provides for the welfare of employees at an undertaking; provides for employment policies, procedures and codes in an undertaking; and provides for matters connected with, or incidental to, the foregoing.	The Project will employ people both skilled and unskilled, whose employment conditions are subject to this Act.	The developer will ensure that all recruitment procedures and conditions of employment of persons under the Project will comply with the provisions of the Act. The developer will also ensure that the contractors promote STDs & HIV/AIDS awareness among construction workers during Project implementation.
13	Workers' Compensation Act No. 10 of 1999	The Act makes provision for the establishment and administration of a Fund for the compensation of Workers disabled by accidents to, or diseases contracted by, such Workers in the course of their employment, and for the payment of compensation to dependents of workers who die as a result of such accidents or diseases; for the payment of contributions to such Fund by employers; for the grant of pensions and	The nature of the Project may cause injury, illness or death to workers on-site if safety measures are neglected.	In case of any accidents occurring to any worker, the developer and appointed contractors will treat such employees in accordance with these regulations.

Ref	Legislative Instrument	Description	Relevance	Compliance
		allowances to certain dependents of Workers who, being in receipt of pensions for such disablement, die from causes not connected with such accidents or diseases; for the appointment and powers of a Workers' Compensation Commissioner and the establishment and powers of a Workers' Compensation Board and an Appeal Tribunal; and for matters incidental to and connected with the foregoing.		
14	Factories Act Cap 441 no 2 of 1966	The Act provides a framework for the setting of regulations to ensure the safety, health and welfare of persons employed on construction work sites and in factories.	The Project during operation and as a construction site is subject to provisions of the Act as a place of work.	All work procedures and workers Personal Protective Equipment (PPE) will be required to meet the provisions of this Act. Inspection procedures for the operation of all plant and equipment during construction and operation will be governed by this Act.
15	Occupational Health and Safety Act, No. 36 of 2010	The Act establishes the Occupational Health and Safety Institute and provides for its functions; provides for the establishment of health and safety committees at workplaces and for the health, safety and welfare of persons at work; provides for the duties of manufacturers, importers and suppliers of articles, devices, items and substances for use at work; provides for 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 provides for matters connected with, or incidental to, the foregoing.	The Project will involve procedures and activities with inherent risks to the occupational health and safety of employees and other persons (e.g. community members).	The developer and appointed contractors shall be obliged to comply with the provisions of the Act.
16	Solid Waste Regulation and Management Act No. 20 of 2018	The Act provides for the sustainable regulation and management of solid waste; general and self-service solid waste services; the incorporation of solid waste management companies and define their statutory functions; the licensing and functions of solid waste service providers, operators and self-service solid waste providers and provides for their functions; the regulation, operation, maintenance and construction of landfills and other disposal facilities; the setting and approval of tariffs for management of solid waste and provision of solid waste services; and matters connected with, or incidental to, the foregoing.	During the implementation of the Project various kinds of waste are expected to be generated.	Bins will be introduced on site which will be used to collect waste and these will be collected by a licensed garbage collector at regular intervals.
17	Public Health Act, Chapter 295 of 1995	The act provides for the prevention and suppression of diseases and general regulation of all matters connected with public health in the country under the local authority of each district as the enforcement agency.	For the proposed development, this will cover such matters as solid waste management, levels of hygiene and the standards of the general working environment.	Good housekeeping and proper waste management and disposal protocols will be adhered to by the contractor and the developer to avoid the spread of vermin and diseases.

Ref	Legislative Instrument	Description	Relevance	Compliance
18	Public Health (Infected Areas) (Coronavirus Disease 2019) Regulations, 2020	**Regulation 10 (1):** an authorised officer may prohibit or restrict the trade of food products and ready to eat foods from and in any location which may pose a danger to health of consumers and the traders. **Regulation 11.** An authorised officer shall prohibit or restrict trading in or vending of food in unsanitary conditions. **Regulation 12 (2):** an authorised officer may order the cleaning or closure of a public premise or burial of any contaminated water body where the authorised officer determines that public premises or a water body does not have sufficient sanitation and hygiene to prevent the occurrence or transmission of COVID – 19 **Regulation 14.** A person who fails to comply with a direction, prohibition or restriction of an authorised officer or otherwise contravenes these regulations commits an offence and is liable, on conviction to a fine not exceeding two thousand five hundred penalty units or to imprisonment for term not exceeding six months, or both.	During the construction of the transmission line, trading of food products and ready to eat food are expected on site.	The developer and the contractor will comply with the following measures; - All individuals accessing the site must adhere to the infection control measures (temperature testing, hand washing and sanitizing, and foot bath) on site and work areas. - Avoid physical hand contact such as handshakes. - Frontline staff (security, testers etc.) must use appropriate PPE.
19	Public Health (Notifiable Infectious Disease) (Declaration) Notice, 2020	**Regulation 3.** The ministry responsible for health may convert a suitable building to a hospital, observation camp or station for the purpose of placing a person suffering or suspected to be suffering from, or who has been in contact with a person suffering from COVID – 19. **Regulation 5 (2):** subject to sub - regulation (1) a person who intends to enter or leave an infected area may, before entering or leaving the infected area, be required to undergo the following; *(a) Medical examination;* *(b) Disinfection; or* (c) *Remain for a specified period in a hospital, an observation camp or station converted under regulation 3.* **Regulation 6.** The body of a person who has died from COVID – 19 shall be disposed of in conformity with the directions of an authorised officer. **Regulation 7.** An authorised officer may enter premises to search for a case of COVID – 19 or to enquire whether there is or has been a case of COVID – 19. **Regulation 8.** A person who becomes aware or has reason to suspect that another person has died or is suffering from COVID -19 shall immediately inform the nearest authorised officer in a local authority or public health facility.	The implementation of the Project is subject to provisions of the Public Health (Notifiable Infectious Disease) Notice, 2020.	All hygienic practices must be adhered to, to minimize exposure to COVID-19. These include social distancing, personal hygiene and frequently sanitizing any high touched areas. Further, avoid big crowds and travelling to work, employees to wear a face mask and ensure that they wash their hands with soap or sanitize. Reducing meetings and gatherings that bring people within 2 meters of each other for extended durations.

Ref	Legislative Instrument	Description	Relevance	Compliance
		Regulation 9. A public ceremony or gathering of more than five persons, not being a family shall not be held in an infected area without the written permission of a local authority or Medical Officer of Health.		
20	Public Roads Act (No. 12 of 2002)	The Act provides for the care, maintenance and constriction of public roads in Zambia, and for the regulation of inter alia road signage (including temporary signs) and storm water disposal structures.	Materials to be used on-site during Project implementation will be transported by road.	The developer will ensure that all transportation of materials to the site is in compliance with this Act.
21	Human Rights Commission Act (No. 39 of 1996)	The Act covers the functions, powers and composition of Human Rights Commission which include investigation of human rights violations; investigation of any maladministration of justice; and proposing effective measures to prevent human rights abuse.	The Project will employ people whose employment conditions may be subject to this Act.	The Project will adhere to all laws and guidelines (including international standards) with regards to land acquisition, compensation and employment.

2.3 INSTITUTIONAL FRAMEWORK

The Zambia Environmental Management Agency (ZEMA) is a statutory body under the Ministry of Water, Sanitation and Environmental Protection (MWSEP) which facilitates at the national level the coordination of the various Ministries and regulatory bodies that play a role in the management and conservation of the environment.

Government ministries, departments and local authorities work on behalf of the public to ensure that ecological, cultural, social and economic issues are addressed in line with existing government policy and legislation. Institutions with a supervisory and monitoring role relevant to the Project are described in Table 3.

Table 3: Institutions with a Supervisory and Monitoring Role Relevant to the Project

Institution	Responsibility
Zamia Environmental Management Agency (ZEMA)	ZEMA is responsible for the enforcement of the provisions of the EMA on environmental impact assessment, pollution control, natural resources management and solid waste management which includes establishment of landfill sites. The services provided by the ZEMA specifically in relation to EIA studies include: • Assisting the developer to determine the scope of EIA studies; • Reviewing project briefs, terms of reference, and environmental impact statements (EIS) and decision-making; • Disclosure of the EIS to the public through the media; • Holding public hearing meetings to discuss the EIS with stakeholders; • Conducting verification surveys of the affected environment; • Monitoring the project once implemented; • Conducting compliance audits of the project between 12 and 36 months after implementation; and • General administration of all the Regulations under the EMA. In addition to the Project Environmental Permit, ZEMA is responsible for the issuing of licenses relating to: • Emissions (air and waste water), • Waste management, and • Hazardous waste management.
Department of Energy (DOE)	The DOE falls under the Ministry of Energy and its functions, among others, are to develop and implement a Policy on Energy, integrate the energy sector into Zambia's national and regional development strategies; to regulate the energy sector through appropriate legislation including the development of new laws and by-laws.
The Energy Regulation Board (ERB)	The ERB is the statutory body under the Ministry of Energy which has the mandate of regulating the energy sector in line with the provisions of the Energy Regulation Act of 2003. In order to carry out this role, the ERB, among other functions, ensures that all energy utilities in the sector are licensed, monitors levels and structures of competition, and investigates and remedies consumer complaints. The unit price of that electricity generated by the Project and sold to the national grid will be regulated by the ERB. ERB issues licenses for electricity generation plants and energy related facilities such as bulk fuel storage facilities.
ZESCO	ZESCO Limited is a vertically integrated electricity utility, which generates, transmits, distributes, and supplies electricity in Zambia. It is a public utility, with the Government of the Republic of Zambia being a sole shareholder. It will be the operator of the TL for the Unika Wind Farm.
Water Resources Management Authority (WARMA)	A statutory body under the Ministry of Water, Sanitation and Environmental Protection which is responsible for the management of water resources and liaises with ZEMA on issues relating to water pollution.

Institution	Responsibility
	In accordance with the provisions of the Water Resources Management Act, WRMA will regulate and control the rates of water abstraction to ensure that available surface and underground water resources are not depleted and is responsible for issuing of water permits (previously known as 'water rights').
Department of National Parks and Wildlife (DNPW)	Administers research permits which requires supervision by an Area Ecologist during fieldwork.
Ministry of Lands and Natural Resources: Forestry Department	Consent will be required from the Forestry Department for the construction of the transmission line as parts of the current preferred route run through the Chiulukire West and Chivuna Hills Forest Reserves.
The National Heritage Conservation Commission (NHCC)	The NHCC, which falls under the Ministry of Tourism and Arts (MOTA), is responsible for the identification of sites of cultural and historical interest and their conservation. In the case of new discoveries of cultural or historical sites, the NHCC will be the first agency to be notified and give guidance on how to handle and preserve them. The NHCC is responsible for issuing permissions to remove/alter/destroy heritage sites and for establishing concession agreements for the management of heritage sites. A heritage impact assessment (HIA) gas been undertaken as a component of the ESIA.
Ministry of Health (MoH)	The Ministry of Health is concerned with issues of health of the human population. This ministry works closely with local authorities to facilitate the provision of health services and raise awareness of health risks As such the MoH is responsible for monitoring the health status and trends of the communities in the Project area through the Health Management Information System.
Provincial Planning Office	Planning permission for the Project will be sought through the Provincial Planning Office (Eastern Province)
District Councils	The District Councils are responsible for issuing Building Permits, Fire Permits and permissions for establishment of waste disposal sites (landfills).

2.4 TRADITIONAL LEADERS AND OTHER STRUCTURES

The traditional administration in the Project area is a complex and interconnected set of relationships and responsibilities. Part of the TL route falls under the Chewa chieftainship (under Chief M'bangombe). The remaining northern portion of the TL route falls under the Kunda chieftainship (under Chieftainess Msoro).

The functions, powers and duties of the Paramount Chief are delegated to Chiefs, who administer broad areas of the Kingdom (i.e. Chiefdoms). The chiefs are further supported by headmen / headwomen that administer one or more villages. The Chief and headmen may also be supported by indunas who function as advisors but who have no specific powers.

The areas controlled by the different headmen / headwomen is fluid. Headmen / headwomen are often selected based on their ties with major or founding clans of their respective villages. The headmen / headwomen provide direct administrative functions at the village level, and therefore play a direct role in supporting individual households as well as the administration of land.

The traditional leaders and other structures relevant to the Project include:

- Chewa King, Kalonga Gawa Undi;
- Chief M'bangombe;
- Chieftainess Msoro
- Headmen / headwomen of the villages within the Project area.
- Indunas of the Project area.

2.5 INTERNATIONAL AGREEMENTS AND CONVENTIONS

Zambia is a party to a number of international and regional conventions related to the environment and natural resources management which influence the country's policies and legislation.

The environmental treaties and conventions most relevant to the project are set out in Table 4.

Table 4: International Treaties and Conventions of Relevance to the Project

Name of Convention (Date of ratification)	Description	Relevance to the Project
Convention on Biological Diversity (1992)	The Convention is relevant in that land clearing activities have the potential to cause loss of habitat and associated biodiversity and habitat disturbance. In addition, the IFC Performance Standard 6 (Biodiversity Conservation and Sustainable Natural Resource Management) reflects the objectives of the Convention to conserve biological diversity and promote use of renewable natural resources in a sustainable manner.	The Project will be executed sustainably in such a way as to conserve natural aquatic, woodland and wildlife habitat as far as possible and minimize disturbance to the site ecosystem.
United Nations Framework Convention on Climate Change (1996)	The Convention is relevant as the clearing of land for the Project has the potential to contribute to climate change since loss of vegetation deprives the earth of the carbon sink which help mitigate global warming.	The Project will ensure a conservative approach to vegetation clearing so as to limit loss of vegetation.
African Convention on the Conservation of Nature and Natural Resources (1968)	This convention aims at enhancing environmental protection, to foster the convention and sustainable use of natural resources and to harmonise and coordinate policies in these fields.	This convention is relevant to the planning, construction and operation phases of the Project.
Convention on the Protection of World Cultural and Natural Heritage (ratified 1984)	Provides for the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage which are of outstanding universal value from the point of view of history, art or science.	The Project will implement the necessary procedures to protect cultural and natural heritage.
UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage	The purposes of this Convention are to safeguard intangible cultural heritage; to ensure respect for the intangible cultural heritage of the communities, groups and individuals concerned; to raise awareness at the local, national and international levels of the importance of the intangible cultural heritage, and of ensuring mutual appreciation thereof; and to provide for international cooperation and assistance.	The Project will implement the necessary procedures to protect cultural and natural heritage.
Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (ratified 1993)	This is an international agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Protection of the biodiversity in the surrounding area of the Project.
Basel Convention on the control of transboundary movements of	International treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries.	Waste management during the construction and operation of the Project will be managed accordingly.

Name of Convention (Date of ratification)	Description	Relevance to the Project
hazardous wastes and their disposal (1999)		

In addition, Zambia is a signatory to various **International Labour Organisation (ILO) Conventions** which are relevant to working conditions and regulation on site during construction and operation of the Project. These include[1]:

- C138 - Minimum Age Convention, 1973 (ratified 1976)
- C182 - Worst Forms of Child Labour Convention, 1999 (ratified 2001)
- C111 - Discrimination (Employment and Occupation) Convention, 1958 (ratified 1979)
- C017 - Workmen's Compensation (Accidents) Convention, 1925 (ratified 1964)
- C148 - Working Environment (Air Pollution, Noise and Vibration) Convention, 1977 (ratified 1980)
- C155 - Occupational Safety and Health Convention, 1981 (ratified 2013).

2.6 EQUATOR PRINCIPLES

The Equator Principles are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. Equator Principle Financial Institutions (EPFIs) commit to implementing the Equator Principles in their internal environmental and social policies, procedures and standards for financing projects and will not provide Project Finance or Project-Related Corporate Loans to projects where the client will not, or is unable to, comply with the Equator Principles.

In order to facilitate potential access to funding for project development potential borrowing organisations need to consider the Equator Principles and environmental and social risk management as part of the ESIA process.

There are 10 principles as shown below, and these require that Projects conduct an ESIA process in compliance with the IFC Performance Standards on Environmental and Social Sustainability.

1. Review and categorisation
2. Social and environmental assessment
3. Applicable environmental and social standards
4. Environmental and Social Management System and Equator Principles Action Plan
5. Stakeholder Engagement
6. Grievance mechanism
7. Independent review
8. Covenants
9. Independent monitoring and reporting
10. Reporting and Transparency.

2.7 IFC PERFORMANCE STANDARDS ON ENVIRONMENTAL AND SOCIAL SUSTAINABILITY (2012)

The IFC's Environmental and Social Performance Standards (international PSs) define IFC clients' responsibilities for managing their environmental and social risks and provides an international

[1] Source: http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11200:0::NO::P11200_COUNTRY_ID:103264

benchmark that has been adopted by many organizations when evaluating and implementing development projects. The IFC Performance Standards encompass eight topics as shown in Table 5.

Table 5: IFC Performance Standards and their Applicability to the Project

IFC Performance Standard	Applicability to this project
PS1: Assessment and Management of Environmental and Social Risks and Impacts PS1 establishes the importance of (i) integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects; (ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and (iii) the client's management of environmental and social performance throughout the life of the project.	Yes An Environmental and Social Impact Assessment needs to be conducted and an Environmental and Social Management Plan needs to be developed
PS2: Labour and Working Conditions PS2 requires that companies treat their workers fairly, provide safe and healthy working conditions, avoid the use of child or forced labour, and identify risks in their primary supply chain.	Yes Various people will be employed which will require measures for managing labour and working conditions
PS3: Resource Efficiency and Pollution Preventions PS3 guides companies to integrate practices and technologies that promote energy efficiency, use resources—including energy and water—sustainably, and reduce greenhouse gas emissions.	Yes The Project will require various resources and activities (especially during construction) could lead to pollution.
PS4: Community, Health, Safety and Security PS4 helps companies adopt responsible practices to reduce such risks including through emergency preparedness and response, security force management, and design safety measures.	Yes Project activities (e.g. construction, transport, power distribution, etc.) could pose a risk to community health and safety.
PS5: Land Acquisition and Involuntary Resettlement PS5 advises companies to avoid involuntary resettlement wherever possible and to minimize impact on those displaced through mitigation measures such as fair compensation and improvements to living conditions. Active community engagement throughout the process is essential.	Yes Although no physical displacement is anticipated at this stage (as it depends on the final TL route chosen and the land use restrictions within the Wayleave), economic displacement is expected. Land rights for the Wayleave are also required.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources PS6 recognizes that protecting and conserving biodiversity, maintaining ecosystem services, and managing living natural resources adequately are fundamental to sustainable development.	Yes The Project through habitat removal for TL construction and operation will have impacts on biodiversity and living resources which will require management/ mitigation measures.
PS7: Indigenous Peoples PS7 seeks to ensure that business activities minimize negative impacts, foster respect for human rights, dignity and culture of indigenous populations, and promote development benefits in culturally appropriate ways. Informed consultation and participation with IPs throughout the project process is a core requirement and may include Free, Prior and Informed Consent under certain circumstances.	No There are no Indigenous Peoples as defined by the IFC present within the Project area of influence.

IFC Performance Standard	Applicability to this project
PS8: Cultural Heritage PS8 aims to guide companies in protecting cultural heritage from adverse impacts of project activities and supporting its preservation. It also promotes the equitable sharing of benefits from the use of cultural heritage.	Yes The Project could have impacts cultural heritage which will require management/mitigation measures.

2.8 CORPORATE STANDARDS AND GUIDELINES

For purpose of this Project, Mphepo aims to align with the Equator Principle and IFC Performance Standards on Environmental and Social Sustainability (2012). In addition, Mphepo has the following policies currently in place that will guide the Project development:

- Health and Safety Policy;
- Anti-Bribery & Anti-Corruption Policy;
- Employment Equity Policy;
- HIV/AIDS Policy and
- Sexual Harassment Policy.

In addition, the Engineering, Procurement and Construction (EPC) contractor will need to have detailed standards and guidelines in place for environmental, health, safety and social management prior to construction commencing.

3. DESCRIPTION OF THE PROJECT

The project entails the construction of a 330 kV Transmission line. The TL will start at the proposed wind farm site substation. The wind farm site is located directly north of Katete (Eastern Province, Zambia), and ± 440 km east of Lusaka, Zambia (see Figure 2). The TL will terminate at the Msoro Substation (ZESCO owned) located approximately 30 km north of the wind farm site (see Figure 3).

3.1 LOCATION OF THE PROJECT

The TL will start at the proposed Unika 1 Wind Farm (at the substation to be built). The Unika Wind I Farm site is located directly north of Katete (Eastern Province, Zambia), and ± 440 km east of Lusaka, Zambia (refer to Figure 2). The TL will terminate at the Msoro Substation located approximately 30 km north of the wind farm site (see Figure 3).

The Project site is strongly rural and a number of small communities are located near the Wayleave. There are no formal villages along the TL; however, villages located nearby the TL route include Budula Siliya, Nkumba, Chinzewe and Msoro (approximately 6 km north of the Msoro substation).

The nearest town to the TL start point is Katete, which is a small but well-established town located immediately southwest of the Unika 1 Wind Farm project site. Msoro town is located near the TL end point. The main access road to the Project area is the T4 National Road (Great East Road), which is the main route connecting the Zambian capital of Lusaka to the smaller towns of Nyimba, Katete and Chipata in the east.

The transmission line route alternatives are located partly on traditional land, controlled by Kalonga Gawa Undi Mkhomo V (the King of the Chewa people), partly on land managed as a Forest Reserve, and partly on traditional land controlled by Chieftainess Msoro.

The coordinates for the TL is presented in Table 6 and shown on a map in Figure 4.

Table 6: Transmission Line Co-ordinates

Route Option	Label on Map	Co-ordinates
Option 1	1	31°54'27.877"E; 13°40'5.758"S
	2	31°54'24.279"E; 13°41'36.729"S
	3	31°56'11.698"E; 13°43'52.416"S
Option 2	AA	31°54'27.877"E; 13°40'8.327"S
	BB	31°54'34.558"E; 13°40'15.523"S
	CC	31°55'49.083"E; 13°43'1.019"S
	DD	31°55'50.111"E; 13°43'1.019"S
Shared	A	31°57'19.541"E; 13°44'16.572"S
	B	32°2'35.114"E; 13°49'29.062"S
	C	32°5'19.583"E; 13°50'34.849"S
	D	32°5'57.616"E; 13°50'2.983"S
	E	32°6'17.661"E; 13°50'4.525"S

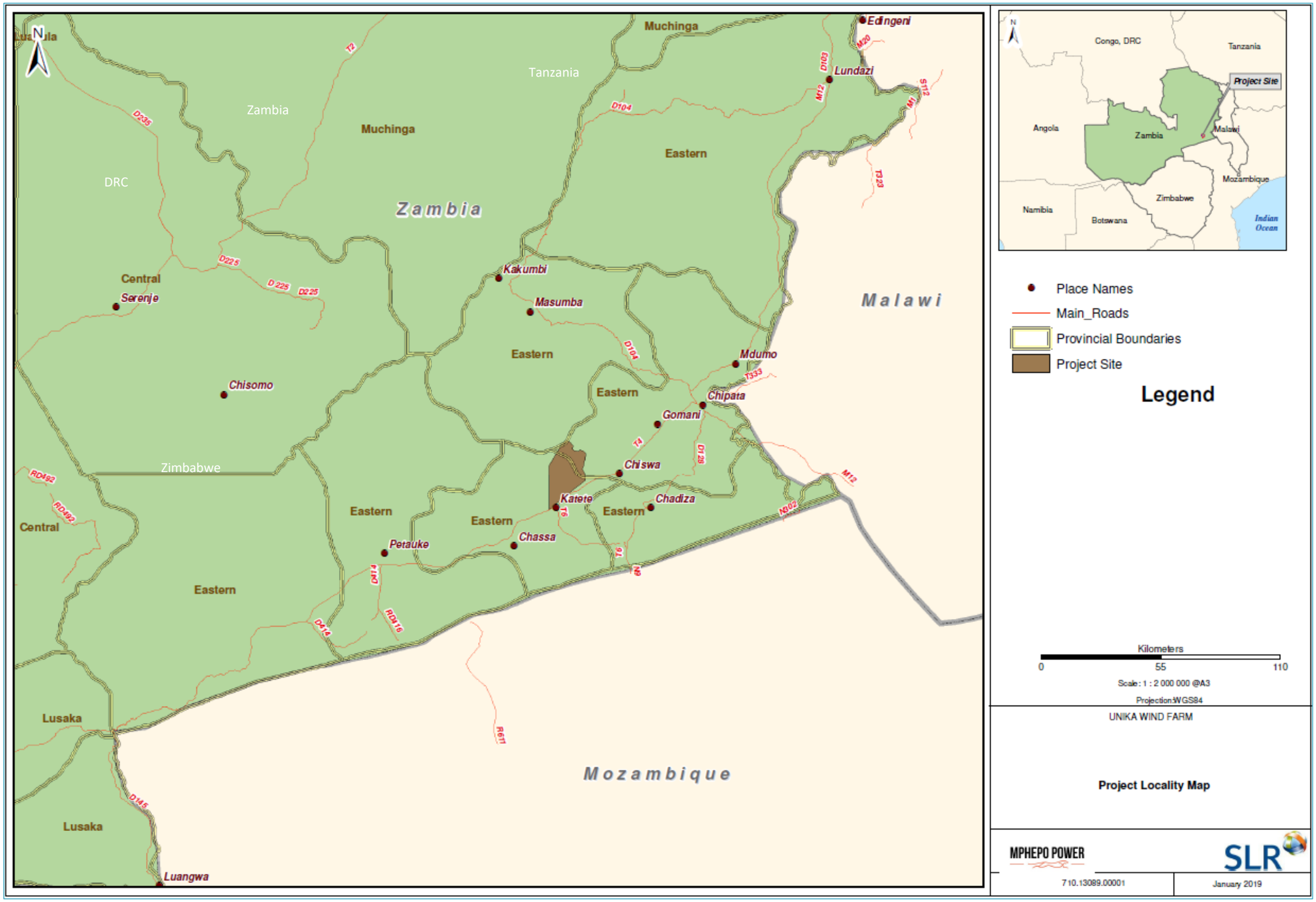


Figure 2: Location of the Unika Wind Farm Project Site (starting point of the TL)

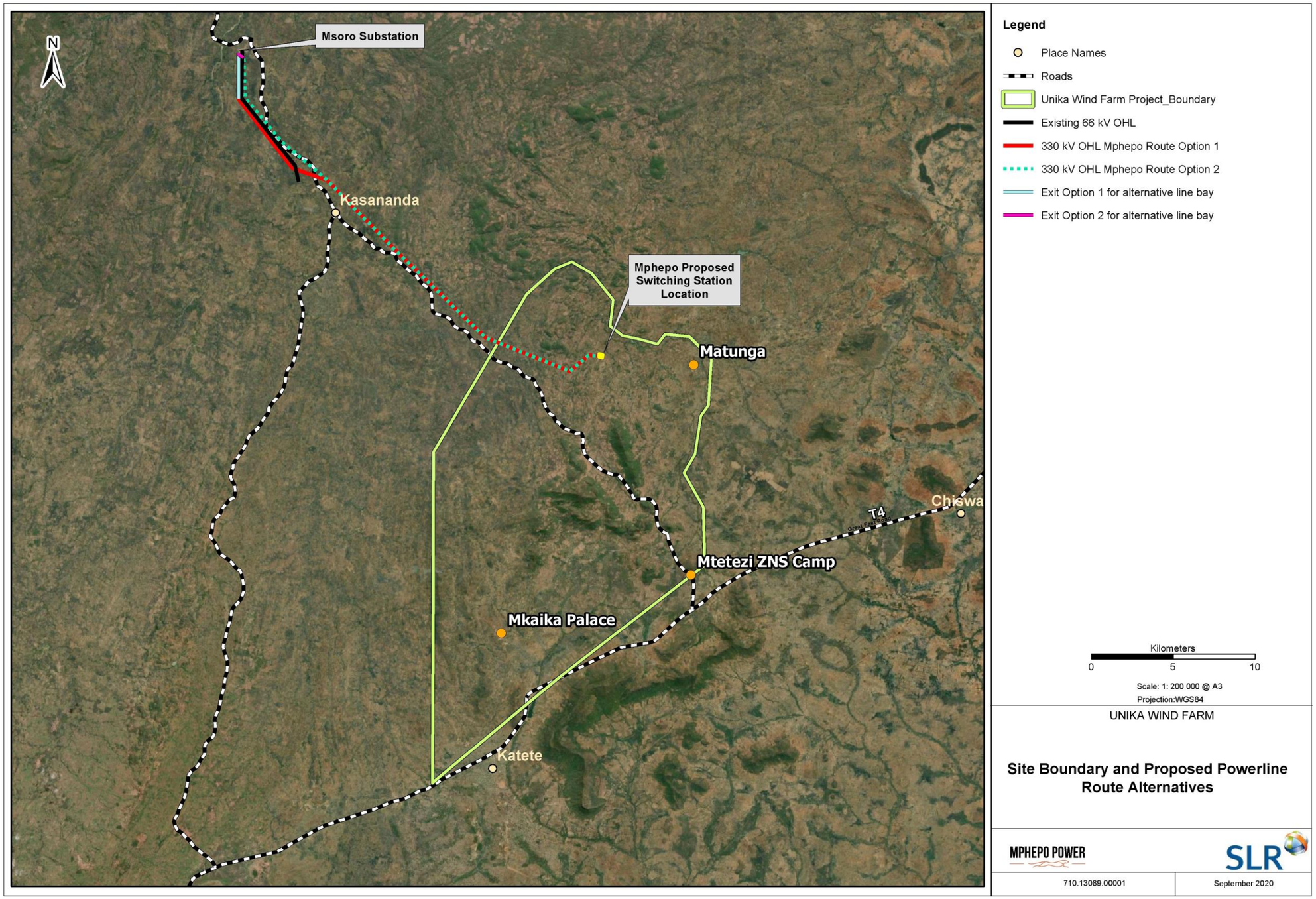


Figure 3: The Unika Wind Farm Project Site and Transmission Line Route Options

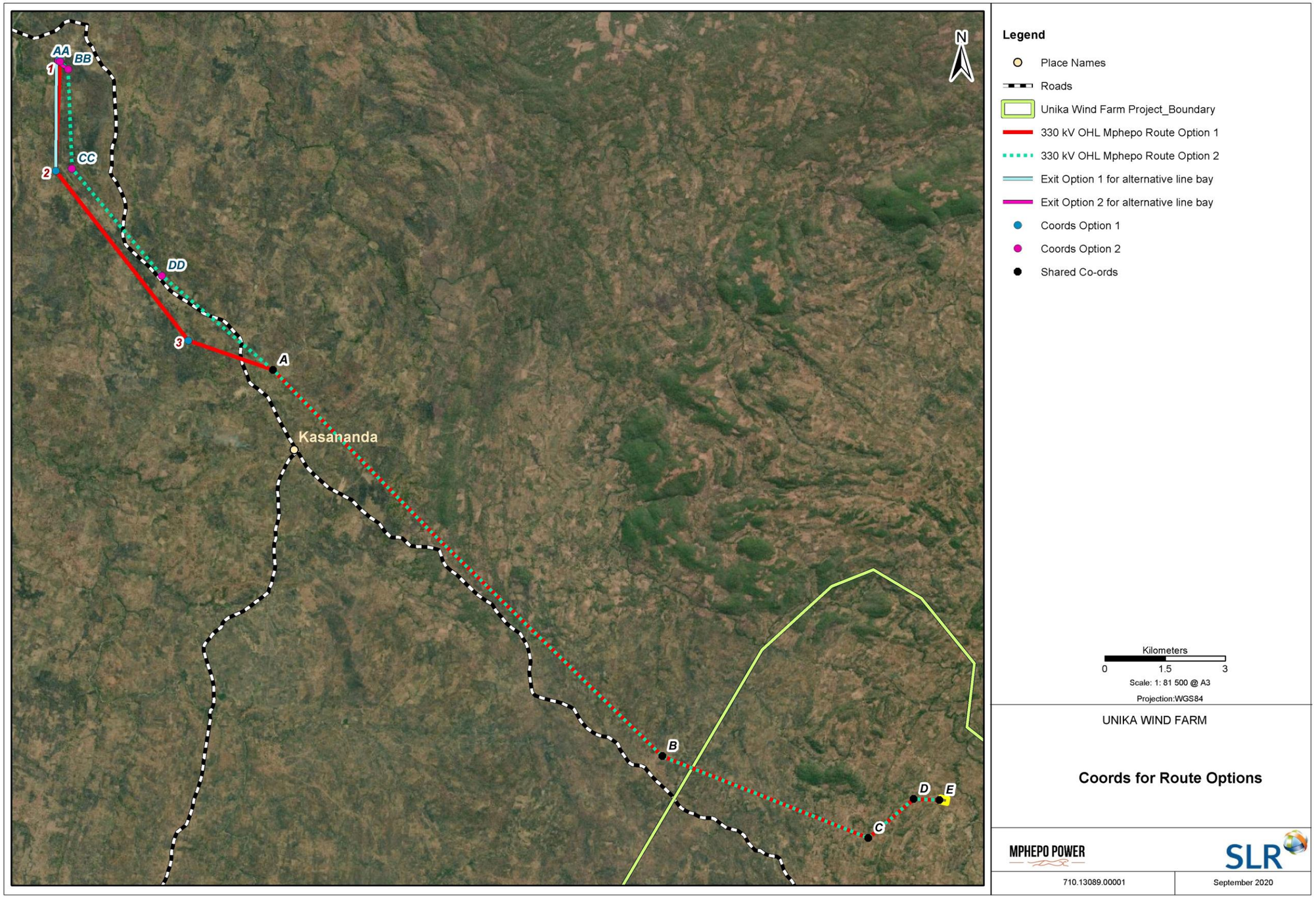


Figure 4: Map of Co-ordinates Along Transmission Line Route Options

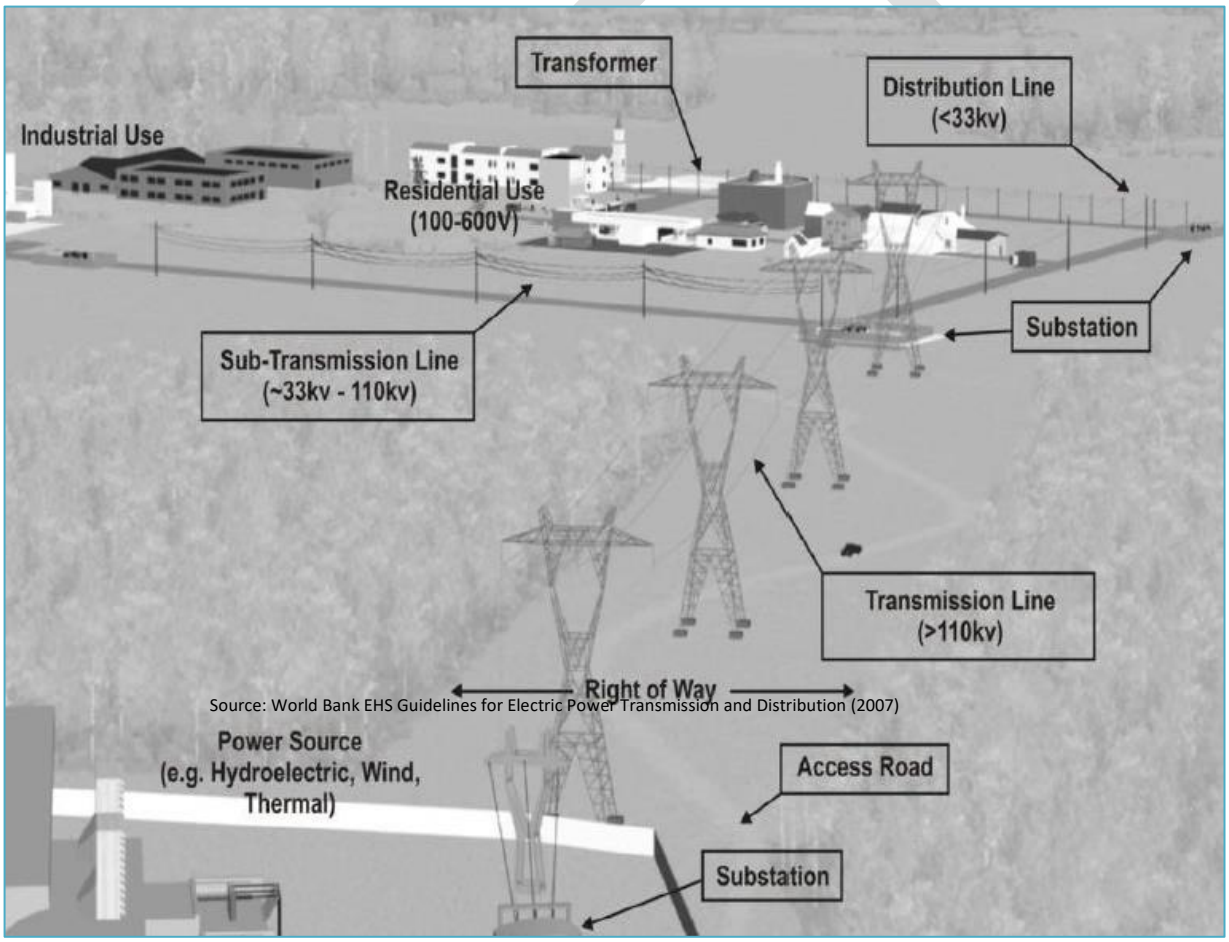
3.2 NATURE OF THE PROJECT

As part of the Unika I Wind Farm (WF) project it is proposed to build a 330 kV transmission line running from the wind farm project substation (to be built) to the existing Msoro substation located approximately 30 km north-west of the Unika I Wind Farm project site. This transmission line will be constructed by Mphepo and then handed over to ZESCO or a Private Developer for operation and maintenance. Based on the current design the transmission line will be approximately 31.5 km long with a wayleave of 55 m (i.e. 27.5 m on either side of the centre line). This equates to a total area of approximately 173.25 ha. The main components of the transmission line are described below.

3.2.1 Project Components

The major components of the transmission line and associated infrastructure are described below and displayed in Figure 5 and the typical tower construction for a 330 kV TL is presented in Figure 6.

This proposed Transmission Line will start at the Unika I WF substation (to be built) and will terminate at the Msoro substation (prior to the distribution network) located approximately 30 km north-west of the WF site.



Source: World Bank EHS Guidelines for Electric Power Transmission and Distribution (2007)

Figure 5: Main Components of a Power Transmission and Distribution Network

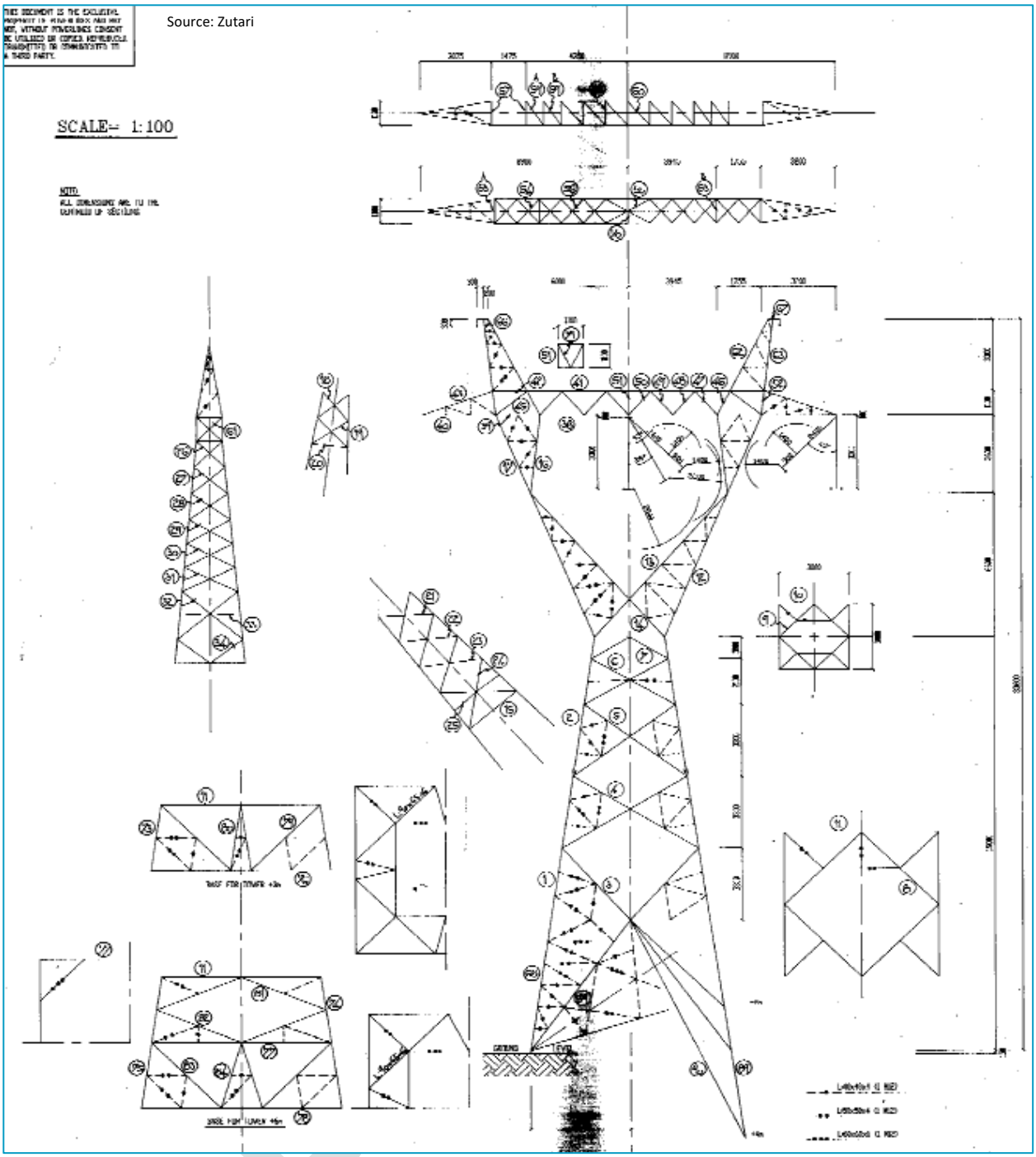


Figure 6: Typical 330 kV TL Tower Design

Towers

There are three main types of transmission towers (or pylons) used in a transmission system. Suspension towers support straight stretches of a transmission line. Deviation towers are located at points where a transmission line changes direction. Terminal towers are located at the end of overhead transmission lines where they connect with substations or underground cables. The most common type of transmission tower or pylon used for high-voltage power lines is a steel lattice structure.

The towers are the most visible component of the power transmission line. Their function is to keep the high-voltage conductors (power lines) separated from their surroundings and separated from each other. A variety of tower designs exist that generally employ an open lattice work or a monopole, but in generally they are tall metal structures.

Higher voltage lines require greater separation. The unintended transfer of power between a conductor and its surroundings, known as a fault to ground, can occur if an energized line comes into direct contact with the surroundings or comes close enough for an electric arc to jump.

Where a change of direction is required, the conductor tension is unbalanced, and a deviation tower is required. This tower is likely to have a broader footprint than the other towers along the transmission line.

In order to establish foundations for the towers activities such as excavation, concrete pouring and pile driving may be required. All of these tasks require access roads and service facilities with dimensions and strength sufficient to handle large, heavy tower components, earthmoving equipment, and maintenance equipment.

The tower construction for this Project will be steel lattice structures as shown in Figure 6.

Conductors (power lines)

The conductors are the power lines that carry the electricity along the transmission line. Generally, several conductors are strung on a tower for each electrical circuit. Conductors are constructed primarily of twisted metal strands; however more modern conductors may incorporate ceramic fibres in a matrix of aluminium for added strength and less weight than conventional copper conductors.

A variety of conductor compositions and designs are in use to meet a variety of specific requirements. Originally copper was used almost exclusively because of its high electrical conductivity, but cable diameters with copper were determined more by the need for mechanical strength than conductivity potential.

More modern aluminium conductors are more economical to use than copper, even though aluminium has only 60% of the conductivity of copper. Typical aluminium conductors are composed of multiple ± 1mm-thick strands twisted together. There are various varieties of multi-strand conductor cables available.

While steel is a relatively poor conductor, its high strength makes it possible to increase span lengths, which reduces tower investments. These composite conductors are designated by stranding combinations. For example, a “84/7” conductor has 84 aluminium strands surrounding a central core of seven steel strands.

A type of composite using ceramic fibres in a matrix of aluminium has been introduced which is lighter and stronger, and has the advantage of high strength, even at elevated temperatures, and the addition of zirconium to the aluminium alloy makes it more resistant to degradation at high temperatures.

Substations

The voltage required for economical transmission of electric power is much higher than the voltage appropriate for distribution to customers (domestic and industrial), so transformers are required to reduce voltage before the power is introduced to a distribution or sub-transmission system. These transformers mark the end of the power transmission line and are located at substations. Intermediate substations may also be required if there is a voltage change along the route (e.g. from 500 kV to 230 kV). Step-up transformers are used to increase voltage while decreasing current, while step-down transformers are used to decrease voltage while increasing current.

Substations vary in size and design, and the areas they occupy are usually flat, cleared of vegetation and typically surfaced with gravel. They are normally fenced off and reached by a permanent access road. In general, substations include a variety of building structures, transformers, switchgear, protection equipment, conductors, fencing, lighting and other features.

There are two main types of electrical substations. Transmission substations contain high-voltage switches used to connect together high-voltage transmission lines or to allow specific systems to be isolated for maintenance. Distribution substations are used to transfer power from the transmission system to the distribution system. Typically at least two transmission or sub-transmission lines enter a distribution substation, where their voltage is reduced to a value suitable for local consumption. Distribution substations can also be used to isolate faults in either the transmission or distribution systems.

The Msoro substation, where this power transmission line will terminate, is an existing substation. Some improvements (new feeder bay and exit line) are required to accommodate the new Unika I Wind Farm transmission line. The Unika I Wind Farm substation, where the transmission line will start, will be constructed as part of this Project.

Figure 7 shows typical substation infrastructure.

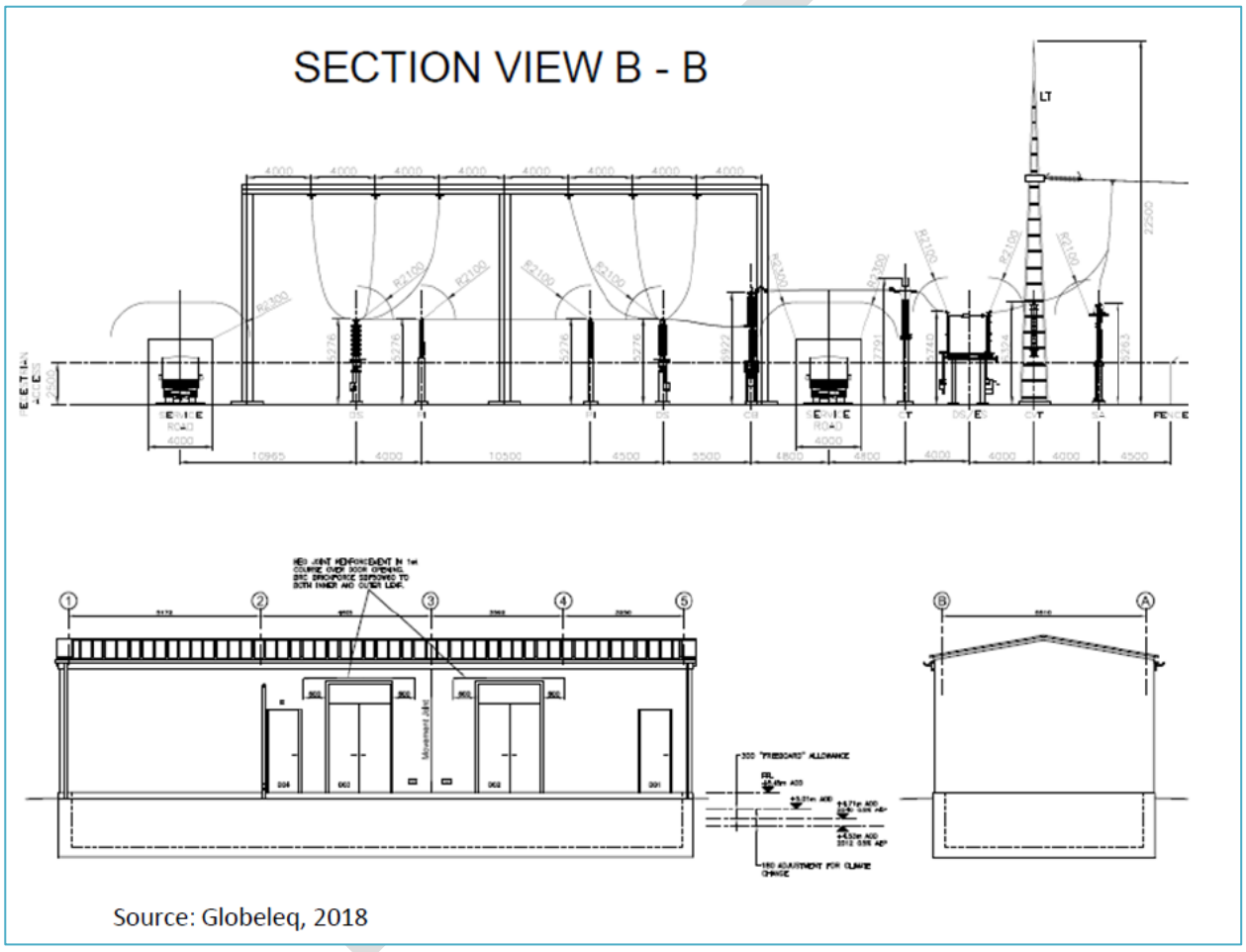


Figure 7: Technical Drawings for Typical Substation Infrastructure

Right-of-Way (Wayleave)

The TL requires a Wayleave to protect the system from windfall, contact with trees and branches, buildings and other potential hazards that may result in damage to the system, power failures, or forest fires.

The Wayleave is also used to access, service, and inspect the transmission lines. Larger systems transmitting higher voltages typically requires a wider Wayleave than those for distribution systems and, consequently, require more extensive management.

The Wayleave for this TL will be 55m (i.e. 27.5 m on either side of the TL). No settlement or large trees will be permitted within the Wayleave and cropping will be limited to growing agricultural crops only as is typically allowed by ZESCO.

To avoid disruption to overhead power transmission lines and towers, regular maintenance of vegetation within the Wayleave is required. Unchecked growth of tall trees and accumulation of vegetation within the Wayleave can result in a number of impacts including power outages through contact of branches and trees with transmission lines and towers; ignition of forest and brush fires; corrosion of steel equipment; blocking of equipment access; and interference with critical grounding equipment.

Typically, tall trees of approximately 4 m or more are not permitted within an aboveground Wayleave. An underground Wayleave has fewer vegetation restrictions, though trees with deep tap roots that may interfere with duct banks are usually prohibited from being grown within the Wayleave.

Following mechanical clearance for construction, vegetation maintenance within the Wayleave may involve mowing with heavy-duty equipment or hand clearance to prevent the establishment of trees and shrubs. Herbicides, may be used to control fast-growing weedy species or alien invasive plants that have a potential to mature to heights over those permitted within the Wayleave. Trimming and pruning is utilized at the boundaries of Wayleave to maintain corridor breadth and prevent the encroachment of tree branches. Hand removal may be required in the vicinity of structures, streams, fences, and other obstructions making the use of machinery difficult.

Access Roads

Access routes to transmission line structures for both line construction and maintenance will be required. Access roads are often constructed in conjunction, or within, a transmission line Wayleave to provide access for maintenance and upkeep of the system during the operational phase. Where these are existing roads they will be used wherever possible. New roads constructed for access would most likely be a combination of gravel roads and 4x4 tracks. Vegetation clearing and/or recontouring of land may be required for access road construction. Additional temporary roads may also be needed during the construction and decommissioning phases. Access roads will be located within the Wayleave as much as possible, and existing access routes will be used where possible.

3.2.2 Resources and Raw Materials Required

Resources that will be required to manufacture and construct the TL and associated components include:

- The resources associated with the tower, conductors and electrical equipment manufacturing (e.g. steel, copper, strategic metals, oils, plastic, etc.);
- Copper for grid connection and connections between turbines and substations;
- Construction materials for building structures (e.g. cement, brick, timber, etc.);
- Electricity for general construction and power supply to equipment/buildings;
- Cement/concrete, materials and steel for the tower feet foundations;
- Fuel and chemicals for construction equipment and vehicles;
- Water for construction, including dust suppression, sanitation and drinking;
- People for labour;
- Food for labour force;
- The resources associated with maintenance of construction equipment and vehicles (e.g. metal, plastic, rubber, oil, lubricants, etc.); and
- The resources associated with the maintenance of the TL and substations (e.g. .g. steel, copper, oils, plastics, fuel, chemicals, cement, aggregate/stone, brick, timber, etc.).

3.2.3 Production Capacity

Not Applicable - The TL will not have a production capacity, but will merely transmit electricity from the proposed Unika I Wind Farm into the National Grid.

3.2.4 Schedule and Life of Project

The construction phase is estimated to take approximately 18 months to complete. The life of the project is expected to exceed 30 years. The construction is anticipated to commence during Q1 of 2023. The TL will be handed over to ZESCO or a Private Developer after construction is completed.

3.2.5 Products and By-Products

Not Applicable - There are no products or by-products associated with the Project. As noted above, the TL will merely transmit electricity from the proposed Unika I Wind Farm to the National Grid.

3.2.6 Processes

The only process associated with this project is the transmission of electricity from the proposed Unika I Wind Farm to the National Grid. The electricity generated by the wind turbines will be collected via a 33 KV network and increased to 330 KV at the Unika I WF substation before being transmitted to the Project TL.

3.2.7 Air and Noise Emissions

Air emissions: Temporary air emissions will occur during the construction phase due to the use of construction machinery, the clearing of vegetation and transportation of equipment and materials, all of which may result in wind-blown dust and fugitive dust emissions. Dust suppression will be undertaken using water bowsers to damp down the surface and spreading woodchips as mulch. Little to no air emissions from the Project are anticipated during the operational phase.

Noise emissions: The main temporary noise sources during the construction phase will be from the mobile machinery (especially during bush clearing for the Wayleave), vehicles, workers and construction activities. In order to meet project time frames, construction activities are expected to be required afterhours (during night time) and on weekends. The operation of the transmission line is not expected to generate noise additional to that generated from the existing Msoro Substation at the end of the proposed TL.

3.2.8 Wastes and Wastewater

Non-hazardous and hazardous wastes: There will be waste generated mainly during the construction phase of the Project. During **construction**, wastes will comprise of spoil from excavations, general domestic waste including sanitary and food waste, office waste, equipment maintenance waste, packaging material (wooden pallets, plastic and cable drums) and concrete. Petrol and diesel will be used during the construction period for vehicles to transport goods and personnel, generators and heavy construction equipment.

During operation, waste materials will be limited to minor quantities of waste from maintenance works on the TL and at substations, including cleared vegetation.

Hazardous materials used on site during **operations** (at the transformers and substations) will include fuels, oils, lubricants, cleaning products, battery materials and specialised gases (for use in switchgear etc.). Minimal waste is expected to be generated during the operations phase. For certain types of transformers or backup generators, oil that needs to be replaced will be recycled, if possible, or safely stored and removed from the site and correctly disposed of.

Whilst there are few hazardous waste landfill sites near the Project site, there are ZEMA-approved and licenced companies that handle hazardous waste through storage, transportation and disposal, depending on the waste type. In addition, ZEMA encourages recycling of waste under their supervision. All solid wastes generated (hazardous and non- hazardous) will be disposed of through contracting an

approved waste handling company for disposal at appropriately licensed landfill sites. This will be the responsibility of the EPC Contractor during construction and Mphepo will have overall oversight to verify that the collection, transport, handling and disposal of these wastes is being undertaken in a suitable manner.

Waste during decommissioning will be similar to that produced during the construction phase; this includes wooden and plastic packaging, cable off-cuts, metal waste, and office and domestic waste.

Wastewater: Wastewater includes any water affected in quality by construction-related activities and human influence and will include sewage, water used for washing purposes (e.g. equipment, staff etc.), drainage from potentially contaminated areas (e.g. concrete batching/ mixing areas and equipment storing areas), etc.

Measures will be implemented to manage all wastewater generated during the construction period. Sewage will be stored on site in mobile and/or underground sanitary storage facilities which will be emptied by a licensed contractor and disposed of at a licensed facility on a regular basis or will be treated through a septic tank reviver (STR) or conservancy tank with a component of anaerobic digestion.

3.2.9 Traffic

Traffic during the construction phase will include earthmoving equipment for bush and land clearance; trucks delivering the TL cables, construction equipment, machinery and labour, and contractor vehicles. The peak trucking will take place around delivery of the TL equipment and machinery, but this is expected to be in batches as the TL progress along the Wayleave. The transportation route for the delivery of the TL equipment has not yet been finalised, but is most likely to be from Lusaka or Chipata along the T4 main road (using large flatbed trucks).

Transport routes will be decided once all the suppliers are finalised after undergoing a procurement and selection period. Route selection must be informed by a detailed transport management study. The traffic will reduce significantly post-construction (limited to a few times a year for inspections and maintenance purposes). Management measures will be implemented to control traffic during the construction phase (see Annexure A).

3.2.10 Water

Water Requirement: Approximately 10 m^3 per day will be required during construction for the following uses:

- Drinking;
- Ablution facilities;
- Access track construction;
- Dust control;
- Fire-fighting reserve; and
- Foundations of mounting structure and substations.

It is likely that very minimal water will be required for the operational phase of the transmission line (e.g during maintenance and potential fires).

3.2.11 Employment opportunities

The final number of people to be employed is likely to be up to 30-50 people during peak construction activities, with an estimated 20-30 unskilled and semi-skilled jobs likely to be available. However the number of people employed at one time may vary. Fewer staff will be required during the operations and maintenance phase.

Recruitment during the construction phase will be undertaken in collaboration with local authorities and local agencies and in compliance with Zambian laws and regulations. No labourers will be hired at Project site office(s). Mphepo will put in place measures to ensure no employee or job applicant is discriminated

against on the basis of his or her race, gender, marital status, nationality, age, religion or sexual orientation.

The EPC contractor will be required to comply with the Zambian Occupational Health and Safety Act, No. 36 of 2010, and any relevant international best practice standards.

3.3 MAIN PROJECT ACTIVITIES

The Project will be carried out in the following phases:

- Planning;
- Site Preparation and Construction;
- Operation; and
- Decommissioning.

These phases are described in more detail below.

3.3.1 Planning Phase

Besides the current ESIA and associated specialist studies undertaken during the current planning phase, additional activities that will be undertaken during this phase will include:

- Engagement with the traditional leadership, communities and key government authorities (e.g. Chieftainess Msoro, Katete Council, Mambwe Council, District Commissioners, Ministry of Energy, Ministry of Roads, Ministry of Forestry, etc.)
- Establishing grid code requirements and connections;
- Establishing the Right of Way for the TL;
- Establishing land-use rights and management requirements for the Right of Way
- Establishing Zambian power requirements and support; and
- Developing the detailed design and layout of the TL and access roads.

During the planning phase the Project will adapt and evolve to meet the requirements, time schedules and expectations of all the relevant parties.

Prior to initiating construction, a number of other surveys may also be required including, but not limited to, topographic surveys, surveys to confirm the tower locations and footprint, and Wayleave surveys to confirm land-use, number of trees to be removed and affected communities.

3.3.2 Site Preparation and Construction phase

The locations, size and type of towers will have been determined using information gathered from the planning phase.

Prior to the installation of the TL the Wayleave will need to be cleared of vegetation (only along sections where existing and already cleared Wayleave are not used) for access roads, tower assembly and spanning cables. Foundations for towers will be constructed of concrete. The Wayleave will be cleared and developed in progressive sections.

Labour for the Project is expected to come from Katate, Msoro and other towns and villages along the TL Wayleave, and preference would be to employ local people. It is not anticipated to accommodate workers on-site at this stage.

A maximum of 100 workers is anticipated on site during the peak of the site preparation and construction phases.

It will take approximately 18 months to complete construction of the TL. This will be followed by the testing to verify proper operation, inspections and hand-over to ZESCO.

Where possible; materials, plant and equipment, will be sourced from local suppliers.

The construction phase will broadly include the activities described below.

Site Preparation

Site preparation would be initiated following issuance of an Environmental License, finalisation and implementation of the Livelihoods Restoration Plan and/or Resettlement Action Plan and achieving Financial Close (i.e. confirmation of project funding). This phase would mainly include the following activities:

- Clearing of the Wayleave;
- Negotiating and establishing access roads;
- Transportation of equipment, materials and personnel; and
- Establishing laydown and equipment storage areas, and temporary construction camps.

Vegetation clearance along the Wayleave will be required to facilitate access, construction and the safe operation of the TL. Vegetation removal and excavations are also required at the footprints of the tower foundations. Excavation activities will require the stripping of topsoil, which will need to be stockpiled for rehabilitation later on. Site preparation will be undertaken in a systematic manner to reduce the risk of erosion. In addition, site preparation will include search and rescue of floral species of concern (where required).

Construction Activities

The construction phase will be initiated following the completion of site preparation activities. The construction phase mainly will include the following activities:

- Construction of site substation foundations and installation of site substation plant and equipment;
- Construction of tower foundations;
- Assembly and erection of towers;
- Stringing and regulation of conductors;
- Site de-establishment and clean up;
- Progressive rehabilitation of disturbed areas;
- Final inspection of the transmission line and handover to ZESCO.

Where possible; materials, plant and equipment, will be sourced from local suppliers.

Construction schedule and work hours

The construction phase is estimated to take approximately 18 months to complete. Construction will be required during day-time and night-time periods and on weekends to meet the expected timelines. The majority of noise generating works will occur during the first half of the construction period, for the following activities in particular:

- Site clearing via bulldozer and manual labour;
- Deliveries of equipment and materials;
- Clearing for access roads; and
- Assembly and establishment of the towers, substations and other electrical infrastructure.

Where possible, the contractor will prioritise to schedule noisy night-time activities as far away as possible from nearby homesteads, and will inform (through the Community Liaison Officer (CLO)) nearby residents when any noisy night-time activities need to take place in proximity to these sites.

In order to minimise potential impacts on the electrical supply grid, night-time work is likely to include the commissioning and testing of the interconnection between the Project and the ZESCO network at the Msoro Substation and any construction works on the feeder bays and interconnections.

3.3.3 Operational Phase

The transmission line will be in operation immediately after completion of successful testing and will remain operational for the lifetime of the Unika I WF project (expected to be at least 25 years at this stage). Subsequent maintenance and refurbishment would normally occur during the operational lifetime

of the transmission line. Operation of the transmission line will require routine maintenance work that necessitates the utilisation of access roads that will be created mostly along the Wayleave of the TL. From time to time it may be necessary to clear vegetation to facilitate access for maintenance and the safe operation of the transmission line.

3.3.4 Decommissioning phase

When the TL is decommissioned (expected to be over 25 years)at this stage, all components will be removed and the site rehabilitated. Where possible all materials will be recycled, otherwise they will be disposed of in accordance with local regulations and international best practice in force at that time. Waste management and rehabilitation requirements are addressed in the ESMP (Annexure A).

4. ANALYSIS OF PROJECT ALTERNATIVES

4.1 IDENTIFICATION OF ALTERNATIVES

During the planning phase of the Project a number of transmission line alternatives were considered. Throughout the assessment of these alternatives the following criteria were used:

- Ecological sensitivity including priority fauna and flora, and habitats;
- Social and community sensitivity, including land ownership, land use and proximity to communities;
- Financial criteria, including life cycle costs balanced against initial capital expenditure and operational costs; and
- Technical criteria, including whether the options can be efficiently implemented, maintained and operated.

4.2 ANALYSIS OF ALTERNATIVES

A total of six transmission line route alternatives to connect the Unika I WF site to the Msoro Substation were considered initially (see Figure 8). This was refined based on environmental, social and technical constraints, and currently there are two transmission line route alternatives that are considered, shown by the red (Option 01) and blue dashed (Option 2) lines on the map.

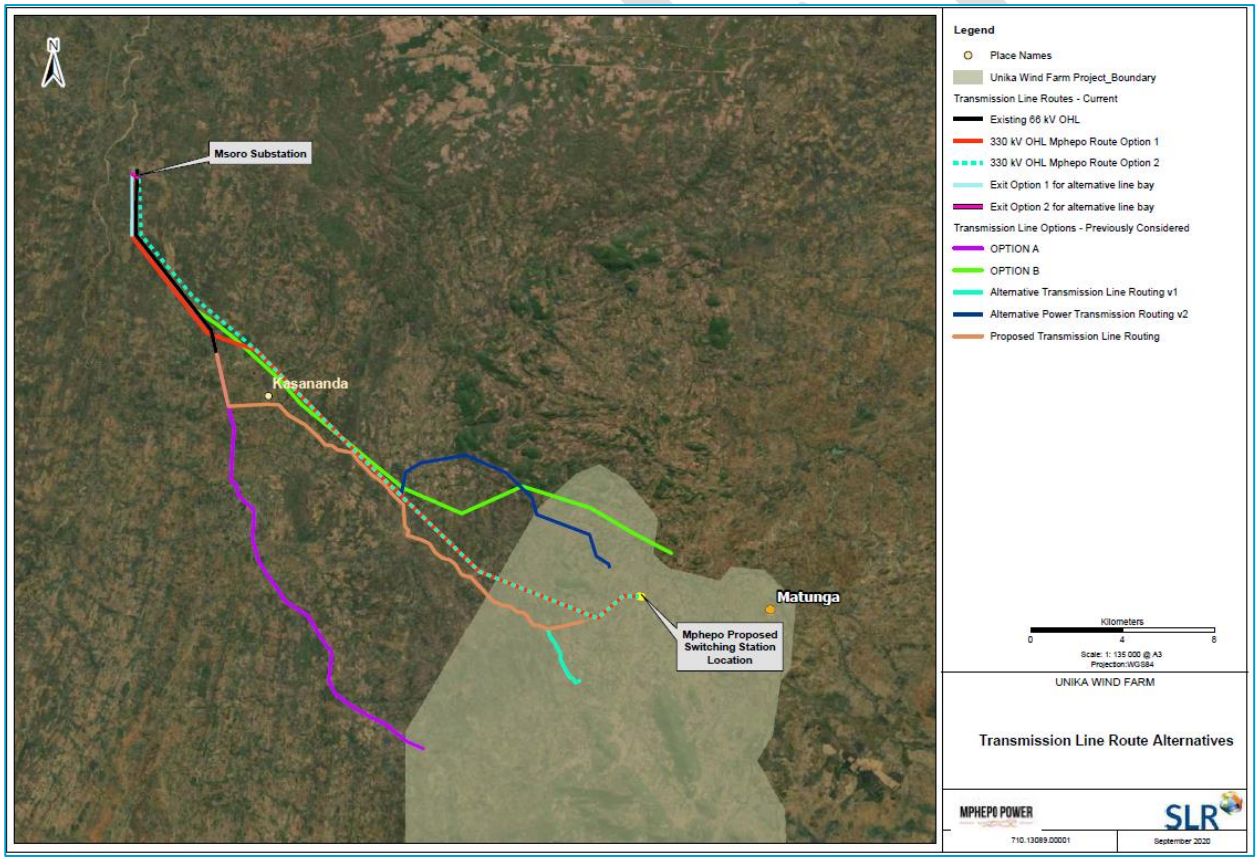


Figure 8: Transmission Line Route Alternatives Considered

The preferred alternative transmission line routes are shown in Figure 3. The two route alternatives follow the same route for the first 21 km starting at the Unika substation (shown as red/blue dashed line) and then splits, with Route Option 01 (red line) deviating to the west and Route Option 02 (dashed blue line) continuing in a more north-westerly direction. Route Option 01 has been chosen as the preferred alternative as it is expected to impact less Miombo woodland and freshwater habitats than Route Option 02 (see Table 13).

4.3 NO-GO ALTERNATIVE

The no-go alternative is for the Project (i.e. the Transmission Line) not to be developed. This would prevent the implementation of the Unika Wind Farm Project and the generation and transmission of power supply into the national grid. Should the Project not move forward, then the benefits of improved power supply and associated positive environmental, social and economic benefits of the Unika Wind Farm would not be realised.

Should the project not be developed, then the Project site area would remain the same except from ongoing natural rate of habitat degradation or loss and change in settlement and land use patterns. The land area would remain with its current environmental and social characteristics as described in Section 6 below.

In conclusion, the ESIA has investigated the potential positive and negative impacts associated with Project development and can confirm that the significant positive environmental, social and economic impacts of the Project outweigh the negative environment and social impacts anticipated at the Project site-specific level. The 'no project' alternative is not a preferable option as this will result in the Unika Wind Farm not being able to connect to the national grid.

5. STAKEHOLDER ENGAGEMENT

5.1 COMMITMENT TO STAKEHOLDER ENGAGEMENT

Mphepo is committed to free, prior, and informed engagement with stakeholders. Effective stakeholder engagement and public consultation is a cornerstone for successful project development. It involves working closely with interested and affected parties through the Project's life to ensure stakeholder are well-informed about plans, impacts, and risk and have meaningful opportunities to provide input into decisions which may affect them.

A structured, effective and culturally appropriate engagement program is required in order to build and maintain positive community relationships, and by extension, a Project's social license to operate.

5.2 STAKEHOLDER ENGAGEMENT PRINCIPLES

The key principles guiding the Project's approach to stakeholder engagement are as follows:

- To be open and transparent with stakeholders;
- To be accountable and willing to accept responsibility as a corporate citizen and to account for environmental and social impacts associated with the Project activities;
- To have a relationship with stakeholders that is based on trust and a mutual commitment to acting in good faith;
- To respect stakeholders' interests, opinions and aspirations;
- To work collaboratively and in cooperatively with stakeholders to find solutions that meet common interests;
- To be responsive to stakeholders;
- To be pro-active and to act in anticipation of the need for information or potential issues;
- To be fair and engage with stakeholders such that they feel they are treated fairly and their issues and concerns are afforded fair consideration;
- To be accessible and within reach of stakeholders so that they feel heard and to provide comprehensive information; and
- To proactively anticipate, identify and include all stakeholders.

These principles have informed the Project's approach to stakeholder engagement.

5.3 SUMMARY OF STAKEHOLDER ENGAGEMENT UNDERTAKEN

Comments received during the Scoping Phase were recorded and responded to (refer to Annexure E). Stakeholder engagement meetings will be held with various local communities located within the Project area after a public review period. A report providing a summary and the minutes of the stakeholder engagement meetings held during the ESIA phase, including the issues raised, responses given, a list of stakeholder invited and a list of the attendees, will be presented in the draft ESIA to be submitted to ZEMA.

A Community Liaison Officer (CLO) has been appointed by Mphepo, and is responsible for disseminating information and coordinating community communications through the course of the Project (in particular the Chewa Development Trust, the Msoro Chiefdom and local community leaders).

An External Grievance Mechanism has been developed and will need to be implemented prior to construction to enable community members and other stakeholders to raise issues of concern. This will serve to receive and facilitate resolution of affected communities' concerns and grievances about the Project.

5.3.1 Stakeholder Engagement During Scoping

A summary of the key stakeholder engagement/public participation activities undertaken during the Scoping Phase is presented in Table 7.

Table 7: Summary of Stakeholder Engagement Activities During the Scoping Phase

Date	Description
12 February 2019	Initial meetings with the Katete council and local traditional leaders of the Project area (wind farm and TL).
18 – 23 March 2019	Focus group meetings with village leaders to inform the social baseline conditions and land uses.
09 April 2019	Meeting with District Joint Operations Committee (DJOC) members, Heads of Department from Government agencies and District Council Members.
05 – 10 June 2019	Preparation and distribution of notice letters (in Lusaka and Katete) and Background Information Document (BID) via hand, email and sms to identified stakeholders to inform them of the Project and the Public Scoping Meeting.
05 & 12 June 2019	Advertisements of the project and invitation to Public Scoping Meeting were published twice in the Daily Mail and Daily Nation newspapers.
19 June 2019	Public meeting for the Scoping Phase of the Project was held in Katete.
12 February 2020	Final Scoping Report and Terms of Reference made available on the SLR website
11-15 December 2021	Scoping meetings with Chieftainess Msoro and village leaders along Transmission Line

Mphepo also had various engagements with Chieftainess Msoro, Mambwe District Council, between 2019 and 2021.

5.3.2 ESIA Phase Engagement

The draft ESIA report will be advertised for stakeholder comment in national newspapers and made available on the SLR website to Project stakeholders and the general public for a period of 25 days. After this review period further stakeholder engagement will involve small Focus Group Meetings at each village or group of houses. These meetings will be recorded, attendance lists taken and a photographic record will be kept for inclusion in the draft ESIA to be submitted to ZEMA. These meetings will be organised through the Chief / Chieftainess and Village Headmen so they are kept fully informed.

5.3.3 Stakeholder Concerns

The issues raised during the public meetings for the Scoping phase relate to the following:

- How will people benefit from the Project;
- Size (spatial extent) and output of the Project;
- Distances between the wind turbines;
- Emergency response measures that will be in place;
- Occupational health and safety arrangements for workers
- Effective communication required with key stakeholders
- Impact on livelihoods and restoration/management;
- Timeframes for construction;
- Parties involved in the implementation of the Project;
- Wind resource availability at the site; and
- Interactions with ZESCO undertaken by the Project company to date.
- If power can be drawn by local villages from the Transmission Line.
- Required distance (metres or kilometres) for the houses to be connected, if ZESCO agrees to connections.
- Possibility of training to the unemployed youths.
- Levels of literacy and education, leading to misinterpretation of information.
- Spreading/allocation of benefits.

- Loss/reduction of wind resources in the area.
- Location of wind farm project in relation to Msoro substation.
- Tariffs for power supply.
- Employment of local people.
- Compensation for land.
- Design and size of Transmission Line.

The issues raised during the stakeholder engagements for the ESIA phase (and ZEMA public hearing if required) will be included in the ESIA to be submitted to ZEMA.

6. ENVIRONMENTAL AND SOCIAL BASELINE CONDITIONS

6.1 CLIMATE

The study area is characterized by three distinct seasons: cool dry season from mid-April to August; hot and dry season from September to October; and a rainy season from November to April. The area receives annual rainfall in the region of 450 mm to 1 000 mm with the mean annual rainfall being in the order of 850 mm. The months between December and February typically receive 70% of the annual rainfall.

The temperatures in the Project area are moderate with the mean monthly temperatures ranging between about 17°C in the cold season to about 32°C in the hot season when humidity is relatively high.

The area is dominated by prevailing easterly winds during the dry season with fresh winds experienced in the months of July and August. Winds from the south-east are also experienced during the dry months while westerly winds are experienced in the wet months.

6.2 GEOLOGY

Geology along the TL is broadly defined as metamorphic rocks of the Mozambique Belt according to the Geological Map of Africa (compiled by Dr Schlüter), and consists mainly of granitic gneiss, granite, migmatites and schists. Although the wider area does have large granite domes which create unique landscape features adding to the scenic quality, no domed granite features were identified in the vicinity. The regional terrain is hilly, surrounded mainly by gently undulating terrain.

6.3 HYDROLOGY AND DRAINAGE

Numerous extensive drainage systems were identified in the study area and along the TL routes, many of which are interlinked and extend far beyond the boundaries of the site. At a high level, these watercourses were classified as Inland Systems falling within the Middle Zambezi – Luangwa and Lower Zambezi Aquatic Ecoregions. The identified drainage systems comprised the following primary hydrogeomorphic (HGM) types: rivers with associated riparian vegetation and in some cases with associated floodplains and what are referred to locally (in Zambia) as ‘dambos’ (characterised by relatively even topography and situated in low-lying areas).

Whilst there were distinct differences between the different HGM types (e.g. between the rivers with associated riparian zones and dambos), it was noted during the fieldwork that conditions were largely homogenous within each group of the various drainage systems. For example, dambos were all characterised by the same floral species composition and vegetation communities throughout the study area, and the rivers had distinctive riparian zones characterised by woody species (with similar composition).

6.3.1 Riverine Systems

Hydraulic Regime

The hydraulic regimes of the various riverine systems have not been notably impacted by existing land uses, except where some instream infrastructure, such as weirs and road crossings (informal and formal) has been constructed. The occurrence of heavy rains at the start of the site assessment enabled assessment of how such infrastructure causes alterations to flow regimes, with flow being concentrated at specific points either around or through the centre of such road infrastructure. Additionally, it was apparent that debris occasionally becomes lodged against instream infrastructure, impeding flow and causing turbulence. Aside from these impacts, no formal abstraction (e.g. pump stations) or unnatural water inputs were observed.

Geomorphology and Sediment Balance

The proximity of subsistence agriculture in close proximity to the rivers has resulted in increased volumes of sediment transported into the rivers. This in turn has resulted in scouring and bank incision. Where bank incision was observed, in most instances it was not considered severe.

Water Quality

Although no reference state information of these rivers is available, it is apparent that the clearing of vegetation and disturbance of soils has contributed to the increased turbidity of the rivers. This was evident as the surveys took place during a period of relatively high rainfall and is assumed to reflect a relatively natural state. Basic water quality parameters (temperature, pH and Electrical Conductivity [EC]) were measured at five sites. At all five sites, pH ranged from 7.07 to 7.60, and EC ranged between 1.2 mS/m to 3.0 mS/m. These results indicate that water quality is relatively unimpaired, save for increased turbidity and possibly increased nutrients.

6.3.2 Dambos and Floodplain Wetland Systems

Hydraulic Regime

Disturbances to the soils within dambo areas – primarily for cultivation - may have led to altered movement of groundwater within the vadose zone of the wetlands, in turn potentially altering the hydraulic regime of these systems.

Geomorphology and Sediment Balance

As for rivers and streams, the primary impact on geomorphology of wetland systems is due to soil disturbance and informal road crossings. Increased sediment inputs caused by surface water movement is apparent in the rainy season. Some patches of erosion were observed within areas subjected to long-term cultivation.

Water Quality

Surface water was present in some dambos at the time of the assessment due to recent rainfall but is not likely to be present during the dry season. Based on water quality parameters recorded in the various riverine and channelled valley bottom wetland systems, water quality within the dambos is likely to be relatively unimpaired, apart from increased turbidity due to soil disturbance.

6.4 HYDROGEOLOGY

Ancient (Precambrian) crystalline basement rocks comprising gneisses and granitic rocks with some meta-sediments are dominant in the eastern and southern parts of Zambia. Groundwater is mainly restricted in the crystalline basement rocks which are the dominant rock types. Consequently, water availability is a more significant problem in these areas. Nonetheless, groundwater is present within fractures and joints in the basement rocks and within the weathered overburden, which is typically of the order of 10–15 m thick, but up to 30 m thick in places. Sporadic thermal or saline springs occur in parts of Southern, Central and Eastern Provinces. Chemical data are available for groundwater in Zambia, and specifically for the Project site area, is very limited. Available data suggest the groundwater generally has low concentrations of dissolved constituents.

The Project site falls within the BL-02 quaternary catchment of the Luangwa catchment (see Figure 9). The Project Site area is underlain by aquifers of limited potential or regions without significant groundwater. The stratum has intermediate characteristics with borehole yields typically 0 – 2 litres per second as a result of low yielding formations (e.g. basement gneiss).

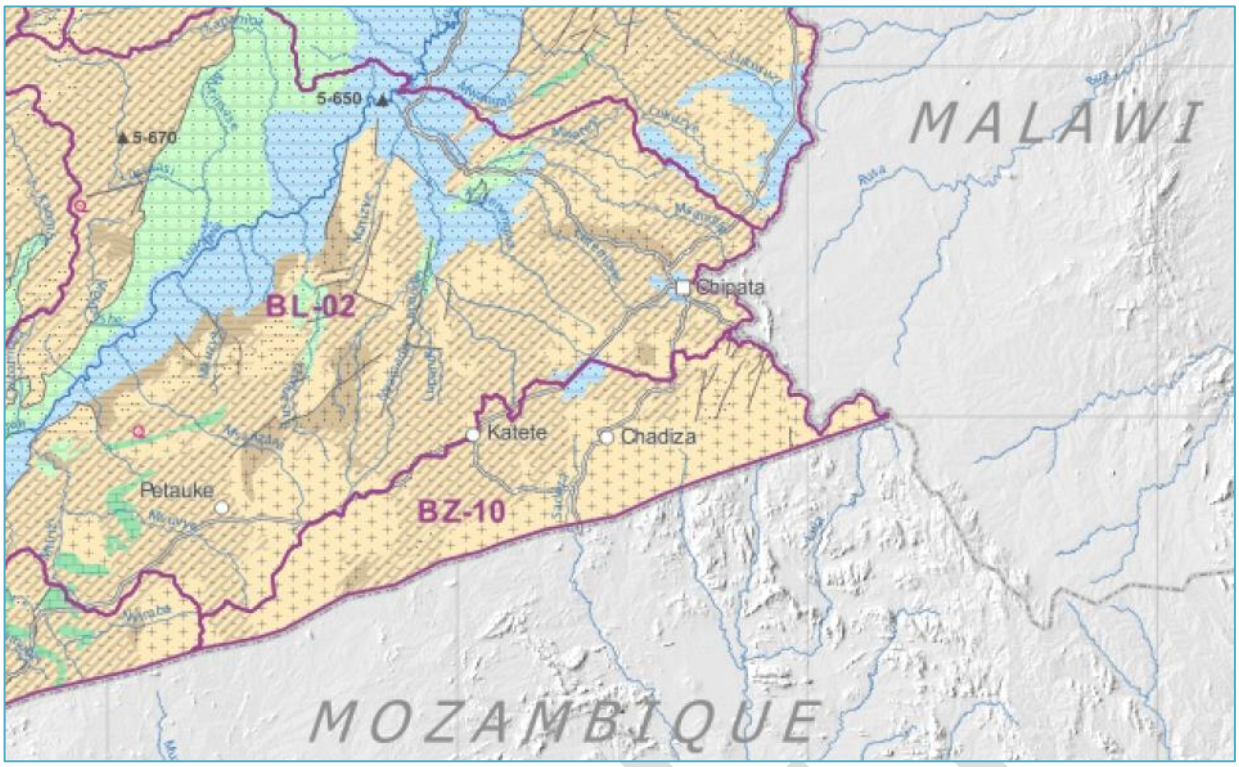


Figure 9: Quaternary catchment of the Luangwa catchment

6.5 LANDSCAPE AND TOPOGRAPHY

In general, the study area is comprised of a landscape of tall, forested hills, elevated ridges and low-undulating hills, with broad, flat valleys extending between the hills. The valleys in-turn supports a number of ephemeral streams and seasonally flooded wetlands (Figure 10).

The elevation ranges from approximately 900 mamsl to 1 400 mamsl. There are numerous other small hills which also range from 200 m to 300 m in height. Smaller cone-shaped hill features are also present, which due to their conical shape, create interesting topographic features in the landscape.

Figure 10: Images of the Project Site Landscape

6.6 TERRESTRIAL AND FRESHWATER ECOLOGY

6.6.1 Flora and habitats

The following terrestrial habitat units were identified along the TL route:

- **Degraded Forest Habitat,** comprising several forest tree species, where trees exceeded 8 m in height with large, predominantly interlinking canopies. This habitat unit was observed primarily in the upper reaches of the large inselbergs and central mountainous areas of the Project Site. This habitat is under threat due to the harvesting of timber for charcoal production, leading to the encroachment of miombo woodland species.

- **Degraded Miombo Woodland Habitat**, the dominant vegetation type along the TL routes and that of southern Zambia. The characteristics of this habitat unit were varied, with some of the more degraded areas being noted to have fewer characteristic/typical miombo floral species. The woodlands typically comprised trees varying between 4 – 8 m in height but without densely interlocking canopies;

- **Freshwater Habitat**, comprising streams and dambos (wetlands). This habitat unit has been notably impacted by vegetation clearance for agriculture (grazing and crop cultivation). The dambos and streams convey large amounts of water, although the removal of natural vegetation has resulted in increased peak water flows causing some erosion within the dambos and along stream banks; and
- **Agricultural Areas**, associated with cultivated fields and areas where vegetation has been cleared including that used for livestock grazing.

Illustrations of these broad habitat units along the TL routes is presented in four maps in Figure 11, Figure 12, Figure 13 and Figure 14.

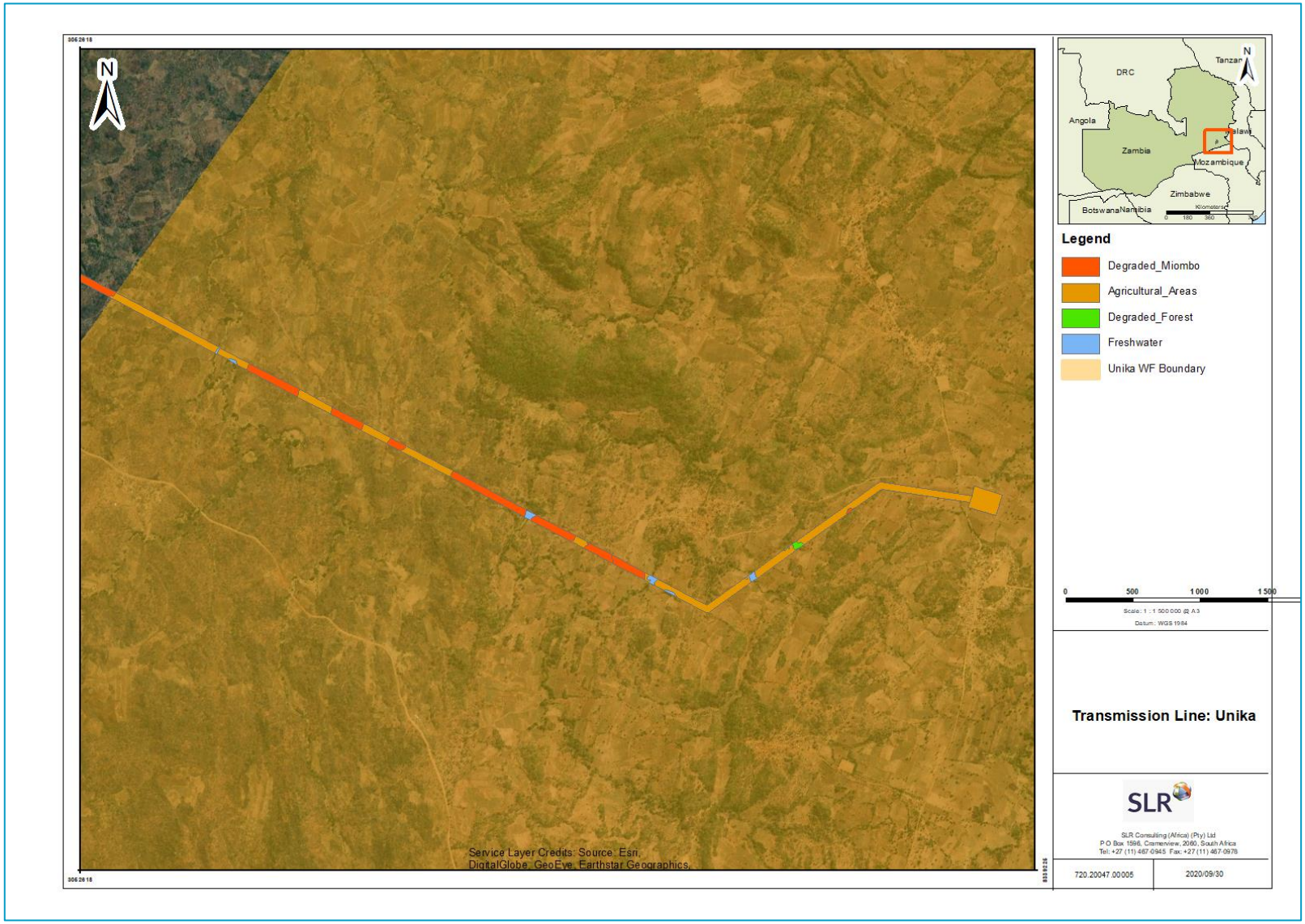


Figure 11: Habitat Units along the TL Routes – Section 01

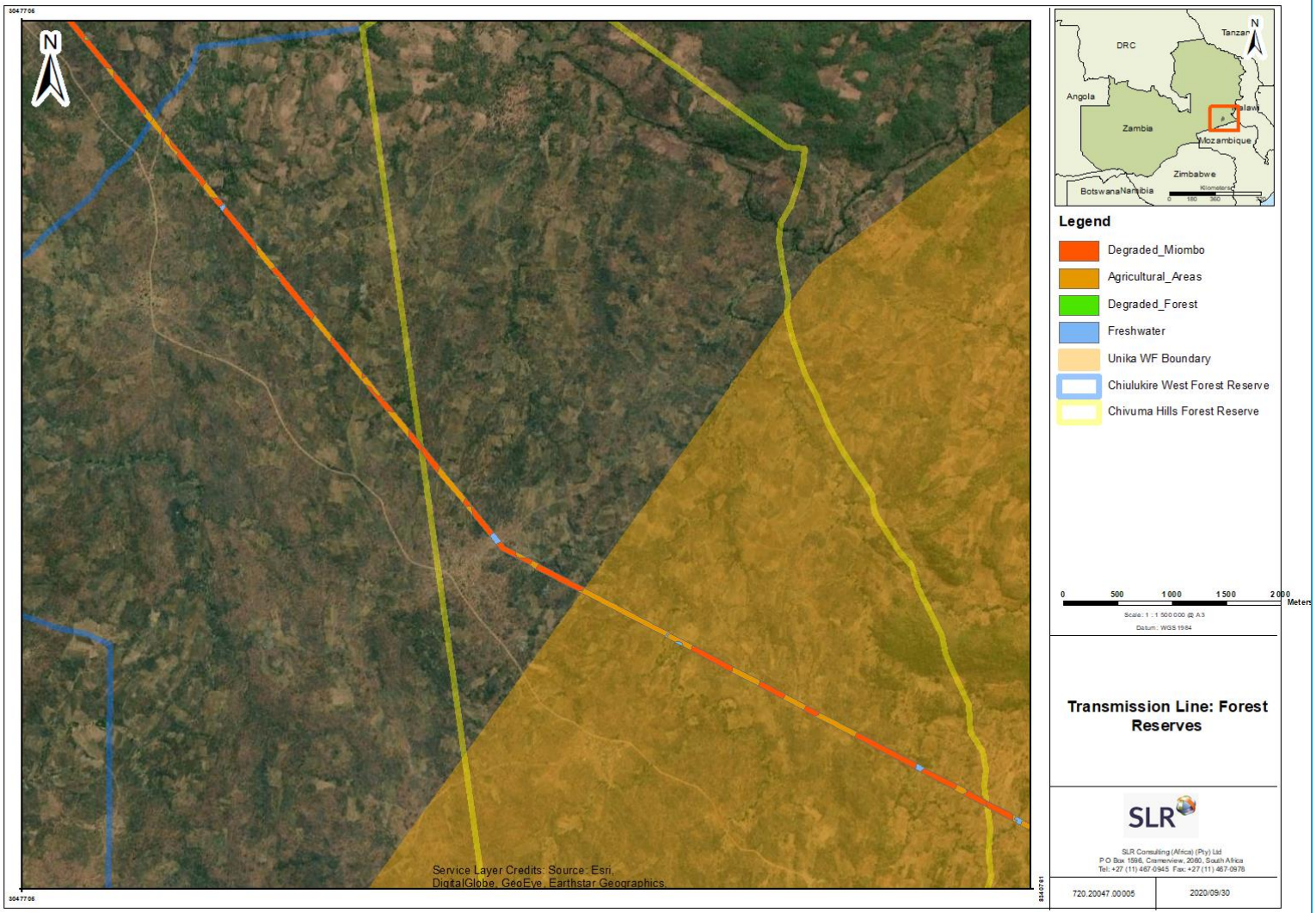


Figure 12: Habitat Units along the TL Routes – Section 02

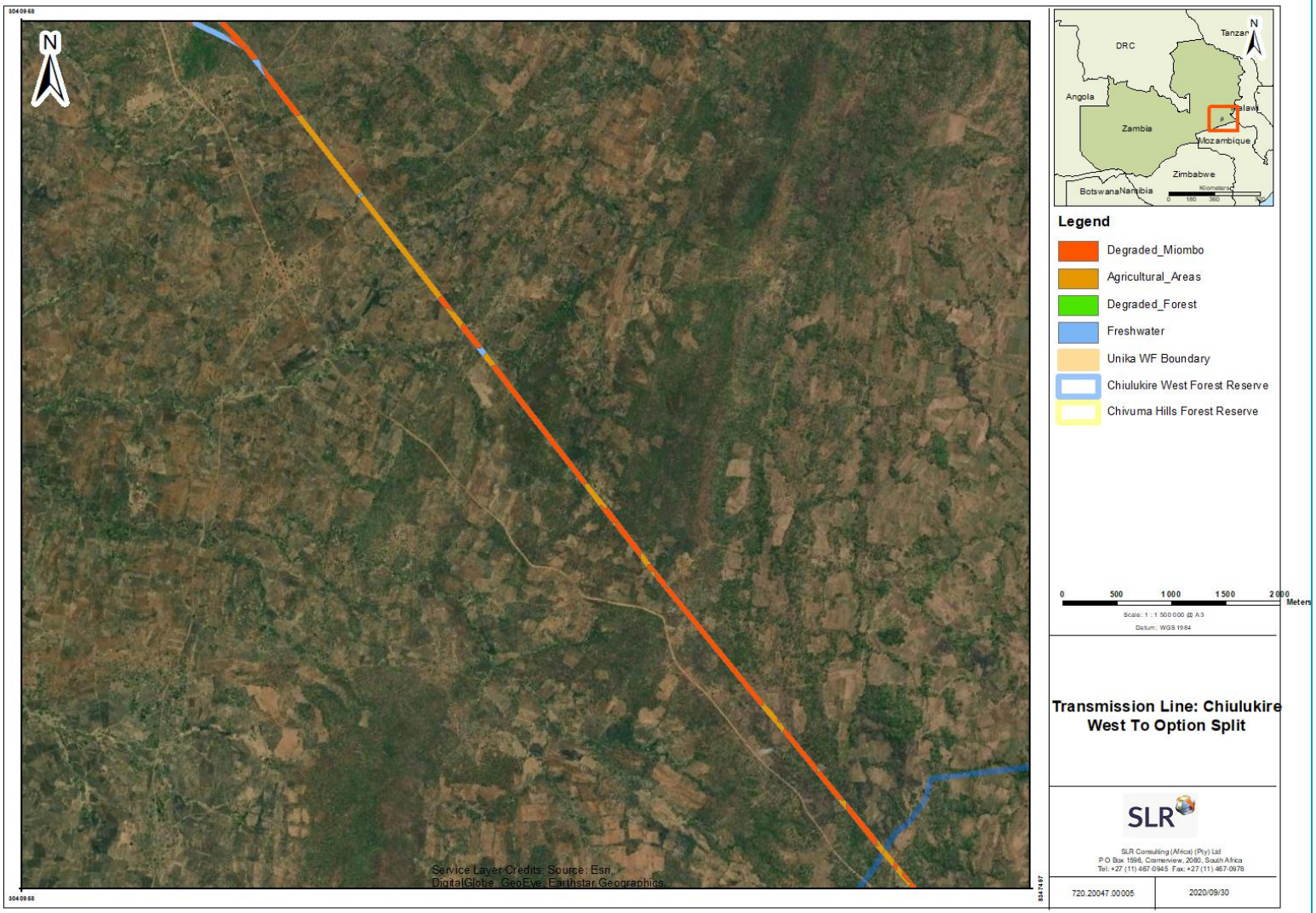


Figure 13: Habitat Units along the TL Routes – Section 03

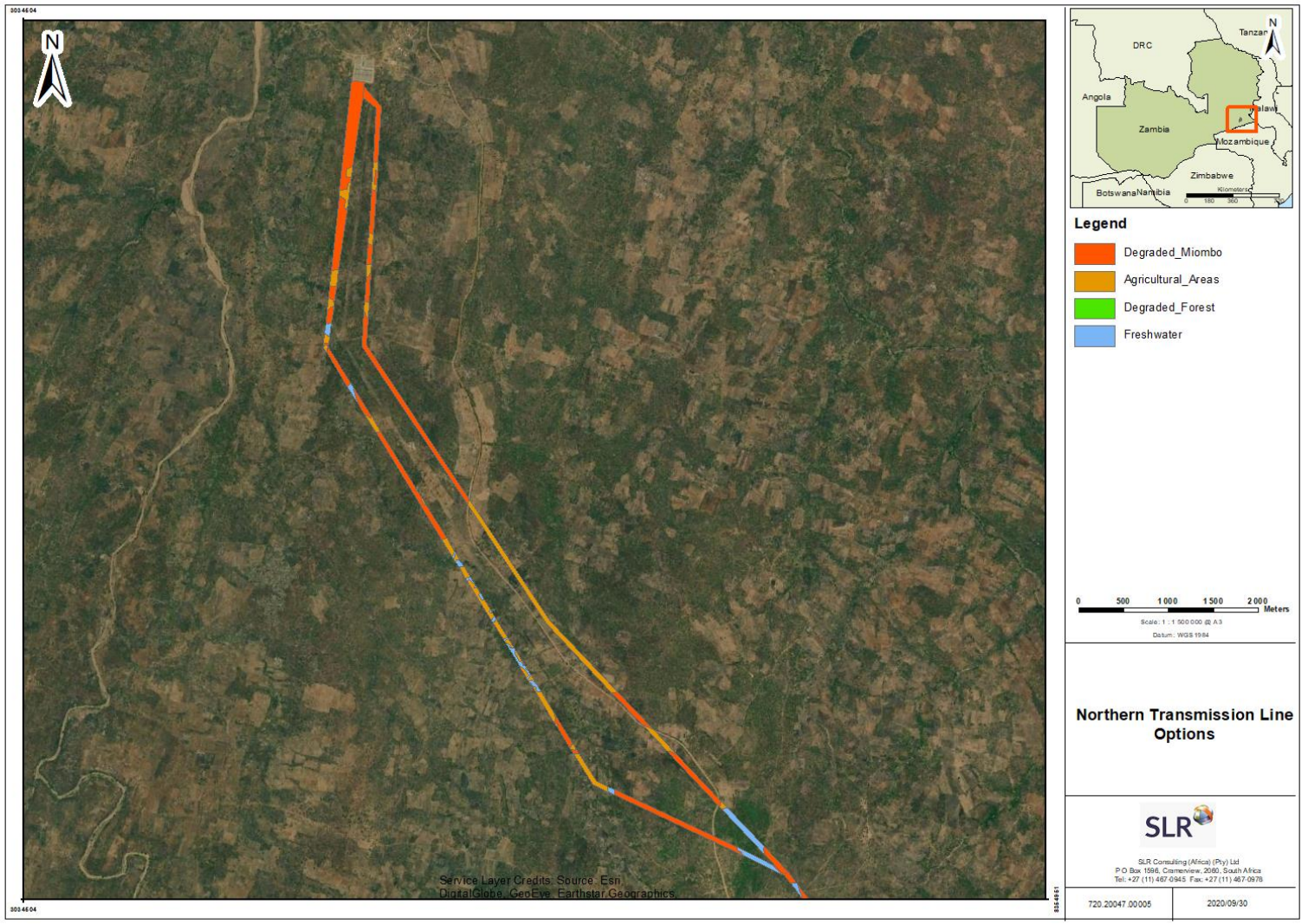


Figure 14: Habitat Units along the TL Routes – Section 04

Degraded Forest

The Degraded Forest habitat has, over the years, been subjected to continuous wide scale impacts largely from collection of firewood, timber harvesting for household structures, and for charcoal, which is typically sold for income. This has led to the extensive felling and removal of older, large trees at a rapid rate. Due to the high demand for wood many of the younger intermediate sized trees are also being harvested, with the net result that the forest environment is unable to recover. This continuous deforestation has led to an encroachment of miombo woodland species along the outer margins of this forest habitat unit, as well as the overall retraction of the forested areas. In addition to the deforestation, slash and burn activities were regularly observed in order to clear forested lands for crop production. These anthropogenic activities have led to the forest habitat becoming isolated and fragmented, occurring only in areas where the terrain is not suitable for agriculture, or where areas have cultural significance. This has led to the overall loss of habitat integrity, driving species diversity loss and the degradation of the overall forest habitat.

Floral species observed in this degraded forest habitat unit include, but are not limited to *Julbernardia globiflora, Brachystegia bussei, Adenia senensis, Lannea discolour, Cassia singueana, Diospyros kirkii, Pericopsis angolensis, Pterocarpus angolensis, Pterocarpus chrysothrix, Dalbergia martini, Dichrostachys cinerea, Brachystegia utilis, Acacia nigrescens, Commiphora africana, Erythrina abyssinica, Brachystegia boehmi, Diplorhynchus condylocarpon, Pseudolacnostylis maprouneifolia* and *Brachystegia longifolia,* amongst others.

Two hardwood tree species occur within this habitat unit which are of conservation concern, mainly as a result of continued decline due to harvesting, although both are listed as Least Concern by IUCN: *Pterocarpus tinctorius* and *Pterocarpus angolensis. Pterocarpus tinctorius* (*chrysothrix*) (Makula) is highly exploited in Zambia which has resulted in the Government banning the harvesting and trading of this species. The tree species *Pterocarpus angolensis* (Mukwa/Bloodwood) is also subject to continued harvesting and is decreasing across its range, although currently this species is still fairly widespread across Zambia.

This habitat type is considered to be of Moderately High Biodiversity Importance.

Degraded Miombo Woodland

The Miombo Woodland habitat is the dominant habitat along the TL routes, and its habitat integrity is subjected to the highest degree of disturbance and vegetation clearing. This vegetation community exhibits variable levels of anthropogenic impacts and activities. Although numerous Miombo Woodland species were present, it was evident that in the more degraded areas where charcoal burning activities were higher, *Parinari curatelifolia* appeared to be more dominant. In these areas coppices and miombo saplings were evident, however larger trees had been harvested for charcoal production. In areas where less disturbance was observed this habitat unit was dominated by the miombo species *Julbernadia paniculata* and *Brachystegia boehmi*.

Floral species observed in this habitat unit include, but are not limited to *Ochna schweinfuthiana, Diospyros kirkii, Lannea discolour, Julbernardia paniculata, Brachystegia boehmi, Pterocarpus angolensis, Dichrostachys cinerea, Terminalia sericea, Swartzia madagascariensis, Albizia harveyii, Burkea africana, Kigelia africana, Hexalobus monopetalus, Diplorhynchus condylocarpon, Cassia abbreviata, Strychnos cocculoides, Afromomum alboviolaceum, Ledebouria revoluta, Boophone disticha, Chlorophytum clarae* and *Costus spectabilis*.

The hardwood tree species *Pterocarpus angolensis* (Mukwa/Bloodwood) was observed in this habitat unit. This species is listed as LC by the IUCN but due to continued harvesting is noted to be decreasing across its range. However, it must be noted that currently this species is still fairly widespread across Zambia. In addition, *Boophone disticha* was observed in this habitat unit, and although not formally protected this species is often harvested for medicinal purposes or plant collections.

This habitat is considered to be Intermediate Biodiversity Importance.

Agricultural Areas

The agricultural areas have been cleared to make way for crops such *Zea mays* (maize), *Glycine max* (soybean) and *Cucurbita* sp (pumpkin) which are grown along the TL routes. Large tracts of the low-lying lands have been cleared for cultivation. It was noted that larger trees are often left along the field boundaries, presumably as a wind break but also as it would require unnecessary time and effort to remove them. Larger fruit-bearing trees, notably *Mangifera indica* (mango) are left in place and fields cultivated around them. This is attributed to their importance as a food source in the region.

The agricultural areas have been significantly transformed and bear no similarity to the reference Miombo Woodland vegetation type of the region. Although the agricultural lands are important for food production, they are not considered important for floral species, with a moderately low floral species diversity and a notable loss of habitat integrity.

Floral species observed in this habitat unit include, but are not limited to *Uapaca siberiana, Terminalia sericea, Ficus sycamorous, Vangueria infausta, Brachystegia boehmi, Dichrostachys cinerea, Diospyros kirkii* and *Mangifera indica*.

No floral Species of Conservation Concern (SCC) were encountered within this habitat unit. Vegetation clearance activities in these areas have left limited natural vegetation remaining.

Biodiversity importance of the agricultural areas habitat is considered to be Moderately Low.

Freshwater Habitat (Dambos and Streams)

The freshwater habitat was observed at a few limited sections along the TL routes. The dambos and riparian areas were noted to have increased floral species diversity, as is to be expected, with many of the floral species observed in these areas not occurring within the other habitat units, particularly orchid species. The riparian areas are still largely intact and of moderately high integrity, although the agricultural lands encroach extensively on the riparian vegetation. The dambos located around the villages have been significantly impacted upon as a result of vegetation clearance and crop cultivation, leading to species diversity and habitat loss in these areas. The freshwater habitat unit is considered important for species diversity and habitat provision, as well as ecological functions. Although the freshwater habitat has been subjected to several anthropogenic impacts, its biodiversity importance is still considered Moderately High.

Species observed in the freshwater habitat include *Cyperus esculenta, Platycoryne buchanania, Cyperus* sp., *Kyllinga pumila, Habenaria schimperiana, Gnidia chrysantha, Ascolepis protea, Hypoxis nyasica, Drocera* sp., *Popowia obovata, Senegalia polyacantha, Ficus sycamorus, Mucuna coriacea, Stereospermum kunthianum, Vitex doniana, Piliostigma thonningii, Pseudolacnostylis maprouneifolia, Antidesma venosum, Grewia caffra* and *Markhamia obstifolia*.

Although no SCC were observed in the freshwater habitats, the dambos provide habitat for unique floral species such as *Habenaria schimperiana* (Orchid), *Drosera sp.* (Sundew), *Boophone disticha* and *Hypoxis nyasica*, which although not formally protected are often harvested for medicinal purposes or plant collections.

Biodiversity Importance of this unit is considered to be Moderately High.

Floral Species of Conservation Concern

No globally threatened (i.e. IUCN redlisted species) were identified in the TL routes i.e. no species listed as Critically Endangered (CR); Endangered (EN) or Vulnerable (VU) were found. However, species such as *Pterocarpus tinctorius* (*chrysothrix*) and *Pterocarpus angolensis* are of concern as their known population numbers are declining due to overharvesting, and are protected species. In addition to these woody species, small bulbous species such as *Boophone disticha* and *Habenaria schimperiana*, although of LC according to the IUCN, are also considered under pressure due to harvesting for medicinal purposes and species collections.

Alien Invasive Plant Species

Alien invasive plant species identified within the study area were mostly associated with villages and in particular agricultural areas and livestock pens, where in some instances they were completely dominant, notably in the case of *Lantana camara* (Lantana). Table 8 lists the exotic and invader species identified along with their basic methods of control. Alien invasive plant species will require control measures to prevent further spread. The only two exceptions on the list below are that of *Mangifera indica* (mango) and *Psidium guajava* (guava) which have an important social and economic use in the communities as a seasonal supply of food. Removal or destruction of these trees should be avoided where possible.

Table 8: Exotic or Invasive Species

Scientific name	Common name	Control
Bidens pilosa	Spanish Blackjack	Pre-emergence herbicide
Mangifera indica	Mango	None, agricultural use
Psidium guajava	Guava	None, agricultural use
Lantana camara	Lantana	Mechanical control, herbicide

Medicinal Plant Species

The majority of the plants identified in the study area all have medicinal properties and are considered to be common to the region, especially within the degraded forest and miombo woodlands. Although no survey of plant uses was undertaken it is likely that many local residents rely on natural medicines. A list of the traditional medicinal plants species and their uses is provided in Table 9.

Table 9: Traditional Medicinal Plant Species

Scientific name	Medicinal use
Annona senegalensis	The bark is used medicinally to treat gastrointestinal ailments and the gum from the bark is used for sealing cuts and wounds.
Pericopsis angolensis	Included in treatment for ringworm, stabbing pains, eye problems, malaria, blackwater fever, stomach problems and to increase the supply of breast milk.
Stereospermum kunthianum	Pods are chewed with salt for coughs and are used in treatment of ulcers, leprosy, skin eruptions and venereal diseases; also used to cure flatulence in horses.
Mangifera indica	Charred and pulverized leaves make a plaster to remove warts and also act as a styptic. Seeds are used to treat stubborn colds and coughs, obstinate diarrhoea and bleeding piles. The bark is astringent, homeostatic and antirheumatic.
Bauhinia petersiana	Wounds were successfully treated when pounded leaves boiled in a salt solution were applied.
Vachellia sieberiana	In Central Africa, a bark/root decoction is used for inflammation of the urinary passages. Leaf, bark and resin are used as an astringent for colds/chest problems, diarrhoea, haemorrhage and eye inflammation. In Tanzania, bark is used to treat gonorrhoea.
Philenoptera violacea	Most parts of the plant are used to treat diarrhoea. The roots are used for gastro-intestinal problems; powdered root bark is used to treat colds and snakebite. Root infusions are commonly used as part of a hookworm remedy.

Scientific name	Medicinal use
Syzygium cordatum	The powdered bark is used as a fish poison. In central Africa the tree is known as a remedy for stomach-ache and diarrhoea. It is also used to treat respiratory ailments and tuberculosis.
Parinari curatellifolia	An infusion of the roots is used to treat toothache and a leaf decoction is either drunk or used in a bath as a remedy for fevers. The crushed or pulped leaves are used in a dressing for fractures or dislocations, and for wounds, sores and cuts.
Erythrophleum africanum	An infusion of the bark is drunk to treat stomach-ache or dysmenorrhea. The bark is used to make a mouth wash for relieving toothache. Steeped in water, the bark is applied externally and internally to cure cardiac diseases and epilepsy. A paste of root bark is applied to the skin to cure scabies.
Strychnos cocculoides	The fruit is mixed with honey or sugar and used to treat coughing. The fruit is used in making eardrops for treating ear complaints. The root can be chewed to alleviate stomach disorders, eczema and sores on the skin. It is also an alleged cure for gonorrhoea.
Combretum adenogonium	The branches, free of fruit, are used to prepare an infusion in Liberia for washing the body to relieve pain. An infusion of the bark is taken with natron to relieve “lekki beernde” (pains in chest). The bark, together with a mistletoe which commonly parasitizes the tree, is made into an infusion for washing the body.
Diplorhynchus condylocarpon	A decoction of the root bark is used to treat indigestion, diarrhoea, fever, snakebites, infertility and venereal diseases. A decoction of the root is used to treat a variety of complaints including chronic cough, pneumonia and pulmonary tuberculosis; rectal prolapse; diabetes; testicle inflammation; and to facilitate giving birth.
Brachystegia spiciformis	An infusion provides treatment for dysentery and diarrhoea. A decoction is applied as an eyewash for conjunctivitis.
Pseudolachnostylis maprouneifolia	A root decoction is taken as a purgative to treat stomach-ache and abdominal problems. The smoke of burning roots is inhaled to treat pneumonia, A root infusion is taken to treat abdominal pain, gonorrhoea and female sterility. Dried, pulverized root is sniffed to treat nosebleed and headache. It is sprinkled on fresh wounds to heal them.
Rothmannia globose	In some parts of southern Africa, the powdered roots are rubbed into incisions to treat leprosy.
Strychnos spinosa	It is believed that the presence of strychnine in the bark and unripe fruit, along with other alkaloids, are responsible for helping overcome the venom of certain snakes, such as Mamba. Strychnine is a powerful central nervous system stimulant that may be able to fight the respiratory depression caused by the venom of these snakes. It is also used as a purgative, for uterine problems and to treat sore eyes.
Albizia antunesiana	The roots have numerous uses in traditional medicine. An infusion or decoction is used to treat sore throat, tonsillitis, tuberculosis, gonorrhoea and other sexually transmitted diseases, abdominal pains, depressed fontanelle in infants and infertility in women.
Turraea nilotica	Traditionally, the roots of this species have been used to treat toothaches, pneumonia, epilepsy, abdominal pain and venereal diseases.
Bobgunnia madagascariensis	A decoction of the fruits has been used to induce vomiting to remove poison from the stomach, and to treat bilharzia, leprosy and ear-ache. Roots are used to induce abortion, counteract venomous stings and bites, kill or expel intestinal worms and treat leprosy. A warm root infusion is used to treat venereal diseases and dysentery. Chopped roots are shaken in water which is then used to treat cataract of the eye.
Steganotaenia araliacea	The stem bark contains a number of dibenzocyclo-octadiene lignans. These have displayed cytotoxic (antimitotic) activity in a manner similar to colchicine on 11 human tumour cell lines. The lignans steganangin (the most abundant analogue), steganacin and steganolide A were most abundant. Saponins isolated from the leaves have shown antileukemic activity. An infusion of the plant is strongly emetic. The roots are used in treating snake bites and painful chest conditions.
Combretum zeyheri	The gum of *Combretum zeyheri* has antibiotic properties. The roots of the tree are used to make baskets, necklaces for young girls and fishing traps. Pounded roots mixed with fats are used for an ointment to relieve haemorrhoids. Powdered roots are taken orally in porridge to stop a bleeding nose and to ease kidney pains. Leaves mixed with oil are used as an embrocation (liquid for rubbing on the body to relieve

Scientific name	Medicinal use
	pain), to ease a stiff neck and backache. Crushed leaves are mixed with water and the resultant fluid.
Khaya nyasica	The bark is bitter, similar to quinine, and is used for colds. Oil from the seed is rubbed into the scalp to kill insects.
Ozoroa insignis	The roots and bark are considered to be cholagogue, purgative and vermifuge. A decoction is used to treat kidney and liver complaints; ulcers and hernias; throat infections; chest pain; diarrhoea; schistosomiasis.
Hymenocardia acida	The leaves, combined with the roots, are used for treating deficiency diseases and oedema caused by malnutrition. The root bark is eaten with porridge as a treatment for malaria. The sap from the roots is applied topically for treating earache and tooth-troubles.
Piliostigma thonningii	Tender leaves are chewed, and the juice swallowed to treat stomach-ache, coughs and snakebite. The roots are used to treat prolonged menstruation, haemorrhage and miscarriage in women and also for the treatment of coughs, colds, body pain and STDs.
Mimusops zeyheri	A root infusion is taken to treat candidiasis. A bark decoction is used to treat wounds and ulcers.
Ceratotheca sesamoides	The leaves, when eaten as a vegetable, act as a laxative. The leaves are steeped in water and the slimy liquid is dropped into the eye to treat conjunctivitis.
Combretum collinum	Most African people use boiled root decoction to treat constipation, headaches, stomachs, fever, dysentery, and swellings, and as an anthelmintic for hookworm. The leaves are chewed, soaked in water and the juice drunk for chest complaints; it can also be used as an inhalant in a hot steam bath.
Senna singueana (Cassia singueana)	Extracts of the root bark have shown significant analgesic, antipyretic, anthelmintic and anti-plasmodial activity. An infusion of the leaves is used as a remedy for venereal disease, malaria, convulsions, epilepsy, coughs, intestinal worms, constipation, heartburn and stomach-ache.
Commiphora africana	The fruits are used for the treatment of typhoid fever and as a remedy for stomach problems. The fruits are chewed or pounded and used as a treatment against toothache and diseases of the gum.
Peltoforum africanum	African wattle is commonly used in African traditional medicine, especially the bark and the roots. They are taken internally to treat a range of digestive disorders and as general tonics, whilst externally they are used to treat wounds and sore.
Ficus sycamorus	The bark is used for the treatment of scrofula, coughs, and throat and chest diseases. The milky latex is used for treatment of dysentery and chest diseases or is applied to inflamed areas.
Xeroderris stulhmannii	The bark is purgative. It is used in traditional medicine to treat coughs, colds, rheumatic arthritis, stomach-ache, dysentery, eye infections, and wounds.
Flacourtia indica	The leaf is carminative, astringent and used as a tonic, an expectorant and for asthma, pain relief, gynaecological complaints and as an anthelmintic, and treatment for hydrocele, pneumonia and intestinal worms.
Terminalia sericea	The leaves and roots are boiled in water and the infusion is taken orally for the treatment of coughs, diarrhoea, and stomach-ache. The leaves can be used as an antibiotic for wounds. In the case of bleeding, a paste can be made by cooking the leaves in water and placing them on the wounds.
Cassia abbreviate	The leaves are smoked as a treatment for haematuria. The smoke of smouldering twigs is inhaled to cure headache. The powdered stem bark is applied to abscesses and added to food to cure diarrhoea. A decoction of the stem bark is used as a purgative and to cure malaria.
Adenia senensis	An infusion of the bark is used as a remedy for mental disorders and snakebite. The leaves and bark are boiled, and the decoction inhaled to treat fever and influenza.
Adansonia digitate	The leaves are hyposensitive and an antihistamine. They are used to treat kidney and bladder diseases, asthma, general fatigue, diarrhoea, insect bites, and guinea worm. The fruit pulp, seed and bark are reputedly an antidote to *Strophanthus* poisoning. The pulp is widely used in Africa as a diaphoretic to combat fevers, and to treat dysentery.

Scientific name	Medicinal use
Thespesia garckeana	A decoction of roots is taken in the treatment of painful menstruation, coughs and chest pains. An infusion made from the roots and leaves is dropped into the ear to treat earache or is taken orally as an antiemetic.
Friesodielsia obovata	The roots are boiled, and the decoction used for treating stomach-ache, infertility in women and as an antidote for snakebite.
Philenoptera violacea	The roots are used to treat stomach disorders, hookworms, and coughs.
Ziziphus abbysinica	The roots are boiled, and the liquid drunk as a treatment for after-birth pains, stomach ache, snakebite, and also to induce abortion. A decoction of the roots, mixed with those of *Rhynchosia resinosa*, is drunk as a treatment for stomach-ache. The roots are pounded, and the powder is rubbed on the chest, which is first scarified, as a treatment for pneumonia.
Stereospermum kunthianum	The pods are chewed with salt as a treatment for coughs. They are also used in the treatment of ulcers, leprosy, skin eruptions and venereal diseases. A leaf infusion is used for washing wounds. The macerated leaves are used to treat asthenia and exhaustion. The bark is used as a haemostatic and for treating wounds. A stem-bark decoction is used to cure bronchitis, pneumonia, and coughs. The roots and leaves are used in the treatment of venereal diseases, respiratory ailments and gastritis.
Vangueria infausta	The root is anthelmintic, antidote and purgative. A popular snake-bite remedy, it is also used to treat a variety of complaints such as malaria, pneumonia, coughs and other chest troubles. A warm decoction of the roots is said to be an effective remedy for heart ailments in Namibia. The leaves are applied externally as a treatment for swellings on the legs; inflammation of the navel in children; abdominal pain; and for the relief of dental pain.
Bidens pilosa	Its roots, leaves, and seeds are reported to have antibacterial, antidysenteric, anti-inflammatory, antimicrobial, antimalarial, diuretic, heptoprotective, and hypotensive properties. In Africa, *B. pilosa* is used to treat headaches, ear infections, hangovers, diarrhoea, kidney problems, malaria, jaundice, dysentery, burns, arthritis, ulcers, and abdominal problems. It is also used as an anaesthetic, coagulant, and treatment to ease childbirth. In sub-Saharan Africa, its fresh or dried shoots and young leaves are eaten as a leaf vegetable, especially in times of food scarcity.
Euphorbia hirta	Asthma weed is a very important herbal medicine both within its native range and also beyond. It has traditionally been used to treat respiratory system disorders including bronchitis, asthma, hay fever, emphysema, coughs, colds and laryngeal spasm, though in modern herbalism it is more used in the treatment of gastrointestinal disorders, including intestinal parasites, diarrhoea, peptic ulcers, heartburn, vomiting and amoebic dysentery. The plant is also used as a diuretic to treat uro-genital diseases, such as kidney stones, menstrual problems, sterility and venereal diseases. The plant has a reputation as an analgesic to treat severe headache, toothache, rheumatism, colic and pains during pregnancy. It is used as an antidote and pain relief of scorpion stings and snakebites.
Xerophyta retinervis	The roots are smoked to relieve asthma, and smoke from the whole plant is used to stop nosebleeds. Stem bark preparations are reported to have anti-inflammatory and analgesic properties. The active ingredient, called amentoflavone, is also found in gingko extract.
Elephantopus scaber	The plant is widely used as a medicinal herb in the tropics. It is anthelmintic, diaphoretic, diuretic, emmenagogue, emollient, febrifuge and tonic. It is used to treat conditions such as asthma, coughs and pulmonary diseases; dyspepsia, diarrhoea and dysentery; oedema; urethral discharges and venereal diseases. A decoction is used to treat fungal skin diseases.
Cyperus esculentus	The Tiger nuts are regarded as a digestive tonic, having a heating and drying effect on the digestive system and alleviating flatulence. They also promote urine production and menstruation.
Tacca leontopetaloides	The inside of the root is squeezed in water and applied as a rinse to injured eyes. The starch from the tubers of the plant was used as a remedy for diarrhoea and dysentery. The root is also used as a thickener in medical preparations. The starch from the root is rubbed onto sores and burns.
Boophone disticha	The outer covering of the bulb is applied to boils and abscesses; fresh leaves are used to stop bleeding of wounds.

Scientific name	Medicinal use
Aframomum alboviolaceum	The plant is used as a febrifuge (to reduce fever).
Bidens schimperi	The roots are used to treat coughs and colds.

6.6.2 Fauna

A summary of the habitat types are described in Section 6.6.1 and extent of cover along the TL routes is provided in Table 13. The conceptual illustrations of the habitat units along the TL routes is presented in section in Figure 11, Figure 12, Figure 13 and Figure 14.

Mammals

During the baseline investigations very limited signs of mammal species were observed. During interviews it was ascertained that over the years the cutting down of the forests and woodlands (for charcoal fuel, building materials, charcoal production and agriculture) and the intensified subsistence hunting has resulted in a significant decrease and loss of mammals from the region. It is likely that as a result of the habitat loss and increased persecution levels that the remaining species have either sought refuge in the more inaccessible areas of the forest habitat or have migrated to areas which are deemed safer and have a decreased human presence.

The Forest habitat in this regard in the higher mountainous areas is still likely to harbour a few mammal species, notably those which are shy and secretive, such as the *Potamochoerus larvatus* (Bushpig), *Otolemur crassicaudatus* (Brown Greater Galago) and *Cercopithecus mitis* (Blue Monkey), although these species are likely to be under increased persecution as they are hunted for the bush meat trade.

In addition, the freshwater systems may play host to *Ichneumia albicauda* (White-tailed Mongoose). The small predatory mammal *Otocyon megalotis ssp. virgatus* (Eastern Bat-eared Fox) is also likely to occur in the project area. The Miombo Woodlands and Freshwater Habitats are likely to provide habitat to smaller less conspicuous mammal species of the Rodentia family as well as small scrub hares. In addition, the freshwater systems and associated riparian areas may provide movement corridors for mammal species, allowing them to traverse the project area under cover, minimising detection. Food resources are deemed adequate for the remaining species in the Project Site; however, the continued habitat modification has had a notable impact on such resources as well as the overall habitat integrity for mammals.

No mammal SCC were observed. Although not observed, it is possible that the following species may occur within the Project Site: *Eidolon helvum* (African Straw-coloured Fruit-bat, NT), *Otomops martiensseni* (Large-eared Free-tailed Bat, NT), *Hipposideros vittatus* (Commerson's Leafnosed Bat, NT) and *Aonyx capensis* (African Clawless Otter, NT).

Although unlikely to occur in the study area due to poaching and the medicinal trade, *Smutsia temminckii* (Temminck's Ground Pangolin, VU) probably once did inhabit the Miombo Woodlands.

Mammal sensitivity is considered to be Moderately High

Amphibians

Several amphibian species were observed, notably in the freshwater habitats associated with the Miombo Woodlands. The abundance and diversity of amphibian species in the study area is largely attributable to the large areas of standing water and damp soils as well as a high level of food resources in the form of abundant insects. Amphibian species are often a good bio-indicator of ecosystem health, notably that of freshwater systems, as they are generally susceptible to pollution and unnatural toxicants in the water. Although the study area has been subjected to extensive habitat alteration, land use changes and forest clearing, it is evident that the water systems are still in good health. The Dambos, forest streams and streams in the Miombo Woodlands all provide high levels of suitable habitat both for foraging and breeding of amphibian species. The interconnectedness of the freshwater habitat further ensures that

the overall habitat integrity for amphibian species remains moderately high, allowing for the free and relatively easy movement of such species.

Additional species that are expected to occur in the project area include but are not limited to *Sclerophrys gutturalis* (Guttural Toad), *Leptopelis bocagii* (Bocage's Tree Frog), *Breviceps poweri* (Power's Rain Frog), *Phrynobatrachus natalensis* (Natal Puddle Frog), *Tomopterna marmorata* (Marbled Sand Frog), *Sclerophrys pusilla* (Eastern Flat-backed Toad), *Arthroleptis xenodactyloides* (Dwarf Squeaker), *Hyperolius marginatus*, *Hemisus marmoratus* (Shovel-nosed Frog), *Schismaderma carens* (African Split-skin Toad) and frogs of the Genus Ptychadena (Ridged/Grass Frogs).

All the aforementioned species are likely to occur within the Freshwater Habitat and the associated areas of increased moisture surrounding these freshwater systems.

No amphibian SCC were observed. The available databases further do not indicate the possible current or historical occurrence of amphibian SCC in the study area.

Amphibian sensitivity is considered to be Moderately High.

Reptiles

Several reptile species were observed but not in close proximity to the villages. Although the habitat within the study area has been degraded, reptile species show remarkable resilience to such degradation, often able to continue thriving in these changed environments. This is largely due to their ability to live in and amongst human populations with ease, whilst still finding adequate food resources to sustain themselves. The smaller lizards' and skinks' primary food resource is that of the abundant insect life in the study area, whilst the larger predatory snakes and lizards will rely on larger prey items such as rodents, other reptiles, amphibians and nestlings of bird species. Although not photographed, during the site assessment individuals of *Naja mossambica* (Mozambique Spitting Cobra) were often observed, as well as a snake most likely of the Genus Amblyodipsas (Purple-glossed Snakes). Both of these snakes were observed in and around the freshwater habitats, most likely foraging for small mammals and amphibians.

Reptile sensitivity is considered to be Moderately High.

Insects

Insect diversity and abundance was notably high. This can be attributed to the high levels of food resources as well as increased and varied habitats that suit a diversity of insects. Flowering and fruit producing plants as well as the graminoid layer all provide increased food resources to insects, whilst the smaller insects themselves are preyed upon by larger predatory insects. A high abundance of insects is imperative for the overall functioning of the ecosystem, as the insects play an important role as pollinators as well as nutrient recyclers. Although habitat degradation is evident, the study area is still considered to be an important area in terms of habitat provision for insects, notably the hillsides, forests and freshwater habitats.

In addition, insect overall provide the staple and important food resource for a variety of other species, without which many would not be able to survive.

No insect SCC were observed. The available databases do not indicate the possible current or historical occurrence of insect SCC in the Project Site.

Insect sensitivity is considered to be Moderately High.

Arachnids

Arachnid species are notoriously hard to detect over a relatively short period of time, which can often lead to the under estimation of diversity and abundance. As such, it is necessary to take into consideration the habitat conditions for arachnids as well as available resources, whilst also consulting available databases. During the field assessment particular attention was paid to searching out arachnid species, as they are known to be secretive and often elusive. By searching under rocks, fallen logs, shrubs and tree

canopies, it was noted that the overall arachnid abundance and diversity of the study area was moderately high. This abundance and diversity of arachnid species can be sustained due to the increased levels of suitable habitat and high abundance of food resources, predominantly that of insects. Vegetation clearance has had an impact on the habitat integrity for arachnids, however the more open and cleared areas are now favoured by ground hunting spiders such as those belong to the Family Ctenidae (Wandering Spiders) and Family Lycosidae (Wolf Spiders). Like amphibians, a high abundance and diversity of arachnids further helps maintain insect population numbers, which if left uncontrolled would become problematic as well as possibly destructive.

No arachnid SCC are known to occur in the study area according to the available databases at the time of the assessment, with all species observed being considered common and widespread.

Arachnid sensitivity is considered to be Moderately High.

Faunal Species of Conservational Concern

Species listed in Table 10 below whose known distribution ranges and habitat preferences according to the IUCN include the Project Site have been taken into consideration.

The species listed in Table 10 all have a relatively high probability of occurring within the project area, and are most likely to occur within and around the Freshwater Habitats, as these habitats provide suitable movement and refuge areas, as well as areas for foraging and roosting.

Table 10: A summary of the potential mammal SCC that may occur within the area

Scientific name	Common name	Threat Status
Eidolon helvum	African Straw-coloured Fruit-bat	Near Threatened
Aonyx capensis	African Clawless Otter	Near Threatened
Otomops martiensseni	Large-eared Free-tailed Bat	Near Threatened
Hipposideros vittatus	Commerson's Leafnosed Bat	Near Threatened

6.6.3 Avifauna/Birds

Approximately 750 bird species have been recorded in Zambia. The Southern African Bird Atlas Project has no cards (bird counts) submitted for pentads near the Project Site (Figure 15), the closest being in the Nyanje Hills and South Luangwa National Park areas.

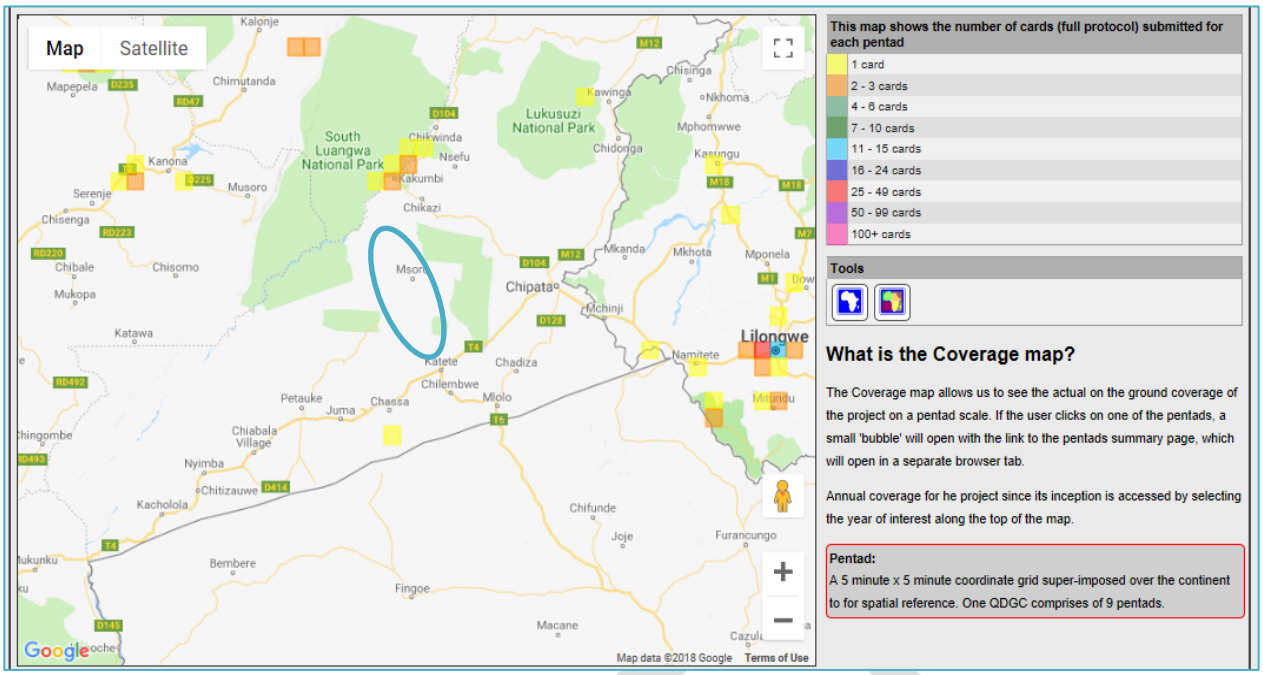


Figure 15: SABAP2 Coverage of the Project Area

Zambia has 42 Important Bird Areas (IBA – BirdLife International) covering approximately 10 538 250 ha (or 14% of the country). The Project area is not located in any of these IBAs, the closest IBA being Nyanje Hills IBA, south-west of the Project site. This IBA is approximately 5 000 ha in size and consists of a high density of granite inselbergs.

The IBA is important for the localized and specialized Boulder Chat *Pinarornis plumosus*, Black Stork *Ciconia nigra*, Augur Buzzard *Buteo augur*, Black Eagle *Aquila verreauxii*, Lanner Falcon *Falco biarmicus*, Peregrine Falcon *Falco peregrinus*, Freckled Rock Nightjar *Caprimulgus tristigma*, African Black Swift *Apus barbatus*, African Rock Martin *Ptyonoprogne fuligula*, Striped Pipit *Anthus lineiventris*, Familiar Chat *Oenanthe familiaris*, Mocking Chat *Thamnolaea cinnamomeiventris*, Rock loving Cisticola *Cisticola emini*, White-necked Raven *Corvus albicollis*, Red-winged Starling *Onychognathus morio* and Cinnamon-breasted Rock Bunting *Emberiza tahapis*i. These birds occur despite heavy transformation of vegetation around the inselbergs. Although the Nyanje Hills IBA is too far from the Project area to have a direct bearing, a similar bird composition may occur if there are similar inselbergs in the Project area. None of the above listed species are either regionally or globally threatened (Dowsett *et al*, 2008; IUCN 2018)

South Luangwa National Park IBA is located north-east of the Project Site. The bird data from this site is considered less relevant to the Project Site than that of Nyanje hills IBA as the Luangwa is a large protected area traversed by the significant Luangwa River.

Flagship birding species in Zambia (according to Birdwatch Zambia, www.birdwatchzambia.org) are as follows: Zambian Barbet *Lybius chaplini*; Wattled Crane *Bugeranus carunculatus*; Grey-crowned Crane *Balearica regulorum*; White-headed Vulture *Trigonoceps occipitalis*; White-backed Vulture *Gyps africanus*; Hooded Vulture *Necrosyrtes monachus*; Black-cheeked Lovebird *Agapornis nigrigenis*; Slaty Egret *Egretta vinaceigula*; Shoebill *Balaeniceps rex*; Taita Falcon *Falco fasciinucha*; Margaret's Batis *Batis margaritae*; African Pitta *Pitta angolensis*; Blue Swallow *Hirundo atrocaerulea*; Kori Bustard *Ardeotis kori*; and Southern Ground Hornbill *Bucorvus leadbeateri*. A number of these species will not occur in the Project area on account of their habitat requirements. Of this group, vultures and other raptors such as Black Eagle amongst others which are highest risk due to their wide-ranging habits. Also expected are various waterfowl (probably mostly common species) in the lower lying ground where there are wetland areas and crop lands.

Habitat Description

The area is comprised predominantly of Miombo Woodland. In describing bird usage of an area, a description of the micro-habitats available to birds is typically more useful than a vegetation description as it takes account of land use and anthropogenic factors in addition to vegetation. The following bird micro-habitats on and near site were identified: woodland; hills; arable lands; streams, rivers; dams; and human settlement (Figure 16). The more natural of these micro-habitats such as streams, rivers and woodland are more sensitive from an avifaunal perspective.

Small Passerine Bird Species Abundance and Diversity

Data obtained during walked transects comprised a total of 887 records of 2 022 individual birds across 123 different species. Species diversity peaked in autumn with 97 species, followed by spring (61), winter (54) and summer (44). Over the full year and across all species an abundance of 56.22 birds per kilometre was recorded. None of the 123 species are Red Listed either in Zambia or Globally (IUCN, 2021). The five most abundant species across the whole year were: Black-winged Red Bishop *Euplectes hordeaceus*; Yellow-fronted Canary *Crithagra mozambicus*; Bronze Mannikin *Spermestes cucullatus*; Blue Waxbill *Uraeginthus angolensis*; and Dark-capped Bulbul *Pycnonotus tricolor.* Four of the five most abundant species were seedeaters. These were recorded in the open areas around drainage lines and wetlands where sufficient tall grass exists, and crops are nearby. Dark-capped/Black-eyed Bulbul is the only non-seedeater amongst the top five but is amongst the top 20 most widespread (common) species in Zambia.

European Bee-eater *Merops apiaster* was the sixth most abundant species but was recorded only in spring and autumn. These were mostly small flocks of birds in migration over the site.

Large Terrestrial Birds and Raptor Abundance and Diversity

Driven transects comprised a total of 9 records of 9 individual birds across 6 species. Species diversity was highest in spring (4 species) followed by autumn (3), summer (2) and winter (0). All six species were raptors.

The most abundant species were: Brown Snake-Eagle *Circaetus cinereus*; Augur Buzzard *Buteo augur* and Lanner Falcon *Falco biarmicus*. Over the full year and across all six species an abundance of 0.03 birds per kilometre was recorded. None of the six species are Red Listed either in Zambia or Globally (IUCN, 2019). It must be noted that the tall woodland and poor road conditions make visibility and detectability of birds whilst driving challenging, which likely accounts for the low numbers of birds detected using this method.

Focal Site Surveys

The focal site surveys recorded far fewer water birds than expected. Focal Site 1 was the Katete Dam, and Focal Site 2 was Mtetetzi Dam on the Mtetezi River. It was expected that these dams will concentrate waterfowl such as ducks, geese and others, particularly since these open water habitats are scarce in this landscape. Very few waterfowl species were recorded during the course of the year. The most notable records were flocks of White-faced Whistling Duck *Dendrocygna viduata* recorded in winter and autumn. Significant human fishing pressure on the dams in the form of nets was noted, and this may contribute to the low abundance of waterfowl.

A third focal site, the hill south of the Unika I Wind Farm site was surveyed using a vehicle transect. The area was surveyed for any sensitive habitats such as cliffs and roosts. Six raptor species were recorded in this area: African Goshawk *Accipiter tachiro*; African Harrier-Hawk *Polyboroides typus*; Augur Buzzard; Brown Snake-Eagle; European Honey Buzzard; and Steppe Buzzard. No habitats of specific bird importance were present on this hill, and it does not present any particularly different habitat for avifauna from that in the rest of the project area.

Figure 16: Examples of Micro Habitats in the Project Area

Incidental Observations

During the year a total of 83 records of 797 individual priority birds were made incidentally. This comprised of 32 species. Species richness was highest in autumn (16 species) followed by spring (10), winter (9) and summer (7)[2]. The top five most abundant species recorded by this method through the year were: Barn Swallow *Hirundo rustica*; European Bee-eater; Southern Carmine Bee-eater *Merops nubicoides*; House Martin *Delichon urbicum*; and African Palm Swift *Cypsiurus parvus*. The high abundance of these species is entirely due to a few records of large flocks of the birds in autumn. These are presumed to be migration events.

[2] Since this data are not the product of formal data collection they need to be used cautiously

Combining all data collection methods and incidental records, a total of 248 bird species were recorded on site. Species diversity peaked in autumn (178 species) followed by spring (148), winter (121) and summer (95).

Large Bird Species Flight Activity

A total of 240 hours of vantage point observation were conducted on site across the four seasons. During this time, a total of 269 records were made of 335 individual birds representing 28 species. All but two of these species (Black Stork *Ciconia nigra* & White Stork *Ciconia ciconia*) are raptors. No other large terrestrial, waterfowl or other large priority bird species were recorded in flight. Twenty-six species were therefore raptors, reflecting a high diversity of raptor species. Species diversity was highest in autumn (21 species), followed by winter (14), spring (10), and summer (9). Collectively, the 28 species combined flew at a passage rate of 1.40 birds per hour of observation (within the 2km radii of vantage points).

Species flight activity

The most frequently recorded species flying on site through the full year was Common Buzzard (0.296 birds/hr), followed by Augur Buzzard (0.241 birds/hr); Brown Snake-Eagle (0.188 birds/hr), Black-chested Snake-Eagle (0.121 birds/hr); and Wahlberg's Eagle *Hieraaetus wahlbergi* (0.088 birds/hr) (Table 11). The top three most recorded species (Common Buzzard, Augur Buzzard & Brown Snake-Eagle) account for over 50% of all flight activity.

One of the recorded species is Globally Red Listed by the IUCN (2021): Martial Eagle (Endangered) which was recorded flying twice.

Table 11: Summary of Priority Bird Flight Data

Common name	Taxonomic name	Birds	Records	Birds/hr	Mean flight height (m)
Common Buzzard	*Buteo buteo*	71	49	0.2958	82.12
Augur Buzzard	*Buteo augur*	58	44	0.2417	89.90
Brown Snake-Eagle	*Circaetus cinereus*	45	37	0.1875	100.23
Black-chested Snake-Eagle	*Circaetus pectoralis*	29	26	0.1208	110.29
Wahlberg's Eagle	*Hieraaetus wahlbergi*	21	17	0.0875	99.89
African Harrier-Hawk	*Polyboroides typus*	20	19	0.0833	80.11
Lanner Falcon	*Falco biarmicus*	14	10	0.0583	125.29
European Honey-Buzzard	*Pernis apivorus*	13	10	0.0542	144.38
Lizard Buzzard	*Kaupifalco monogrammicus*	12	12	0.0500	99.46
African Hawk-Eagle	*Aquila spilogaster*	12	6	0.0500	83.58
African Goshawk	*Accipiter tachiro*	6	6	0.0250	50.00
Gabar Goshawk	*Micronisus gabar*	5	5	0.0208	103.57
Dickinson's Kestrel	*Falco dickinsoni*	4	4	0.0167	11.40
Black Stork	*Ciconia nigra*	3	2	0.0125	62.50
Western Banded Snake-eagle	*Circaetus cinerascens*	3	3	0.0125	153.44
Shikra	*Accipiter badius*	3	3	0.0125	40.00
Black-shouldered Kite	*Elanus caeruleus*	2	2	0.0083	35.00
Red-necked Falcon	*Falco chicquera*	2	2	0.0083	15.00
White Stork	*Ciconia ciconia*	2	2	0.0083	50.00

Common name	Taxonomic name	Birds	Records	Birds/hr	Mean flight height (m)
Martial Eagle (EN)	*Polemaetus bellicosus*	2	2	0.0083	150.00
African Cuckoo Hawk	*Aviceda cuculoides*	1	1	0.0042	100.00
Black Sparrowhawk	*Accipiter melanoleucus*	1	1	0.0042	54.00
Eurasian Hobby	*Falco subbuteo*	1	1	0.0042	55.00
Long-crested Eagle	*Lophaetus occipitalis*	1	1	0.0042	30.00
Ayres's Hawk-Eagle	*Hieraaetus ayresii*	1	1	0.0042	100.00
Booted Eagle	*Hieraaetus pennatus*	1	1	0.0042	473.33
Lesser Spotted Eagle	*Clanga pomarina*	1	1	0.0042	150.00
Ovambo Sparrowhawk	*Accipiter ovampensis*	1	1	0.0042	40.00

Species flight height

Recorded flight height data for the 27 species is also summarised in Table 11. The proposed transmission line consists of a 330kV power line with a 55m wayleave. Towers will be typical steel lattice type structures between 25-35 m in height. Almost all species flew on average above this height. The only exceptions were Dickinson's Kestrel (mean height of 11 m), Black-shouldered Kite (35 m), Red-necked Falcon (15 m) and Long-crested Eagle (30 m). All of these species have relatively small sample size (i.e. they were recorded flying fairly seldom).

Bird Migration

Birds when migrating do not always select the habitat beneath them, which means that even though the Project area comprises largely degraded habitat, significant numbers of birds could fly over the site in spring and autumn. Migratory bird species are often of particular interest as migration can concentrate large numbers of birds in both space and time, thereby presenting a high risk of transmission line collision. Each individual country also has a responsibility to protect migratory species as impacts on the species within its' boundaries have international consequences. Zambia serves as both passage corridor for many migrants, and a resident area for some of those migrants. In other words, when a migrant bird species is recorded in Zambia at certain times of year, it may be either during its migrating south or northwards or during its' residence during the summer months. Many Palaearctic species pass through Zambia in much higher numbers than those that over-winter in Zambia. This passage is sometimes concentrated, so that it is not uncommon to see hundreds of (for example) Steppe Buzzard, Lesser Spotted *Aquila pomarina* or Steppe Eagle *Aquila nipalensis* in a day.

The spring and autumn site visits of the one-year bird monitoring programme specifically aimed to establish if peaks in temporary higher abundance of birds on site occur. The mean data (derived from multiple years) was consulted on migrant bird species arrival and departure dates in Dowsett *et al* (2008) for approximately 33 of these Palaearctic migrants (Table 12). Arrival dates in Zambia range across these species from 27 August to 15 December. However, the priority species amongst these are the raptors due to their proven susceptibility to transmission line collision, and their ecological importance. For these species, (shown in bold in Table 12) arrival dates range between 5 October and 13 November with most occurring between 22 October and 31 November. The spring site visit was conducted between 20 & 30 October 2019 with the aim of achieving the best possible returns in terms of being on site at the right time to stand a chance of recording migrating birds.

The intra-African migrant data from the same source was also consulted, although these species are less important for the purposes of this assessment. These species show a more dispersed set of dates and were more difficult to focus the bird monitoring efforts on. The autumn migration 'last dates' range from 7 March to 6 April (Table 12), with many species' last dates falling between about 18 and 31 March. The best time for the autumn survey site visit was therefore estimated to be 23 March to 2 April 2020.

Table 12: Summary of Arrival and Departure Dates for Palearctic Migrants

Species	Mean first arrival	SD	Mean last date	SD
Caspian Plover	27-Aug	10.7		
Eurasian Bee-eater	04-Sep	9.1	21-Apr	7.1
Ringed Plover	19-Sep	12.3		
Green Sandpiper	19-Sep	18.1	28-Mar	11.6
Turnstone	21-Sep	14.7		
Willow Warbler	24-Sep	6.9	27-Apr	11.6
Eurasian House Martin	27-Sep	10.5	29-Apr	12.9
Eurasian Sand Martin	28-Sep	14.6	05-May	14.5
Eurasian Swift	01-Oct	13.6	25-Mar	20.0
Common Buzzard	**05-Oct**	**10.7**	**06-Apr**	**18.6**
Spotted Flycatcher	05-Oct	10.0	18-Apr	10.5
Yellow Wagtail	07-Oct	9.4	29-Apr	15.2
Garden Warbler	07-Oct	9.6	03-Apr	12.8
Eurasian Hobby	**15-Oct**	**13.8**	**30-Mar**	**10.4**
Lesser Grey Shrike	20-Oct	5.4	16-Apr	5.5
Honey Buzzard	**22-Oct**	**11.8**	**01-Apr**	**20.4**
Eurasian Golden Oriole	22-Oct	17.9	24-Mar	18.0
Red-backed Shrike	24-Oct	8.3	22-Apr	7.6
Lesser Kestrel	**26-Oct**	**9.0**	**31-Mar**	**14.8**
Lesser Spotted Eagle	**27-Oct**	**17.3**	**18-Mar**	**18.1**
Steppe Eagle	**27-Oct**	**15.3**	**27-Mar**	**16.7**
Pallid Harrier	**29-Oct**	**15.2**	**07-Mar**	**15.7**
Tree Pipit	01-Nov	12.9	24-Mar	12.5
Montagu's Harrier	**02-Nov**	**16.0**	**10-Mar**	**21.8**
Blue-cheeked Bee-eater	04-Nov	12.1	18-Mar	12.0
Sedge Warbler	07-Nov	13.8	26-Apr	8.1
Eurasian Roller	09-Nov	10.9	07-Apr	14.8
Eastern Red-footed Falcon	**13-Nov**	**13.6**	**24-Mar**	**13.8**
Common Whitethroat	14-Nov	12.8	08-Apr	10.1
Whinchat	16-Nov	15.4	27-Feb	22.1
Great Reed Warbler	20-Nov	10.3	04-Apr	8.8
Marsh Warbler	14-Dec	13.8	08-Apr	11.5
Thrush Nightingale	15-Dec	10.6	13-Mar	11.8

The findings from the spring monitoring survey with respect to bird migration at the site were as follows:

- Many migrant small passerine species were recorded on site, such as flycatchers, warblers, swifts, and bee-eaters amongst others. Most of these species did not show any form of congregation, nor were they in higher than normal abundance. They were not recorded flying in any direct or migratory manner.
- One clear exception was the European Bee-Eater *Merops apiaster*, which was recorded several times a day flying over the Unika windfarm site in a migratory manner in groups of 10-30 birds. These birds typically flew approximately 80-100 m above ground in a north-south direction.
- The flight activity was higher in general for raptors. Much of this flight activity was that of Steppe or Common Buzzard.
    - Steppe Buzzard appeared to be on site in higher than normal numbers and in small congregations (<5 birds). Although these birds were not seen in any direct flight movement, they may have been on a short stopover to feed and rest. At least some of these birds appear to have been on a brief stopover whilst migrating southwards. However, no further large migration events were recorded for the species such as those cited by Dowsett *et al* (2008) of several hundred buzzards in a day. A passage rate of approximately 0.92birds/hour (55 birds in 60 hours of vantage point observation) was recorded during spring.
    - A second palearctic migrant raptor recorded was European Honey Buzzard. Single birds were recorded flying four times (passage rate of 0.067 birds/hour).
- One intra-African migrant, Wahlberg's Eagle was recorded flying on site, but the site visit was too late to capture migration behaviour (mean arrival in Zambia cited as 11 August by Dowsett *et al,* 2008). This species was recorded flying 8 times (8 individual birds) for a passage rate of 0.13birds/hour).
- One key migratory raptor which was not recorded on site was the Amur Falcon *Falco amurensis*. Dowsett *et al* cites 13 Nov as mean first arrival, so the site visit may have been a few days early or alternatively the species may typically pass through further east or west.

The findings from the autumn site visit with respect to bird migration at the site were as follows:

- Once again, many migrant small passerine species were recorded on site but did not show any form of congregation, nor were they in higher than normal abundance.
- European Bee-eater was again recorded migrating in high numbers, in groups of between 20 and 70 birds. Likewise for Southern Carmine Bee-eater which was recorded in groups ranging from 6 to 40 birds. Barn Swallow, House Martin, Brown-throated Martin and African Palm Swift were also recorded in large groups indicating migration. One group of 12 Pale-billed Hornbill was also recorded.
- No increased frequency or abundance of raptor flights was recorded.

It was concluded that one raptor species (Common or Steppe Buzzard) and at least 6 passerines (European Bee-eater, Southern Carmine Bee-eater, Barn Swallow, House Martin, Brown-throated Martin, African Palm Swift) showed signs of migrating over the area. In the case of Steppe Buzzard this presents increased transmission line collision risk as compared to the remainder of the year, but not to the extent typically associated with migration events. Small passerines do not pose a high risk of collision with transmission lines.

Description of Priority Bird Species

Taking the above data into account the species listed below listed species have been identified as being of topmost priority for this impact assessment, based on records showing flight over the project area in excess of twenty times each during the year. Most of these species are not Red Listed. The only Globally Red Listed species recorded on site, Martial Eagle, did not fly frequently but is included as a precaution.

It is notable that vultures, large terrestrial bird species and waterfowl are almost entirely absent from the monitoring data collected. The lack of waterfowl records is not surprising given the little open water along the transmission line routes. However, given the scarcity of open water it was expected that any such

features would have attracted large numbers of waterfowl. This does not appear to be the case and this may indicate a relative lack of these species in the broader landscape.

It was also expected to find various stork species, as well as Secretarybird and Southern Ground Hornbill *Bucorvus leadbeteri* but none of these species were recorded. This does not mean that they will never use the site but does indicate they are not prevalent on site and they may visit the site only occasionally.

Steppe (Common) Buzzard **(IUCN – LC)**

Steppe Buzzard is a Palaearctic-breeding migrant species which spends the summer months in sub-Saharan Africa (non-breeding range for the species). It is typically one of the most abundant raptor species throughout its' range. It prefers to forage over open habitats including grassland, savannah open woodland, and agricultural lands (Hockey *et al*, 2005). Although it mainly hunts from a perch it does also spend extensive time in flight. In Zambia most birds are passing through rather than resident (mid-October-November & first half of March) (Dowsett *et al,* 2008). Peak passage rates cited by Dowsett *et al* are of 500 birds per hour at Mbala in spring and up to 800 birds per hour at some places in autumn. This species was recorded frequently on site throughout the year, and in slightly higher frequency during spring. However, abundance anywhere near that cited by Dowsett above was not recorded. This species holds no particular conservation concern, being classified as Least Concern Globally and is not listed in Zambia.

Augur Buzzard **(IUCN – LC)**

Augur Buzzard is fairly common locally but with a discontinuous distribution through Africa. It is a resident species typically found in hilly country with rocky outcrops. It spends most of the day perched as it hunts mostly from the perch. The species was recorded during winter, spring and autumn in fairly high frequency. This species holds no particular conservation concern, being classified as Least Concern Globally and is not listed in Zambia.

Brown Snake-Eagle **(IUCN – LC)**

Brown Snake-Eagle is distributed widely in sub-Saharan Africa, mainly in mesic woodland areas. It is locally common where it occurs. It is sometimes resident but can also be nomadic in response to environmental conditions. It overlaps in range with Black-chested Snake-Eagle but prefers to use more wooded habitat. It is mostly solitary and hunts from the perch more than while soaring (Hockey *et al,* 2005). This species was recorded in all seasons. This species holds no particular conservation concern, being classified as Least Concern Globally and is not listed in Zambia.

Black-chested (breasted) Snake-Eagle **(IUCN – LC)**

Black-chested Snake-Eagle is distributed through much of Africa and is uncommon to common where it occurs. It is primarily a nomadic species which uses a range of habitats from desert to open grassland and closed deciduous woodland. In Zambia it is most abundant in the dry season (March to October). It generally occurs singly but can also gather into aggregations of up to 50 birds. Most hunting is done hovering or soaring which places it at risk of collision with transmission lines. The species was recorded flying on site in all four seasons. This species holds no particular conservation concern, being classified as Least Concern Globally and is not listed in Zambia.

Wahlberg's Eagle **(IUCN – LC)**

Wahlberg's Eagle is a common intra-African migrant raptor. It is distributed through much of Africa excluding the extremes of rain forests and arid areas. It favours well wooded areas and spends much time soaring over its territory. The species was recorded flying in summer, spring and autumn. This species holds no particular conservation concern, being classified as Least Concern Globally and not listed in Zambia.

African Harrier-Hawk **(IUCN – LC)**

African Harrier-Hawk (or Gymnogene) is distributed throughout sub-Saharan Africa. It is typically resident and sedentary in woodland areas. It is distributed throughout Zambia and fairly common throughout. It displays a wide variety of foraging methods including from the perch, walking on ground and clambering

around in foliage, high and low soaring. This species was recorded in all seasons. This species holds no particular conservation concern, being classified as Least Concern Globally and is not listed in Zambia.

Martial Eagle **(IUCN – EN)**

Martial Eagle is a large eagle that is distributed through much of Africa excluding west Africa. Likewise, in Zambia it is widespread almost throughout. It is uncommon through all its' range, with the greatest abundance in large formally protected areas. It is mostly resident in any given area when adult. It prefers open woodland, drainage lines, savannah and forest edges. This species spends most of the day on the wing hunting, soaring and occasionally hovering. This species was recorded only twice on site in autumn. Although this species is not Red Listed in Zambia it is Globally listed as Endangered and deserves as much protection as possible.

6.6.4 Aquatic Ecology

Riverine Systems

Ecostatus

Due to the nature of the terrain and access conditions, the majority of riverine systems that were assessed were located close to existing roads and human settlement, and had typically undergone various impacts such as altered geomorphologic regimes (e.g. increased sediment loads originating from adjacent crop fields). More remote and inaccessible reaches of the various rivers are likely to remain in a largely natural condition, with impacts mostly limited to those occurring upstream such as impaired water quality due to discharge of domestic effluent.

Habitat and biota

Instream habitat in the majority of the rivers observed comprised a combination of biotopes, including sand, gravel and mud, rocks and overhanging vegetation, although very little instream vegetation was observed.

In terms of riparian habitat, the rivers along the TL routes are considered to be important faunal migratory corridors as they provide connectivity to undisturbed, natural areas. Additionally, reptile and amphibian species were observed within several of these systems, indicating that breeding and foraging habitat is available and utilised.

Goods and Services Provision

Although some of the larger villages in the area have access to communal boreholes and are able to obtain groundwater for domestic purposes such as cooking, the rivers are utilised extensively for bathing, washing of clothes, fishing and crop cultivation within the floodplains. In those areas where natural vegetation remains, it was apparent that the rivers provide a level of ecological services such as flood attenuation and sediment trapping. In addition, biodiversity maintenance is deemed high, as the connectivity to undisturbed areas provides refugia and foraging habitat for fauna.

Dambos and Floodplain Wetland Systems

Ecostatus

As with all watercourses along the TL routes, the primary modifiers of the dambo systems are related to subsistence agriculture, although due to the relatively flat terrain the extent of cultivation within the dambos is greater than in the other habitat types. Overall, the dambos are deemed to be in a largely natural to modified ecological condition, and reinstatement of natural conditions could occur with little to no human intervention.

These expansive wetland systems are considered important for the provision of ecological (i.e. indirect services such as flood attenuation, trapping of sediment, and biodiversity maintenance) and for direct socio-cultural benefits in particular, crop cultivation, charcoal manufacturing and provision of grazing for livestock. Interviews revealed that, traditionally, local residents avoided cultivation within these wetland areas; however, due to increased populations and lack of available arable land the communities surrounding the wetlands have been forced to encroach into the wetlands.

Habitat and biota

The dambos provide essential habitat for a variety of faunal and floral species, including (as depicted above) *Drosera* sp., numerous orchid species (e.g. *Platycoryne buchanania*, *Habenaria schimperiana*), *Ascolepis protea* and *Hypoxis nyasica* amongst many others. Faunal species observed included the frogs: *Hyperolius marmoratus*, *Arthroleptis stenodactylus* and *Phrynobatrachus mababiensis.* Numerous species belonging to the *Odonata* (dragonfly, damselfly) order were also recorded.

Goods and Services Provision

The low-lying, extensive dambos appeared to be the most utilised of all the watercourses within the Project Site in terms of socio-economic uses. Because of the relatively flat topography these systems are generally easily accessed and are therefore preferred in terms of agriculture (both crop cultivation and livestock husbandry) as well as charcoal manufacturing.

6.6.5 Protected Areas

Protected areas located in the general region of the study include:

- South Luangwa National Park located approximately 60 km northwest;
- Lukusuzi National Park located approximately 100 km northeast;
- Kasungu National Park located approximately 120 km northeast;
- Lusandwa Forest Reserve located approximately 50 km west;
- Dzalanyama Forest Reserve located approximately 120 km southeast;
- Mchinji Forest Reserve located approximately 50 km east; and
- Lupande GMA located approximately 1 km west of the Msoro Substation.

According to the World Database on Protected Areas (UNEP-WCMC, 2016), the Chiulukire West and Chivuna Hills Forest Reserves are located along the southern portions of the TL Routes (Figure 12). Approximately 8 km of the TL route would need to be located within these Forest Reserves (5 km through Chivuna Hills and 3 km through Chiulukire West). Mphepo conducted forest inventories through the Ministry of Lands and Natural Resources: Forestry Department (Eastern Province) to assess the quantity (volume) of wood that will be removed for the Transmission Line.

As highlighted above, these Forest Reserves have already been subjected to continuous wide-scale impacts from human use, largely from collection of firewood and timber and charcoal manufacture.

6.7 HABITAT ASSESSMENT

6.7.1 Overview

Alignment with International Finance Corporation Performance Standard 6 (IFC PS6) (Biodiversity and Conservation of Living Natural Resources (IFC 2012) requires project developers to follow a differentiated risk management approach to habitats based on their biodiversity values (see Box 1 below). This requires the classification of habitats and quantification of the extent of adverse impacts on the different habitat status categories to determine the level of mitigation required to compensate for significant impacts on habitats of different biodiversity value. This chapter summarises the status of habitats in the along the TL routes in alignment with IFC definitions and thresholds in order to determine the implications for the project.

PS6 addresses the requirements for determination of habitats as 'Modified Habitat', 'Natural Habitat', and 'Critical Habitat' and sets out specific guidance for projects which may have residual impacts on these.

Definitions are as follows:

Natural Habitat: *"areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition"*

Modified Habitat: *"areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species*

composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.

Critical habitats: *areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.*

Critical habitats can be represented by modified or natural habitats depending on whether either category meets the thresholds the critical habitat set out in the Guidance Note 6 (IFC, 2018).

Clause GN43 of the GN6 indicates that natural habitats should not be interpreted as untouched or pristine habitats, may have undergone historic or recent anthropogenic impact and should be assessed by comparing current and historic conditions to determine the degree of impact. If the habitat still largely contains the principal characteristics and key elements of its native ecosystem such as complexity, structure and diversity then it should be considered a natural habitat regardless of the presence of some invasive species, secondary forest, human habitation or other human induced alteration.

In light of the above, categorising habitats as 'natural' or 'modified' based on their condition needs to recognise that in practice, natural and modified habitats exist on a continuum ranging from largely untouched, pristine natural habitats to intensively managed modified habitats. Land which has been or is used for shifting agriculture, hunting, grazing or selective timber harvesting may still be classified as natural habitat depending on the degree of transformation or degradation.

Box 1: Summary of IFC requirements for Modified, Natural and Critical Habitats

Implications of Projects in Natural Habitats

IFC PS6 Clause 14 requires that:

The client will not significantly convert or degrade natural habitats unless all of the following are demonstrated:

- *No other viable alternatives within the region exist for development of the project on modified habitat;*
- *Consultation has established the view of stakeholders, including Affected Communities, with respect to the extent of conversion and degradation, and*
- *Any conversion or degradation is mitigated according to the mitigation hierarchy.*

In terms of the above, "significant conversion or degradation is: i) the elimination or severe dimunition of the integrity of a habitat caused by a major and/or long-term change in land or water use or ii) a modification that substantially minimises the habitat's ability to maintain viable populations of native species.

Clause 15 states:

In areas of natural habitat, mitigation measures will be designed to achieve no net loss of biodiversity where feasible. Appropriate actions include:

- *Avoiding impacts on biodiversity through the identification and protection of set-asides;*
- *Implementing measures to minimise habitat fragmentation, such as biological corridors;*
- *Restoring habitats during operations and / or after operations; and*
- *Implementing biodiversity offsets.*

Note: no net loss is defined as the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimise the project's impacts, to undertake on site restoration, and finally to offset significant residual impacts, if any, on an appropriate geographic scale.

Implications of Projects in Critical Habitat

In areas of critical habitat, the client will not implement any project activities unless all of the following are demonstrated:

- *No other viable alternatives within the region exist for development of the project on modified or natural habitats that are not critical;*
- *The project does not lead to measurable adverse impacts on those biodiversity values for which the critical habitat was designated, and on the ecological processes supporting those biodiversity values;*
- *The project does not lead to a net reduction in the global and/or national/regional population of any Critically Endangered or Endangered species over a reasonable period of time; and*
- *A robust, appropriately designed, and long-term biodiversity monitoring and evaluation program is integrated into the client's management program.*

6.7.2 Summary of Habitat Types, Threats and Conservation Status

The following habitat types were defined and are mapped in Figure 11, Figure 12, Figure 13 and Figure 14:

- Degraded Forest;
- Degraded Miombo Woodland;
- Agricultural Areas; and
- Freshwater Habitat.

A summary of the habitat units and extent of cover in the 55-m wide Wayleave along the TL routes is provided in Table 13.

Table 13: Summary of the Extent of Habitat Units Along the TL Routes

Habitat units	Area (ha)	
	TL Route Option 01	TL Route Option 02
Degraded Miombo	34.05	47.10
Agriculture	20.35	19.02
Freshwater	3.50	7.96
Degraded Forest	0.34	0.34
Total	***58.24***	***74.42***

The primary sources of habitat modification observed within the study area are:

- Clearing for construction of settlements, roads and other infrastructure and around existing settlements;
- Clearing (often by burning) for development of croplands;
- Intensive grazing by domestic animals;
- Harvesting of timber for charcoal production;
- Erosion of watercourses due to vegetation clearing; and
- Presence of alien invasive vegetation.

Areas dominated by settlement or agriculture areas that have been transformed such that the key characteristics and elements of the natural ecosystem have been lost, have been classified as modified habitat, with the remainder classified as natural habitat. Minor infrastructure and agriculture, including roads and isolated cropland, has been included in areas of natural habitat where the scale of the disturbance is such that the general area is still dominated by natural ecological processes.

Portions of two Forest Reserves are traversed by the TL Route Options: 3 km in Chiulukire West and 5 km in Chivuna Hills. According to the Zambian Wildlife Authority, the National Forest Reserve management category corresponds to an IUCN VI protected area category[3], although the IUCN's Protected Planet lists the IUCN Management Category as 'Not Reported'[4]. The forest reserves have been proclaimed in terms of the Forest Act (39 of 1973). Neither appear to be protected in the conventional sense and protection appears to be largely for the purpose of sustainably managing the harvesting of timber, firewood and other forest resources[5]. A large portion of land in both Forest Reserves appears to be actively farmed and constitutes modified habitat. The remaining habitat within the overlapping portions of forest reserve include degraded forest, degraded miombo woodland and freshwater areas, although no forest habitat occurs within the two Forest Reserves.

Approximately 8 km of the TL route would need to be located within these Forest Reserves (5km through Chivuna Hills and 3 km through Chiulukire West). Descriptions of the habitats units falling within the two Forest Reserve portions are included and discussed in the relevant habitat sections below, and generally appear to be degraded.

6.7.3 Natural and Modified Habitats

Habitats of the Unika Project Area were assigned to Natural and Modified Habitat classes as described below.

[4] As for 3 above.
[5] IUCN, 2020. Protected Planet. [Online] Available From <www.protectedplanet.net>
[6] Zambian Wildlife Authority (2008). REMNPAS Information Portal: Description of the current National Protected Area System. [Online] Available From: <http://zm.chm-cbd.net/remnpas/prot-areas-system/current-protected-area-system/description-current-national-protected-area>

Natural Habitats

Degraded Forest

Forest habitats occur primarily in the upper reaches of the large inselbergs and central mountainous parts of the study area, along with certain low-lying ridges. In these areas trees exceeded 8 m in height with large predominantly interlinking canopies. Plant species diversity is higher than in the surrounding more low-lying habitats comprising trees such as *Julbernardia globiflora, Brachystegia bussei, Adenia senensis, Lannea discolour, Cassia singueana, Diospyros kirkii, Pericopsis angolensis, Pterocarpus angolensis, Pterocarpus chrysothrix, Dalbergia martini, Dichrostacys cinerea, Brachystegia utilis, Acacia nigrescens, Commiphora africana, Erythrina abbyssinica, Brachystegia boehmi, Diplorhyncus condylocarpon, Pseudolacnostylis maprouneifolia* and *Brachystegia longifolia* amongst others.

The species composition is not consistent with any forest type listed in the Zambian NBSAP[6] as defined by the Zambian Forestry Department[7] and the Potential Vegetation Map for East Africa[8]. Many of the common species are consistent with Miombo Woodland, but the closed canopy forest structure and the balance of the common species are distinct.

Forests provide a wide range of harvestable products and contribute approximately 6.3% of Zambia's GDP[9] primarily in the form of logging and harvesting of timber for charcoal production. This habitat unit in the area has been impacted mainly by uncontrolled use of timber resources which is leading to the encroachment of miombo woodland species. It still meets the definition of Natural Habitat, but given the impact and fragmentation, it is designated as 'Degraded' Natural Habitat.

Despite the higher plant diversity, no IUCN-listed threatened species were confirmed, although two species assessed as globally Least Concern are present and under threat from selective logging; *Pterocarpus angolensis* and *Pterocarpus tinctorius*. Moratoriums on the harvesting of the latter species have been instituted and removed several times since 2014 by the Zambian government[10].

For fauna, no threatened species were confirmed to occur. It was predicted however that three Near Threatened bat species, namely *Eidolon helvum* (African Straw-coloured Fruit-bat), *Otomops martiensseni* (Large-eared Free-tailed Bat), and *Hipposideros vittatus* (Commerson's Leaf-nosed Bat) could occur in the rocky outcrops of the inselbergs. The inselbergs represent the only substantial intact patches of degraded forest habitat which makes up only 16% of the total study area.

[6] Ministry of Lands, Natural Resources and Environmental Protection (2015) Zambia's Second National Biodiversity Strategy and Action Plan (NBSAP-2) 2015-2025. [Online] Available from: <https://www.cbd.int/doc/world/zm/zm-nbsap-v2-en.pdf>
[7] Food and Agriculture Organisation of the United Nations (2002). Forest Genetic Resources Working Papers. [Online] Available from: <http://www.fao.org/3/ac455e/ac455e02.htm#b1-2.1.%20VEGETATION%20TYPES>
[8] VECEA (2020). Potential Vegetation Map of East Africa. [Online] Available from: <http://vecea.vegetationmap4africa.org/>
[9] Turpie, J., B. Warr, J. Carter Ingram and M. Masozera. 2014. The Economic Value of Zambia's Forest Ecosystems and potential benefits of REDD+ in Green Economy Transformation in Zambia. Report to the United Nations Environment Program on behalf of the Ministry of Lands, Natural Resources and Environmental Protection, Zambia
[10] CITES (2019). Consideration of Proposals for Ammendment of Appendices II. [Online] Available from: <https://cites.org/sites/default/files/eng/cop/18/prop/020119_d/E-CoP18-Prop_draft-Pterocarpus-tinctorius.pdf>

Freshwater habitats (rivers, streams and riparian zones)

Rivers, streams and associated riparian zones are associated with higher overall biodiversity than the terrestrial areas and are intact over large areas. Agricultural encroachment is however very significant and various areas have been cleared for crop cultivation. Parts of the riparian zone that are dominated by crop cultivation and these portions are discussed under 'Modified Habitats' below.

All rivers exhibited increased turbidity from exposed sediments present in cultivated portions of the catchments and riparian zones. Bank incision was present in most rivers and is an indication of increased runoff related to decreased surface roughness and infiltration in the catchment due to crop cultivation. Alien vegetation such as *Ricinus communis* (castor oil) was present in the riparian zone, but nowhere was dominant. The vegetation structure was largely natural in all non-cultivated areas. Geomorphological and hydrological impacts were noted in the form of road crossings of most of the smaller river systems.

No species of conservation concern (SCC) were noted within the river, streams and riparian zones, although it is possible that the Near Threatened *Aonyx capensis* (African Clawless Otter) is present. This species is highly mobile and tolerant of terrestrial habitat changes. Only changes in aquatic habitats that impact on their food sources (primarily fish and crabs) or that substantially reduce cover within riparian and wetland corridors are likely to impact this species substantially and no significant impact on theses aquatic habitats is expected from the proposed transmission line.

Several reptile and amphibian species were noted in the riparian zones and indicate the importance of these areas as wildlife corridors.

Modified Habitats

Degraded Miombo Woodland

The miombo woodland occurs on a continuum from seriously degraded to less degraded depending on proximity to settlements and extent of fragmentation for cultivation, timber harvesting and charcoal. Less degraded portions occur adjacent to the inselbergs with degraded forest. Large areas near the inselbergs that were historically under forest have been converted to Miombo Woodland through disturbance and thereby represent a departure from natural habitat even in its least disturbed areas.

Areas of higher disturbance are dominated by *Parinari curatellifolia* while areas of less disturbance are dominated by the typical miombo species *Julbernadia paniculata* and *Brachystegia boehmi*. *Boophone disticha* found in the dambos was also found in this habitat.

The remaining miombo woodland is under threat from human pressure for grazing, wood resources, cultivation and settlement expansion. Little mammalian fauna remains although birdlife may still be representative of near natural conditions.

Given the extent of disturbance and trajectory of further decline in habitat condition, the degraded miombo woodland has been classed as Modified.

Freshwater (crop cultivation) Areas

Freshwater habitats, including both wetlands and the riparian zones of rivers, have been subjected to significant habitat modification, primarily through crop cultivation. Crops are varied, but cassava and maize are the most common. Wetland species assemblages and vegetation structure has been lost in these areas with modified wetland hydrology, soils and terrain are often the only indications of the underlying wetland nature. These areas can therefore no longer be considered natural habitat.

Agricultural Areas:

Large tracts of the low-lying land, particularly alongside drainage lines and in dambos have been cleared for cultivation. Agricultural crops are mainly *Zea mays* (Maize), *Glycine max* (Soybean) and *Cucurbita* sp (pumpkin).

Large indigenous miombo woodland trees are often left along the field boundaries, presumably as a wind break, and include species such as *Uapaca siberiana, Terminalia sericea, Ficus sycamorous, Vangueria infausta, Brachystegia boehmi, Dichrostachys cinerea,* and *Diospiros kirki.*

Large mango trees (*Mangifera indica)* are often left in the fields as a fruit source.

6.7.4 Critical Habitat Assessment

Each of the IFC PS6 criteria and thresholds for determination of Critical Habitat were assessed to confirm whether any of the Modified or Natural Habitats described above trigger Critical Habitat. The Unika Project Area including TL routes does not trigger Critical Habitat.

IFC PS6 Criteria & Thresholds	Rationale	Critical Habitat
Criterion 1: Critically Endangered and Endangered Species[11]		
a) Areas that support globally-important concentrations of an IUCN Red-listed EN or CR species (≥ 0.5% of the global population AND ≥ 5 reproductive units[12] of a CR or EN species).	No EN or CR species were confirmed or are likely to occur in any of the terrestrial or aquatic habitats of the proposed wind farm area.	No
b) Areas that support globally-important concentrations of an IUCN Red-listed Vulnerable (VU) species, the loss of which would result in the change of the IUCN Red List status to EN or CR and meet the thresholds in GN72(a).	No VU species were noted not are likely to occur in any of the terrestrial or aquatic habitats of the proposed wind farm area.	No
c) As appropriate, areas containing important concentrations of a nationally or regionally-listed EN or CR species.	No regionally or nationally listed EN or CR species were confirmed present or likely to occur within the site.	No
Criterion 2: Endemic or Restricted Range Species[13]		
d) Areas that regularly hold ≥10% of the global population size AND ≥10 reproductive units of a species	No species are known or likely to occur within the proposed site in numbers that meet the threshold.	No
Criterion 3: Migratory or Congregatory Species[14]		
e) Areas known to sustain, on a cyclical or otherwise regular basis, ≥ 1 percent of the global population of a migratory or congregatory species at any point of the species' lifecycle.	No migratory or congregatory species were confirmed to occur. While the inselbergs may provide habitat for several bat species (e.g. the Near Threatened *Eidolon helvum* (African Straw-coloured Fruit-bat), *Otomops martiensseni* (Large-eared Free-tailed Bat), *Hipposideros vittatus* (Commerson's Leaf-nosed Bat), no colonies were detected. It is unlikely that any colonies occur that would meet the IFC criterion.	No
f) Areas that predictably support ≥10 percent of the global population of a species during periods of environmental stress.		No
Criterion 4: Highly threatened or unique ecosystems		
g) Areas representing ≥5% of the global extent of an ecosystem type meeting the criteria for IUCN status of CR or EN.	Miombo Woodland is a widespread habitat type that does not meet IUCN criteria for CR or EN and has a regional extent of approximately 2.7 million km^2. While the degraded forest patches on the inselbergs are threatened by selective logging and have local biodiversity value they do not	No

[11] Where subspecies and sub-populations have been separately assessed for inclusion in the IUCN Red List, they may be considered under Criteria 1, as appropriate (GN68)

[12] The IUCN Biodiversity Areas standard uses the following definition for reproductive unit: "the minimum number and combination of mature individuals necessary to trigger a successful reproductive event at a site Examples of five reproductive units include five pairs, five reproducing females in one harem, and five reproductive individuals of a plant species." Eisenberg, 1977. The Evolution of the Reproductive Unit in the Class Mammalia (footnote GN16 under GN72)

[13] Restricted range species are those with limited Extent of Occurrence (EOO) (GN74):

- For terrestrial vertebrates and plants, a restricted-range species is defined as those species that have an EOO less than 50,000 square kilometers (km^2).
- For marine systems, restricted-range species are provisionally being considered those with an EOO of less than 100,000 km^2.
- For coastal, riverine, and other aquatic species in habitats that do not exceed 200 km width at any point (for example, rivers), restricted range is defined as having a global range of less than or equal to 500 km linear geographic span (i.e., the distance between occupied locations furthest apart).

[14] Migratory species are defined as any species of which a significant proportion of its members cyclically and predictably move from one geographical area to another (including within the same ecosystem) (GN76). Congregatory species are defined as species whose individuals gather in large groups on a cyclical or otherwise regular and/or predictable basis (GN77).

IFC PS6 Criteria & Thresholds	Rationale	Critical Habitat
	qualify as a highly threatened or unique ecosystem. They are not included in the forest reserves for their biodiversity value, but rather for the regulation of harvesting of wood and medicinal products. Similar inselbergs are scattered from beyond Chipata, almost as far as the Luangwa valley. The freshwater ecosystems are of types, species and vegetation assemblages that are common in the region.	
h) Other areas, not yet assessed by IUCN, but determined to be of high priority for conservation by regional or national systematic conservation planning.	While no national systematic conservation plan exists for Zambia no portions of the Unika area have been identified as a high priority for conservation by either the Zambian government, nor by other conservation entities. The Matanta and Chiulukire Forest Reserves which overlap the Unika project area are not conventional protected areas and have been instituted primarily to regulated harvesting of natural resources with ecosystem conservation a secondary objective. The reserves are listed by the Zambian Wildlife Authority as corresponding to the IUCN level VI.	No
Criterion 5: Key Evolutionary Processes		
i) No thresholds are defined.	No key evolutionary processes in the Unika area are important for sustaining populations of threatened, endemic or migratory/ congregatory species or unique ecosystems.	No

6.7.5 Summary of Habitat Status Assessment

No Critical Habitat occurs in the study area as no populations of threatened, restricted range or migratory/congregatory species occur that meet IFC PS6 thresholds, and the habitats are not threatened or unique and do not have key evolutionary processes.

The project site includes a combination of Modified and Degraded Natural Habitat covering 93% and 7% respectively for Route Option 01, and 89% and 11% respectively for Route Option 02 (see Table 13). It will be important to avoid placing pylons within Degraded Forest and Freshwater habitats.

6.7.6 Implications for the Project

The IFC performance standards do not place specific biodiversity-related restrictions on projects that fall within Modified Habitat. Following the criteria for projects within Natural Habitat (see Figure 11, Figure 12, Figure 13 and Figure 14), the implications of the above for the proposed Transmission Line are as follows:

1. The footprint of the project must be restricted to modified habitat as far as possible, including marginal farmland, and degraded miombo.
2. Degraded Forest patches and wetland, river and riparian areas should be avoided as far as possible for the siting of pylons and access roads. Forest patches have higher importance for

biodiversity (protected tree species; birds and bats) while wetland and stream courses have high value for aquatic species and ecosystem services.

Where avoidance of Natural Habitats is not possible:

- Mitigation measures must be applied that achieve a 'no net loss of biodiversity' across the site. This may be achieved by:
    - Identifying and setting aside areas of Natural Habitat. This should include implementing mechanisms for the improved protection for the Degraded Forest patch;
    - Planning infrastructure layout to avoid fragmentation of remnant forest and woodland patches by maintaining biological corridors;
    - Restoring damaged or degraded areas after construction; or
    - Implementing Additional Conservation Actions (e.g. tree replanting; riparian rehabilitation) to achieve no net loss of biodiversity within the set-asides (preferably) or through conservation projects outside of the TL Project area if needed.

6.8 SOCIAL CONTEXT

6.8.1 Administrative Structure

The TL route starts within the Katete District in the Eastern Province of Zambia, and extends into the neighbouring Mambwe District. The area also falls directly on Chewa and Kunda Traditional Establishment land and under two separate Chiefdomships.

The Katete District is formally administered by the District Council located at Katete Town. The Mambwe District is formally administered by the District Council located at Mambwe.

Zambia supports a dual administrative structure comprised of formal government departments (i.e. the District Councils) and traditional structures. The traditional structures are founded on the Chewa Royal Establishment, which constitutes the Paramount Chief (or King), and the Kunda Royal Establishment, which constitutes their Chiefs, and their respective advisors as well as a number of chiefs, indunas and headmen / headwomen.

The traditional administration in the area is a complex and interconnected set of relationships and responsibilities. The Paramount Chief/King is the overall leader of the Chewa Kingdom and is supported by the Chewa Royal Establishment and the Royal Council (including the royal family, chiefs and other functionaries).

Mambwe District is home to the Kunda and Chewa people. The Kunda and the Chewa represent about 80 and 20 percent respectively of the Mambwe District population. The Kunda are believed to be of Bisa origin, but have closer affinities with the Nsenga. The Chewa, who originated from Nyasaland (Malawi) spilled over from the plateau, while a number of Thumbuka moved into the Nsefu area from the north. The Kunda are said to have entered Zambia from the Luba-Lunda Kingdom with Senior Chief Nsefu as their leader. Chief Nsefu is being subordinated by chiefs Kakumbi, Mnkhanya, Msoro, Malama and Jumbe. The district hosts the Malaila annual ceremony for the Kunda speaking people in October which celebrates the killing of the "beast" that terrorized people (a lion).

The TL route starts on land under Chief M'bangombe, and extends into an area located under Chieftainess Msoro. The chiefs are further supported by headmen/headwomen that administer one or more villages. The Chief and headmen may also be supported by indunas which function as advisors but have no specific powers.

The areas controlled by the different headmen/headwomen is fluid. Headmen/headwomen are often selected based on their ties with major or founding clans of their respective villages. The headmen/headwomen provide direct administrative functions at the village level, and therefore play a direct role in supporting individual households as well as the administration of land.

6.8.2 Land Use

The Project Area and Transmission Line is comprised of several different land-uses, and dominated by (1) rural settlements, (2) urban and peri-urban settlement, (3) small-scale agriculture, (4) open public /communal land. Each land-use is described in more detail below:

- ***Rural Settlements:*** The Transmission Line extends near several rural settlements that vary considerably in size – including 5 proper villages (Chipungu, Mongoni, Mateyo, Mkalema and Gaveni) to smaller isolated hamlets (supporting 1 to 5 households) and single isolated farmsteads. The rural villages also tend to be located on elevation ridges, while avoiding the valley flats and the local hills. The larger villages tend to function as local centres and are generally clustered along main district roads. Smaller satellite villages and hamlets have grown around the larger villages, and this is normally in response to population growth. The distribution of villages and households in the Project area is depicted Figure 17.

- ***Urban and Peri-urban Settlement at Katete Town:*** Katete Town is the nearest urban centre. The town functions as the administrative centre of the Katete District and is the only true urban centre with a total population of 21,458 individuals in 2010. There is no similar major urban settlement near the Transmission Line.

- ***Small-Scale Agriculture:*** Small-scale agriculture is the dominant land-use, and accounts for approximately 34 % of the total Project area (or 116 of the 336 kilometres squared), and a similar proportion of the land required for the Transmission Line wayleave (or 36% of all land in the wayleave is under farmland). The distribution of farmland in the Project area is depicted in Figure 18. There are noticeable forms of farming that include large dryland farm plots dominated by maize production and which are entirely rainfed. There are also smaller garden plots that are localised near local seasonal streams and drainage areas, where the soil-moisture content can support water-thirsty crops. Agriculture practices are further discussed under Section 6.13.3.

- ***Open Communal Land:*** Communal land encompasses all lands that are not held under private ownership, and generally covers the open bush as well as natural or transformed vegetation. This land use type is not actively farmed but is commonly used by local village for natural resource harvesting as well as grazing of livestock. No household may claim to own communal land and it is administered by the traditional authorities.

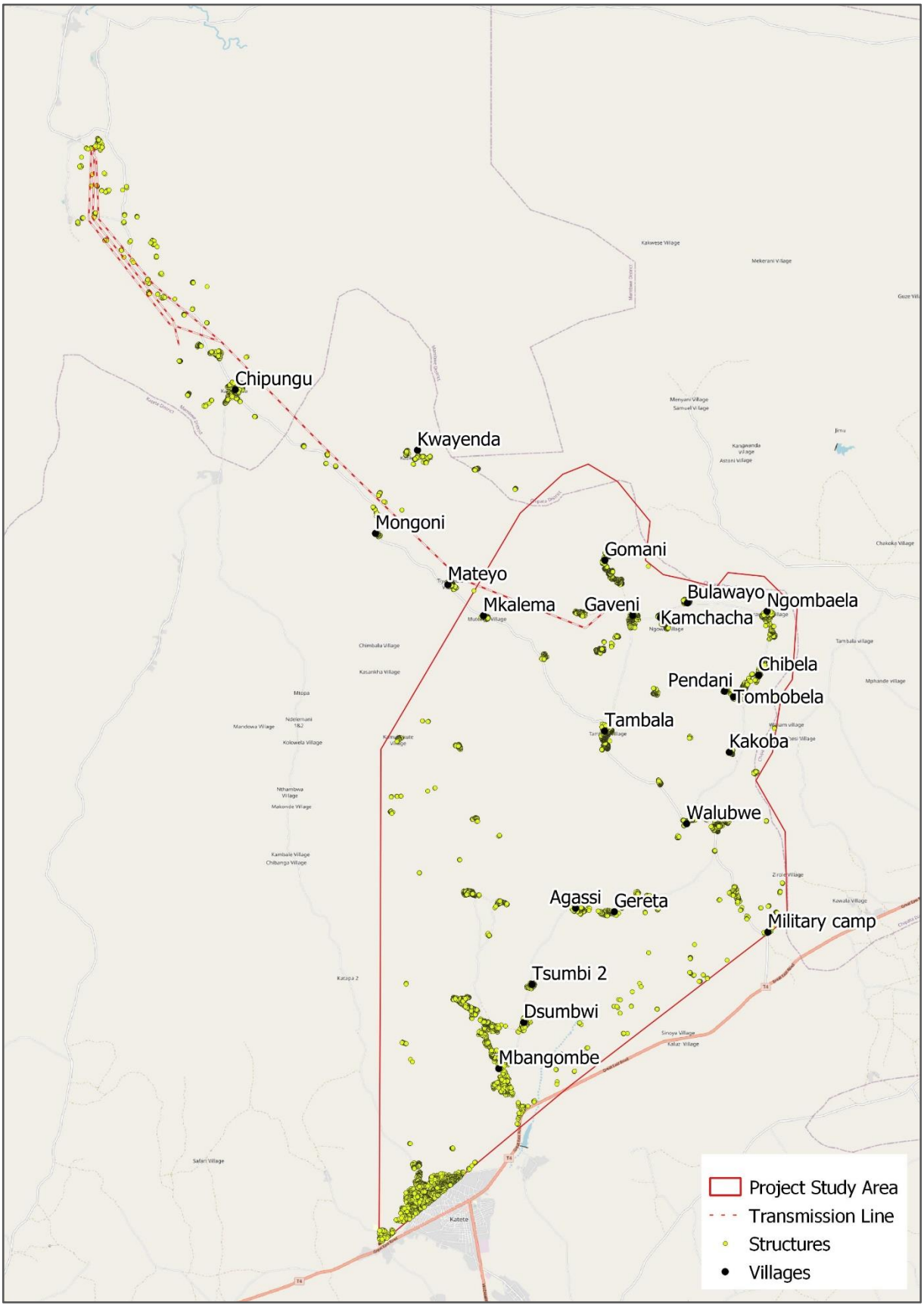


Figure 17: Distribution of Household Structures and Villages

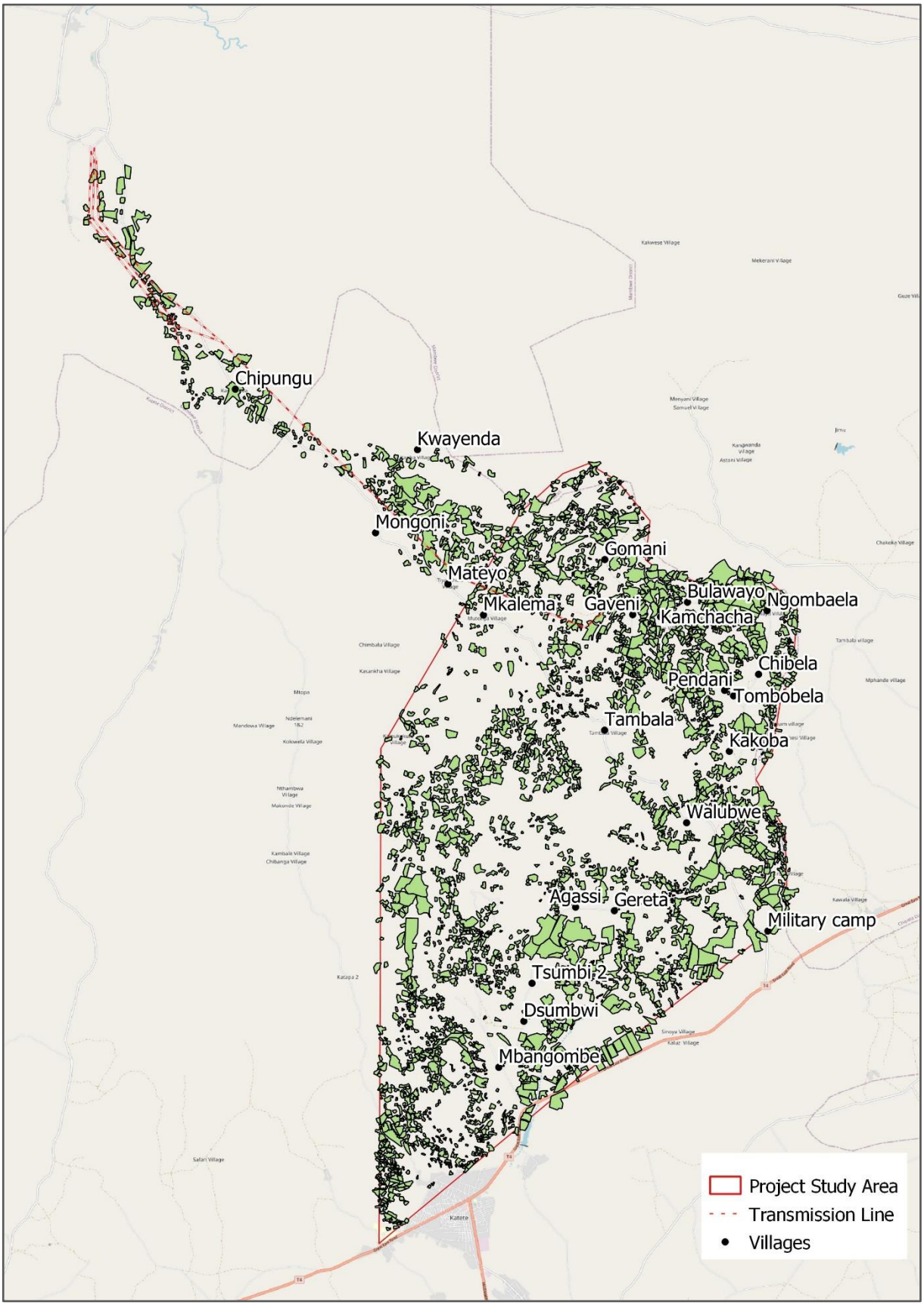


Figure 18: Distribution of Farmland in the Unika Wind Farm Site and Transmission Line Route

6.8.3 Land Ownership and Tenure

All land in Zambia is vested absolutely in the Government of Zambia and is held by the government in perpetuity and in trust on behalf of the people of Zambia. Under such an arrangement, land in Zambia essentially falls into two main categories – Customary and State Land.

All land located along the TL route falls under Customary Land which is legally recognised and protected under the Lands Act (Chapter 184), and any customary land vested in or held by any person under customary tenure is similarly recognised.

The administration of the customary land is via the Chewa Royal Establishment and Kunda Royal Establishment. The Chiefs / Chieftainesses, with support from headmen/headwomen, are granted powers to allocate land to individuals or families for their personal use (i.e. farming) and occupation (i.e. establishment of homes). Interviews suggested that such allocation is done verbally, and there is little written evidence or certification of rights that have been granted.

Historical land ownership would have been secured for large tracts of land by the original family clans in the area. Any clan lands would have, over time, been divided and granted to family members of the clans. Any family member granted land is thereafter deemed to be the exclusive owner of their land. However, the clan may place certain restrictions on how the land is sold or disposed of.

The allocation and administration of land is undertaken directly by the headmen/headwomen, with support from a village committee and via direct consultation of the villagers. The headmen/headwomen generally have strong ties to the major family clans in of the villages they administer. The relationship between clans and headmen/headwomen therefore has a major influence on land administration at the village level.

In addition to the above individual land arrangements, customary tenure also relates to community, common, or forest land within a village, as well as communal grazing land. Such land will not be under any form of individual exclusive right but is freely and openly used by local communities.

All land not held under customary tenure is deemed to be state land. Any attempt to convert customary land to state land, may only be undertaken under national law and only after the approval of the chief and the local authorities in whose area the land to be converted.

6.8.4 Population Demographics

Population Statistics

The Katete and the Mambwe Districts supported a total population of 243 849 and 68,918 persons in 2010 (See Table 14). With a predicted growth rate of 2.6% per annum for both districts, the total district population is expected to be 307 218 and 96,322 respectively. The population growth rate for both district is lower than the national growth rate of ~2,9% per annum.

Table 14: Population Profile

Administrative Division	Census 2010			Projected Population (2019)	Pop. Density (persons/km^2)
	Males	Females	Total		
Katete District	119 995	123 854	243 849	307 218	61.1
Mambwe District	34,253	34,665	68,918	96,322	11,6

Source: (Central Statistics Office of Zambia, 2012)

The population density for the Katete District is 61.1 persons per kilometres squared, while the Mambwe is considerably lower at 11,6 person per kilometre squared. The difference in district population density is attributed to the low density and isolated nature of many of the villages in the Mambwe District, while large towns such as Katete increase average densities in the Katete District.

The district population will be resident in either urban or rural areas, with the greater proportion of the population of both the Katete and Mambwe Districts being resident in rural areas (Table 15). The

Mambwe District however has a higher proportion of rural population with no appreciable urban population.

Table 15: Urban / Rural Divide as a Percent of Total Population

Administrative Division	Urban	Rural	Total
Katete District	13	87	100
Mambwe District	9	91	100

Source: (Central Statistics Office of Zambia, 2012)

T The average household size is 5.2 persons per households for both the Katete and Mambwe Districts (Table 16). Interviews with local headmen / headwomen confirm that households in their villages have, on average, 5 persons, which matches with district statistics. A typical household is therefore comprised of a typical nuclear family, or the father, mother and 2 to 3 children, while some households will also support grandparents and grandchildren.

Table 16: Household Size

Administrative Division	Total Population	Total Households	Household Size
Katete District	243 849	46 852	5.2
Mambwe District	86,918	13,196	5.2

Source: (Central Statistics Office of Zambia, 2012)

A single-family retaining use of a single homestead is by far the most common form of household, as confirmed during local interviews. However, there are also some compound homesteads although this is rare. Such households comprise of a large extended family on a single plot. The extended family comprises of a senior male (usually the grandfather) whom retains ownership of the land and his own household assets, while young adult sons and daughters may divide into separate households upon marriage but remain on their father's land.

Age and Gender Composition

The age and gender profile of the Katete and Mambwe Districts a presented in Table 17. The total population of both districts are relatively young with just under half being below the age of 14 years. The only real variation is the slightly higher proportion of persons above 15 years in the Mambwe District compared to Katete District. This variation is however statistically negligible and may be influenced by the presence of Katete Town, where urban settlements usually result in slightly different population demographics.

Table 17: Age and Gender Profile as Percent of Population

Administrative Division	% of Males			% of Females			Total (%)		
	0-14	15-34	> 35	0-14	15-34	> 35	0-14	15-34	> 35
Katete District	48	33	19	47	33	20	48	33	19
Mambwe District	49	32	19	48	33	19	48	34	18

Source: (Central Statistics Office of Zambia, 2012)

Literacy & Education

Adult literacy rates in the Katete and Mambwe District are poor with between 44 to 46 % of the adult population (aged between 25 to 54 years of age) having never attended school (Table 18), while illiteracy rates increase significantly for persons above the age of 55. This trend is likely reflective of the limited access to and prioritisation of education in the past, however there is some improvement in education enrolment for younger age groups.

Table 18: Percent of Population by School Attendance – Katete and Mambwe District Combined

Age Group	Currently Attending			Not Currently Attending			Never Attended
	Male	Female	Total	Male	Female	Total	
5 to 9	10	13	22	1	1	1	76
10 to 14	28	33	62	3	3	6	33
15 to 19	28	22	50	8	14	23	27
20 to 24	10	4	14	21	27	48	38
25 to 29	2	1	3	26	27	53	44
30 to 34	1	1	2	30	25	54	44
35 to 39	1	1	2	29	23	52	47
40 to 44	1	1	1	29	23	52	46
45 to 49	1	1	1	31	23	54	45
50 to 54	1	1	1	29	24	53	46
> 55	1	1	1	23	15	38	61
Total	**12**	**12**	**24**	**15**	**14**	**29**	**47**

Source: (Central Statistics Office of Zambia, 2012)

Enrolments rates of children of schooling going age (between 5 and 18 years of age) indicates that at least a third had not received any form of education in 2010 (Table 19), and this remains a major social challenge in the two districts. Enrolment in primary school sits around 62% while enrolments in secondary schools are around 50% of the relevant age groups.

Discussion with district authorities and local leadership shows a complex range of issues in terms of gender and education. Young boys and girls are usually enrolled in education, however young boys (aged between 6 - 11 years) may be held back to function as herd-boys with a result that young girls generally receiving a better education. However, once girls enter puberty (aged around 14 years) school drop-out increases significantly largely in response to household care needs as well as a common challenge of child-brides in the region.

The maximum education achievement rates for the Katete and Mambwe District population in 2010 are presented in Table 19 below. There is a noticeable education ceiling reached at Grade 7, with the majority of the district population (75%) reaching only Grade 7 or below. Grade 7 is the end of primary school level education, with few people continuing on to complete secondary level education.

Table 19: Percent of Population by Level of Education – Katete and Mambwe District Combined

Grade	Male	Female	Total
No Grade	2	2	3
1	4	5	9
2	5	6	10
3	5	6	10
4	5	6	11
5	5	5	10
6	5	5	10
7	7	6	12
8	4	3	7

Grade	Male	Female	Total
9	4	3	7
10	1	1	2
11	1	0	1
12	2	1	4
Tertiary	2	1	3

Source: (Central Statistics Office of Zambia, 2012)

The low attendance rates at secondary schools are in part to the limited number and costs of attending secondary schools, whereas primary schools are more common and more importantly free. However, there is also a high and consistent drop-out rate of boys and girls throughout the different grades, and interviews attribute drop-outs to child marriages, the need to support household, or lack of interest or perceived value of both parents and children.

Ethno-Linguistic Profile

Zambian supports approximately 72 ethnic groups, with almost 90% of Zambians belonging to the nine main ethno-linguistic groups: the Nyanja-Chewa, Bemba, Tonga, Tumbuka, Lunda, Luvale, Kaonde, Nkoya and Lozi.

The population of the Katete District are near exclusively comprised of the Eastern Province (Nyanja speaking) Ethnic Groups and more specifically the Chewa Ethnic Group. The Mambwe District in-turn is largely comprised of the same Eastern Province (Nyanja speaking) Ethnic Groups, but more than half of the total district population form part of the Kunda Ethnic Group, while the remaining population are a mixture of Chewa (18% of population) and other ethnic groups.

The Chewa ethnic group accounts for 7.5% of the national population, and 40% of the provincial population. The Kunda ethnic group in turn is relatively smaller and comprise only of only an estimated 60,000, and only 0,3% of the total provincial population. (Central Statistics Office of Zambia, 2012)

Broadly speaking, none of the above groups are considered to be indigenous peoples based on the general definitions of such people under the IFC Performance Standard 7. The Chewa form the provincial majority and are not an ethnic minority. The Kunda, while strictly not indigenous, are however a relative minority ethnic group in the Eastern Province and Zambia overall.

Zambia provides protection for minority groups and there is limited systemic discrimination. Interviews with the District Authorities suggest that there are no ethnic or cultural tensions in the districts, and in general the relationship between ethnic groups is good. In many cases, ethnic minorities are related to economic migrants from Mozambique and Malawi, that provide key skills and basic labour that is generally welcomed by local people. Never-the-less, economic migrants are restricted from obtaining land from the traditional authorities. Vulnerable people are discussed in Section 6.8.9

6.8.5 Livelihoods

Employment Profile

For the combined population of the Katete and Mambwe Districts, 74% define themselves as falling into the economically active group, or persons that are older than 12 years of age and available for casual of formal work (Table 20). Formal or casual wage employment is only secured by ~3% of the two district populations, while the majority of economically active people are either self-employed or unpaid family-workers.

These two latter groups do not fall into the traditional interpretation of employment, and in reality, are family members of small-scale farming households. Formal employment from local agriculture is negligible if non-existent, and farm-based employment is largely restricted to households farming their own land, via provision of labour support by both male and female family members, while seasonal casual labour may be used by local households.

Table 20: Percent of Total Population (Above the Age of 12) by Economic Status

Employment Status	Katete District			Mambwe District		
	Male	Female	Total	Male	Female	Total
Economically Active Group	36	38	37	40	35	37
Employer	0	0	0	0	0	0
Employee	2	1	2	6	2	4
Self-Employed	23	17	20	14	12	13
Unpaid Family Worker	11	20	16	14	18	16
Unemployed (Seeking Work)	1	1	1	4	2	3
Unemployed (Not Seeking Work)	1	1	1	2	2	2
Economically Inactive Group	11	13	12	20	30	25
Total	36	38	37	40	35	37

Source: (Central Statistics Office of Zambia, 2012)

The dominance of small-scale farming in the two districts is similarly reflected in Table 21. The majority of the total economically active workforce (89% for Katete and 80% for Mambwe) fall into the Agriculture, Hunting, Forestry and Fishing industry sector. Forestry and fishing provide minimal contributions, while all other industry sectors in combination contribute only 11% and 205 of the total employment contribution in the Katete and Mambwe District respectively.

Table 21: Percent of District Workforce by Industry Sector

Industry Sector	Katete District			Mambwe District		
	Male	Female	Total	Male	Female	Total
Agriculture, Hunting, Forestry and Fishing	42	47	89	39	41	80
Mining and Quarrying	0	0	0	0	1	1
Manufacturing	1	0	1	2	1	2
Electricity Gas Steam and Air Conditioning Supply	0	0	0	0	0	0
Water Supply	0	0	0	0	0	0
Construction and Allied Repairs	1	0	1	2	0	2
Wholesale, Retail Trade, Restaurants and Hotel	1	1	2	1	1	1
Transport and Storage	1	0	1	0	0	1
Accommodation and Food Services	0	0	0	1	0	1
Information and Communication	0	0	0	0	0	0
Finance and Insurance	0	0	0	0	0	0
Real Estate	0	0	0	0	0	0
Community, Social and Personal Services	2	1	2	4	2	6

Industry Sector	Katete District			Mambwe District		
	Male	Female	Total	Male	Female	Total
Not Stated	1	2	3	2	2	5
Total	48	52	100	52	48	100

Source: (Central Statistics Office of Zambia, 2012)

Small-Scale Farming

According to Census 2010 approximately 92% and 85% of all households in the Katete and Mambwe Districts were engaged in some form of agriculture in the 12-months preceding the Census. Such farming tends to be small-scale and informal with the primary aim of securing household food needs and trade in surplus produce. There is no evidence of large to medium commercial farming operations within the study area, although farming undertaken by the local Military Units may be treated as quasi-commercial.

Interviews with local leaders suggest that the average farmland holdings is 2 hectares per household. Farmland is allocated by major land-holdings clans and headmen/headwomen to individuals, and these holdings are inherited from father to sons. In many cases, any inherited land is granted equally to all sons (but excludes sisters) rather than the eldest. This has resulted in the division of land-holdings into smaller plots through multiple generations.

Interviews with local leaders suggest that the farmland is usually farmed in its entirety, and little land is left fallow or under some form of rotation. Portions of farmland may only be farmed where it is deemed sufficient to support household food needs, while the remaining farmland may be allocated to cash crops or left fallow until the following year. Interviews suggest that fallow land is rare, due to local culture where any fallow land suggests that the landowner is lazy or has been granted too much land. Both such rumours tend to be avoided by local households where possible.

Interviews indicate that staple crop for local households is maize, with sunflower, cotton and groundnuts functioning as important secondary crops. This largely reflects the same crop diversity farmed by households in 2010 in the Katete and Mambwe Districts (Table 22). The majority (91% for Katete and 84 for Mambwe District) of households grow maize at their primary crop and groundnuts, sunflower, cotton, sweet potato is also commonly grown.

Table 22: Percent of District Households by Cultivated Crop Type and Typical Yields

Crop Type	Katete District		Mambwe District	
	No of Households	%	No of Households	%
Maize	42 715	91	11 056	84
Groundnuts	31 432	67	7 635	58
Sunflower	23 204	50	2 022	15
Cotton	21 823	47	5 065	38
Sweet Potato	16 555	35	4 295	33
Mixed Vegetables	10 992	23	1 758	13
Mixed Beans	9 014	19	421	3
Cow Peas	7 870	17	1 651	13
Sugar Cane	6 439	14	592	4

Crop Type	Katete District		Mambwe District	
	No of Households	%	No of Households	%
Cassava	4 591	10	2 897	22
Other Crops	3 313	7	272	2

Source: (Central Statistics Office of Zambia, 2012)

It is noted that local households also grow a mixed diversity of vegetables (Table 22). This is related to a clear divide between what may be termed dryland farming and vegetable gardens as detailed below in Figure 19.

1. **Dryland Farmland:** This type of farmland entails relatively large (interviews suggest average fields holdings of around 2 hectares) farmplots located on slightly elevated land away from local streams and may even extend up into the local hills. These farmplots comprise the major landholdings of local households and are near exclusively comprised of maize, cotton, and sunflower with some secondary crops. Interviews suggest that most of the land is farmed, and rotation farming / fallow land is largely non-existent, suggesting that land will be under pressure from over-use. Depending on the unique characteristics of each household and their total landholdings, most will farm maize that is just enough to feed their households with some surplus for trade. The remaining land is either not used or is planted with a diversity of other crops (notably sunflower and groundnuts) that protects households from shocks from maize losses as well as permitting some additional trade in produce. Dryland farming, irrespective of the crop, is undertaken at a very specific season (See Table 23). Land preparation and planting is undertaken between October and December and coincides with the seasonal rains. Harvesting is undertaken around May of the following year.

2. **Vegetable Gardens:** Vegetable gardens are restricted to local rivers, stream, drainage lines or dambos – or any drainage feature that sustains water during the dry season. The gardens are normally very small (on average 40 metres squared) relative to the dryland farmplots. The gardens are predominately used to grow high-value and water-hungry vegetables (including tomato, onion, watermelon, and other mixed vegetables). The cropping season for vegetables is almost an inverse of the dryland crops (Table 23). The gardens are not farmed during the rainfall seasons as they are usually flooded or water-logged. Land preparation and planting is undertaken in around June, and just after the harvest of the dryland crops. The harvesting of the crops, depending on crop type, extends over July to September.

Figure 19: Images of Dryland Farm plots and Vegetable Gardens

The two cropping seasons also permit a clear distribution of labour. Preparation for vegetables gardens occurs immediately after the harvesting of the dryland crops and when household labour is readily available. The harvesting of any gardens crops occurs before the need to prepare the dryland farm plots for the next season.

Detailed analysis of latest available crop forecast data (Katete District Agricultural Office, n.d.) covering the staple crop of maize in year 2017 /2018, shows that the expected yields for the Katete and Mamba Districts is on average 1.73 and 1,73 tonnes per hectare (Table 24). There are however clear seasonal differences with the 2016/2017 yields predicted at 2.20 tonnes per hectare for the two districts.

In comparison, the expected yields for Zambia as a whole and the Eastern Province is 2.12 and 2.25 tonnes per hectare respectively for the 2016 / 2017 season. The Katete and Mambwe Districts yield is therefore similar to both national and provincial norms but tends to be lower when compared its immediate neighbouring districts.

Table 23: Cropping Calendar

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dryland / Upland Crops												
Land Preparation										■	■	■
Planting										■	■	■
Tending	■	■	■	■								
Harvesting					■							
Fallow						■	■	■	■			
Dambo Crops / Garden Crops												
Land Preparation						■						
Planting						■						
Tending						■	■	■	■			
Harvesting							■	■	■			
Fallow	■	■	■	■	■					■	■	■
Rainfall Seasons												
High / Wet Season	■	■	■									■
Medium				■							■	
Low / Dry Season					■	■	■	■	■	■		

Table 24: District Estimates on Crop Yields and Utilisation

Crop	Unit	Crop Yield				Use of Crop (2017/2018)	
		2016/17	2017/18	2016/17	2017/18	Home Food	Sale / Trade
		50 kg bags/Ha		Tonnes/Ha		%	
Maize	x 50 Kg	44	32	2.20	1.70	60	40
Groundnuts	x 50 Kg	17	14	0.85	0.70	60	40
Soybeans	x 50 Kg	15	13	0.75	0.65	20	80

Mixed beans	x 50 Kg	5	4	0.25	0.20	30	70
Cotton	MT	0.54	0.5	0.03	0.03	0	100
Sunflower	x 50 Kg	21	18	1.05	0.90	40	60
Cowpea	x 50 Kg	13	9	0.65	0.45	60	40
Irish Potatoes	MT	5	3	0.25	0.15	39	61
Sweet Potatoes	MT	6.5	6.0	0.33	0.30	40	60
Cassava	MT	3.8	3.5	0.19	0.18	40	60
Tobacco	MT	0.8	0.8	0.04	0.04	0	100
Rice	x 50 Kg	4	2	0.20	0.10	60	40

Source: District Agricultural Office, n.d.

Interviews indicated that households farm crops to secure household food needs first, and any surplus is then traded. Trade in surplus is fairly common, however interviews suggest that the net total volumes are low, but this will vary by household. District estimates are that 40% of the district total produce is allocated to trade, but interviews suggest that it is likely to be lower.

Interviews suggested that the sale of surplus produce is largely targeted towards local bulk buyers or the government (under the food reserve programme) that visit the villages. In limited cases, households may transport their produce to Katete and Chipata, however this incurs additional travel time.

Interviews indicated that bulk buyers may buy crops, however at heavily discounted prices (half of the market price) while households receive market related prices from both traders in Katete Town and from the Government. The markets rates for the primary staple crops are presented in Table 25. The typical income generated by a household for a 50 kg bag of maize will vary from 50 to 100 Kwacha. Assuming that only 40% of total produce is sold and the household excessively farms maize, a typical household would earn between Kwacha 1 200 to 3 520 for a season's surplus produce from 2 hectares of land.

Table 25: Markets Rates in Kwacha (ZMW) for Selected Crops

Crop	Market Rate Per Kilogram			Market Rate Per Typical 50kg Bag		
	2016	2017	2018	2016	2017	2018
Maize	1 -2	1 -2	1 -2	50 - 100	50 - 100	50 - 100
Groundnuts	5 - 10	4 -5	4 -5	250 - 500	200 - 250	200 - 250
Soybeans	5 - 7	4 -5	4 -5	250 - 350	200 - 250	200 - 250
Sunflower	1.5 - 2	1.5 - 2.5	2 - 3	75 – 100	75 - 125	100 - 150

Source: District Agricultural Office, n.d.

The division of labour in farming is shared between the household males and females with some support from children, while there may be the use of casual labour. Males largely contribute to the clearing of trees and vegetation as well as ploughing with oxen. Women focus on hand-ploughing, sowing, tending, irrigating, and harvesting of crops. Casual labour is generally comprised of hiring local young adults during the labour-intensive land clearing and preparation that extends over October to December.

The division of labour tends to be weighted toward women with most of the post-land preparation activities being undertaken by women with some support from males and children. Harvesting of the

crops is undertaken by women, with men assisting in the transport of crops to the homestead. Both men and women can be involved in the sale of agricultural produce.

Interviews note that storage of produce is problematic, although this varies by household and the level of care given to storage. Most produce is stored in thatch or reed storage bins or in large bags. Both are however prone to losses from weevils and rats as well as rot. The former two may result in the loss of around 10 to 20 % of produce, while households may lose around 5 % of produce to rot.

Local farming is generally thought to be purely subsistence farming, where crops are used to secure household food needs. However, this is not strictly true as households engage in farming to first secure household food needs, and then engage in trade in produce.

The proportion of crops that is allocated for consumption and trade varies based on the levels of surplus food available throughout the year, and interviews note that a significant challenge is crop price fluctuations during the year. The lowest prices for crops just after the crop harvests where there is an oversupply in produce in the national and local markets. The highest crop prices occur just prior to the next season's harvest where surplus crops are the lowest in local markets. The latter is normally at the same time as where households are at their lowest in terms of food reserves, and households are rarely able to benefit from the higher rates.

Livestock Grazing

According to the Census Statistics (Table 26), 77% and 70% of all households located in the Katete and Mambwe Districts engaged in livestock or poultry rearing in the 12-months preceding the 2010 Census.

Table 26: Percent of District Households by Livestock Holding Type

Livestock Type	Katete District		Mambwe District	
	No of Households	%	No of Households	%
Cattle	18 965	40	14	10
Goats	9 802	21	21	14
Pigs	21 997	47	19	13
Sheep	320	1	2	1
Donkeys	130	0	1	1
Chickens	28 362	61	94	66
Other Poultry	2 104	4	13	9
Other Livestock	1 382	3	5	3

Source: (Central Statistics Office of Zambia, 2012)

Chicken, pigs, goats, and cattle were the main livestock that are reared. However, the proportion of households with different types of livestock vary considerably between the Katete and Mambwe District. Forty percent of Katete District households retain cattle compared to only 14% for Mambwe District households. Inversely, a greater proportion of Mambwe households (94%) keep chicken compared to 61% of Katete households.

Interviews indicate that local households' rear chicken, pigs, and goats mostly to secure household food needs, and would function as a primary source of protein. Cattle are commonly reared for the primary function of accumulating household wealth mostly for Katete households; however, cattle are also used for ploughing and carting.

Grazing of small livestock is undertaken near the home as chickens, pigs and goats are allowed to range at random. With respect to cattle, there are no communal grazing areas and cattle are grazed at random

on community land in and around local villages. Livestock are actively herded by men/boys during the day before returning to the home where the cattle are penned in informal corrals.

Interviews with the District officials indicated that livestock play a primary role for local households, however most livestock numbers of kept low due to a number of diseases, specifically Newcastle disease (chickens), African Swine Flu (pigs) and East Coast Flu (cattle).

Natural Resource Use by Communities

Natural resource harvesting is common for rural communities within the study area, and there is a rich diversity or materials and locations from which such materials are collected. The most common form of natural resource harvesting is firewood collection, which is usually undertaken by women and children and is the most common fuel for cooking. Firewood is generally collected from the open bush/community land in and around the household.

The majority of houses are constructed of traditional or natural materials, or a mix of modern and natural materials (as shown in Figure 20). This includes mud and clays for mud-bricks, cut lumber and poles for the frames of traditional homes, as well as reeds and grasses for thatching. All materials are sourced locally on communal land. Interviews suggest that a key natural resource is the local streams which provide clays, reeds for thatching and fishing.

Charcoal production is also commonly undertaken, mostly by males. Charcoal may be used as household fuel; however, it is more commonly sold along roadsides or to local buyers. Charcoal production is inherently destructive as it requires the cutting of mature trees, and in most cases is deemed an informal and illegal activity. The most visible evidence of charcoal production has been around the base and along the slopes of the local hills.

The collection of wild fruit, vegetables and mushrooms is also common, while local households are also able to harvest fruit from communal fruit trees (including mango). It is also expected that a variety of plants are used for medicinal purposes such as those listed in Table 9 although the extent of use and dependence is unknown. There are no specific areas that are targeted although most of such harvesting is undertaken in the open bush (notably in intact or semi-transformed vegetation around the villages and in the local hills).

Local households may undertake hunting of local animals, while interviews also note that children may often dig out burrowing rodents.

6.8.6 Housing and Household Structures

Households within the Katete and Mambwe Districts are predominately rural with a smaller percentage of formal households. Rural households are generally clustered into small rural villages or as isolated farmsteads, and support between 1 to 3 structures per household, generally comprising of a main house, secondary bedroom, and kitchen, however pit latrines and storage sheds are also common (Figure 20).

Most of the structures are constructed with traditional materials (including mud or burnt mud bricks, grass, or thatch roofing, compacted mud, or earth floors) while an additional major proportion (~30%) of structures have a mix of traditional and modern materials (i.e. corrugated iron roof) (see Table 27). Only 11% of all structures are constructed of conventional or modern standards.

Table 27: Count and Percent of Household Structures by Type

Type of Housing Structure	Katete District		Mambwe District	
	Count	Percent	Count	Percent
Traditional Structures	26 642	54	8 034	56
Improved Traditional Structures	15 377	31	4 564	32
Mixed Structures	1 601	3	361	3
Conventional Flat	723	1	180	1
Conventional House	4 568	9	1 002	7
Commercial Building	356	1	115	1
Improvised / Makeshift Building	19	0	12	0
Collective / Institutional Quarters	54	0	34	0
Unintended	32	0	9	0
Other	24	0	47	0
Total	**49 402**	**100**	**14 358**	**100**

Source: (Central Statistics Office of Zambia, 2012)

The profile presented above is reflected in the homesteads present in the area. Households tend to be clustered into villages with homestead blending into the next homestead. Most households have a main residential structure/main home that is primarily used for sleeping, while cooking is either undertaken in the open or in a separate free standing rondavel. Most households also retain at least one poultry coup and grain store, while households with livestock will also establish small corrals.

Figure 20: Typical Examples of homesteads and related structures

6.8.7 Basic Services

There was limited electrical infrastructure in the Project Area and along the Transmission Line, and there has been little substantive development of infrastructure outside of Katete Town. Candles, paraffin, and other fuels sources are primarily used by district households for lighting, while only 3.4% of households have access to electricity.

The Project area does support a transmission line established by ZESCO. This link provides connections for some households in villages that are in proximity to the line. However, the majority of households in the Project area do not have power, and are reliant on firewood, charcoal and other fuels for cooking and lighting.

The primary fuels used by Katete and Mambwe District Households for cooking profiled in Census 2010 are wood (88.7%) and charcoal (8.4%), while only 2.2% of district households utilise electricity. Firewood remains the primary fuel and is collected from the open bush surrounding communities, while local trees are cut down for charcoal production.

There was a limited diversity of water sources used by Katete and Mambwe District households in 2010, with the majority (85%) of households securing water from boreholes or wells. A further 11% of households obtained water from rivers, dam, and streams, although this is limited to households that do not have access to private or communal boreholes or wells. Only 2.7% of households had access to piped water.

Villages within the Project Area and along the Transmission Line largely reflect the district level patterns in terms of access to water. Water is nearly exclusively obtained from community boreholes that have been established by the Government in the larger or medium sized villages, while the smaller hamlets and isolated farmsteads will likely obtain water from natural sources or hand-dug wells.

Basic sanitation in the Katete and Mambwe Districts in 2010 was predominately comprised of unimproved pit latrines, which was used by 45 and 70% of the Katete and Mambwe District households. The remaining households (52 and 25% of the two district's households) claim to have no formal or informal sanitation, and therefore rely on the local bush.

Interviews with local headmen and ward councillors indicate that there has been improvement in the use of pit latrines over the last 10 years, however most are unimproved pit latrines constructed by local households. The pit latrines constructed by local households are also prone to collapse, and often they are abandoned in favour of using the bush.

There was limited formalised waste management practices in both districts in 2010, and there has been limited further development over the last decade. District households are largely dependent on disposal of waste in community or private open pits (46% of households), while burning and street dumping is regularly used by 35% of district households. Only 2.9% have formal waste collection and again this is likely limited to Katete Town.

6.8.8 Access and Mobility

The study area is located north of the Great East Way (T4). The D598 is the primary access road to the study area and is in poor condition. This is equally applicable to the rural areas that connect the various villages (see Figure 21). Interviews with local authorities and leadership repeatedly cite the need for repairs and maintenance. In addition to the gazetted roads, there is a network of community roads/tracks. These tracks are central in terms of connecting smaller village to larger villages as well as to existing district and rural roads. These roads are constructed by local communities and have no specific design standard, and vary in terms of width, quality and condition from good gravel roads to limited cart tracks. A key aspect of these roads is that they extend directly into villages and often cross and wind through individual households. Interviews indicate that only a few households own their own vehicles. Mobility and movement along the roads are predominantly pedestrians, bicycles or cart-drawn carriages between nearby villages, while local communities utilise vehicle or motorcycle taxis to reach further areas such as Katete Town. Transport is expensive therefore most people do not leave their village on a regular basis. Rather transport will be used only when there is a need to reach community services in nearby villages or

Katete Town. Some households will also transport goods (such as charcoal or crop produce) to major markets in the area notably Katete Town, where they obtain better prices.

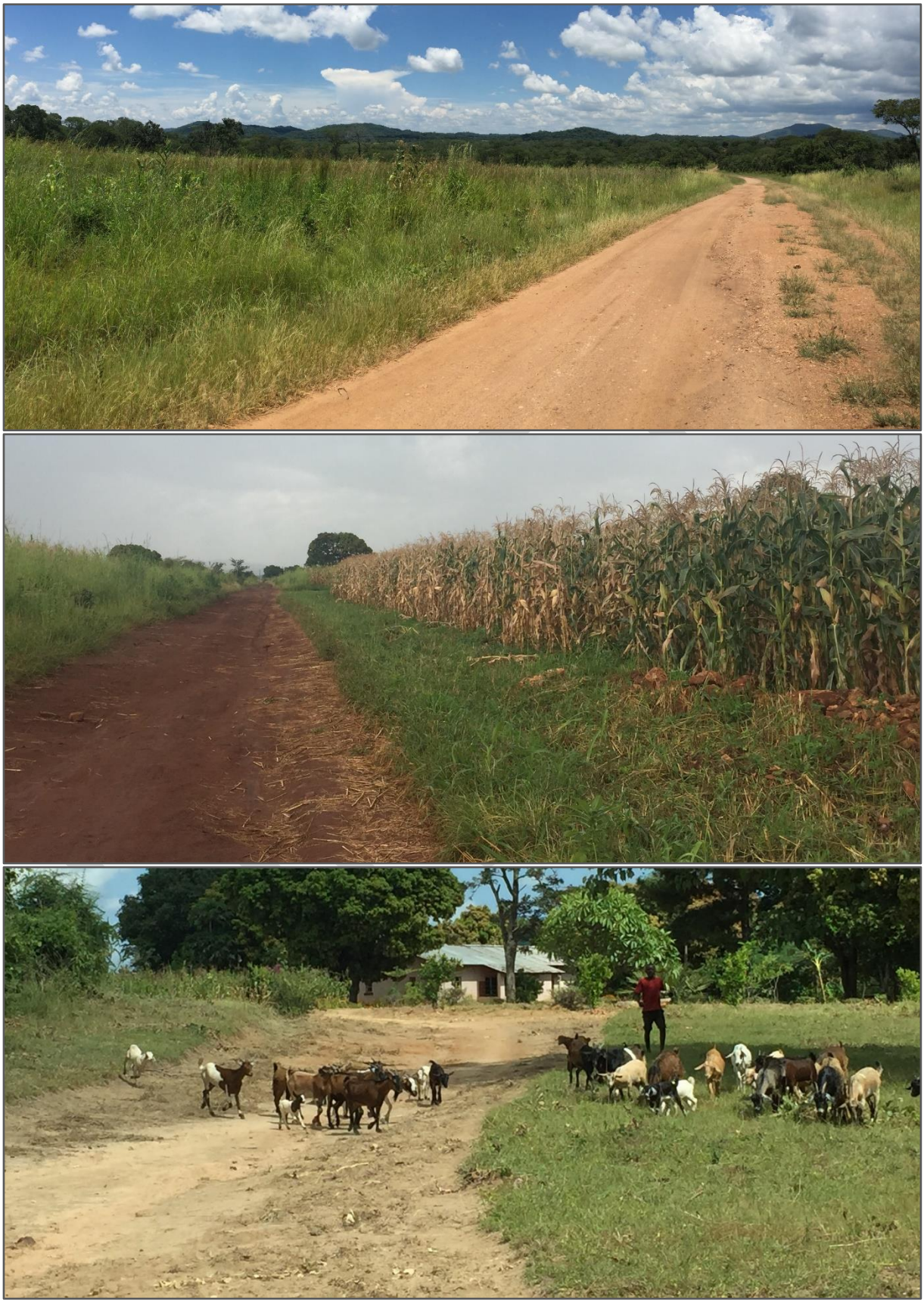


Figure 21: Images of Typical Roads Present in the Study Area

6.8.9 Vulnerable People

Vulnerable People is a term given to individuals, households, or groups of people that may be disproportionately affected by a Project based on their gender, ethnicity, age, physical or mental disability, economic disadvantage, or social status within their community. For the purposes of the Social Impact Assessment, vulnerable people have been identified as follows:

1. **Elderly Households with Limited Support:** Elderly headed households (older than 65 years of age) or where the household is comprised of elderly, who have no or marginal support from economically active (able adults) family members. However, some caution is needed, as some households may be headed by an elderly patriarch or matriarch with substantive support of able adult sons and daughters.

2. **Female-headed or Female-Only Households:** While the rights for women are protected under law in Zambia, local customary rights (notably those linked to land) may undermine those rights, while the lack of able adult males often limits household productivity and income. Again, as above, However, some households headed by women may not be vulnerable if headed by a matriarch with substantive support of able adult sons and daughters. Interviews with the District Social Welfare office indicated that female-headed households are typically very vulnerable. This stems from a range of issues, but specifically the predominance of child-marriages and high divorce rates. In addition, women's right to land is tenuous and may often be undermined where there is no male head and no clear line of inheritance from father to son. Land ownership is entirely patriarchal, and where the male head has deceased females may be evicted from their home or land by the male's clan or extended family.

3. **Child-Headed Households:** The vulnerable group covers cases where the household head is below the age of 18 and has no or marginal support from an economically active (adult) family member.

4. **Persons with Disabilities or Long-Term Illnesses:** Households where one or more household members are defined as disabled (including physical, mental, and long-term illness) are potentially vulnerable.

5. **Landless:** Agriculture is the primary livelihood strategy adopted by local households. Therefore, households without claim to land are potentially vulnerable as their ability to generate food and income is undermined. Interviews suggest that often landless households are headed by females, as their rights to land may be undermined or entirely removed once their husband has passed away or divorced.

6. **Ethnic Minorities:** Local households are near exclusively comprised of the Eastern Province (Nyanja speaking) ethno-linguistic group irrespective of their gender, and this ethnic group is the largest group in the Eastern Province.

Only 2% of the Census 2010 population are not part of the above group but are linked to other major ethnic groups from surrounding provinces. It can be reasonably assumed that the 2019/2020 population will not be much different from the 2010 trends.

Broadly speaking, Zambia provides protection for minority groups and there is no evidence to show that there is local systemic exploitation or pressure on ethnic minorities that may result in these groups being deemed vulnerable.

Interviews with local officials also note that ethnic monitories are generally linked to economic migrants from Mozambique, Malawi and other parts of Zambia. Such migrants are generally welcomed and accommodated by local communities, and the District Authorities noted that here is no evidence of any

systemic conflict or tensions. However, any immigrants have limited opportunities to secure land for homes or farming, therefore they tend to be labourers or semi-skilled individuals.

6.8.10 Social Networks

Local households build networks between people, families, village, facilities, and services within and outside of their home village. These networks are often needed to sustain basic household needs and livelihoods, while building resilience in times of stress. However, to access such networks, personal relations as well as more physical forms of accessibility (roads and waterways) and mobility (means of transports) need to be established.

Most family support networks will be within their own homestead (as part of a single or extended clan structure) and within their home village. There is also little evidence of systemic or widespread outward migration and therefore dependency on non-local families is likely to be limited.

There is little in the way of public facilities (outside of schools and shops) and services in local villages in the Project area, and the level of service will vary from village to village. In many cases, households are required to travel to neighbouring villages to access basic facilities, while core services (including formal administrative functions, secondary schooling, hospitals, cemeteries, markets, police stations, and markets) are concentrated in Katete.

Interviews suggests that most households concentrate activities within their home village, however they may visit neighbouring villages on a regular basis as it entails, on average, a 1 to 2 km walk. Given the relative isolation of the rural villages within the Project area, the poor local roads and the need to pay for transport, most households will likely only travel to Katete only a needs basis, and this is undertaken irregularly.

6.8.11 Air Quality

There are currently no major sources of anthropogenic pollution such as industries in or near the TL route. Possible sources of impact on the local air quality include:

- The T4 National Road (Great East Road) which supports large volumes of both heavy and commuter traffic, while traffic within and surrounding Katete is typical of any urban settlement. Medium to small vehicles and motorcycles were noted on the access roads within the Project Site;
- Households within Katete Town will likely use electricity for cooking and lighting, while rural households remain dependent on wood and charcoal for cooking, resulting in localised air emissions in communities along the Project Site;
- Fugitive dust along gravel access roads and from areas cleared of vegetation; and
- Smoke from bush clearing and charcoal making that takes place in certain areas within the Project Site.

According to the Global Health Observatory (GHO) data for Zambia the annual mean concentrations of fine particulate matter ($PM_{2.5}$) ranges between 15-25 µg/m^3.

6.8.12 Noise and Vibration

The study area is largely undeveloped with a rural character, with a significant number of communities dispersed across the area. Ambient sound levels are typical of a rural noise district.

A number of ambient noise measurements were collected during February 2019 as part of the Unika I WF baseline investigation. Measurements were collected in 10-minute periods for a period of 1 hour. Noise levels ranged from 29.2 – 47 dBA ($L_{Aeq,f}$) or 21.5 – 31.7 dBA (L_{AF90}) as indicated in Table 28 below.

The results indicated a quiet environment where natural noises dominate, mostly wind-induced as well as faunal noises. Anthropogenic noises increase ambient sound levels, especially closer to the communities and local towns. The data is similar to sound level measurements recorded at other, similarly natural locations.

Available data indicated that wind-induced noises start to increase at wind speeds 3 – 4 m/s, becoming significant (and frequently the dominant noise source in rural areas) at wind speeds higher than 10 – 12 m/s. At these wind speeds increased wind-induced noises (wind howling around buildings, rustling of leaves in trees, rattling noises, etc.) could start to drown other noises, including TL construction related noises.

Due to the rural nature of the site and surrounds there are no major sources of vibration.

Table 28: Summary of Ambient Sound Levels Measured On-Site

Measurement name and location (WGS 84)	$L_{Amax,i}$	$L_{Aeq,i}$	$L_{Amin,f}$	$L_{Aeq,f}$	L_{AF90}	Comments
	dBA	dBA	dBA	dBA	dBA90	
MPWFSTSL01 (-13.996717°, 32.063896°)	67.0	44.3	20.2	39.8	24.8	Quiet location with wind induced noises generally defining ambient sound levels. Bird sounds audible and dominating when close to microphone. People walking or cycling past raising noise levels at times. Insects audible at times. Large group of people passing on bicycles during measurement 5, significantly raising noise levels for around 60 seconds. Car passing measurement 6 with cyclist with large radio.
MPWFSTSL02 (-13.961734°, 32.071422°)	69.5	45.2	17.7	43.8	21.5	Wind induced noises from maize leaves the dominant sound at times. Birds and some insects. Voices of passersby at times. Sound levels peaking with wind gusts. Motorcycle passing during measurement 3. Motorcycle passing during measurement 5.
MPWFSTSL03 (-13.939922°, 32.121561°)	65.5	47.4	21.7	43.9	26.2	Quiet with birds and wind induced noises dominating. Sound of running water just audible. Frogs audible at time dominating sound level during event with call up to 58 dBA. Wind through maize leaves dominating during wind gusts. Wind increasing resulting in sound level of approximately 42 dBA for around 30 seconds. Main source of noise is frogs and birds.
MPWFSTSL04 (-13.853300°, 32.104418°)	51.9	34.2	17.3	29.2	21.5	Birds calls dominant. Some insect sounds. Very low winds all measurements.
MPWFSTSL05 (-13.867597°, 32.079747°)	76.2	49.7	26.2	47.0	31.7	Some wind induced noises likely dominant. Crickets and birds audible. Cicada species audible. Possibly frogs audible. Natural noises dominant. Sound from town with wood cutting and voices of kids. Vehicle passing during measurement 2.
MPWFSTSL06 (-13.966362°, 32.155850°)	73.9	46.8	25.0	43.4	28.3	Natural noises dominate with birds being the main source of noise. Background noise due to water flowing in river. Voices audible in distance. Traffic on tar road audible at times. Passersby at times increasing noise level.
MPWFSTSL07 (-13.931836°, 32.140911°)	58.3	39.4	22.9	34.6	29.1	Wind induced noises dominate with light winds. Stream running audible in far distance. Lots of broad leaved trees. Birds audible. Voices barely audible in far distance. Natural sounds dominate. Thunder in distance at times. Chopping of wood in far distance during last measurement. Humidity increasing with light rain end of measurement (not influencing measurement).
MPWFSTSL08 (-13.834341°, 32.129462°)	69.8	46.0	21.3	37.9	26.2	Bird sounds dominating with light drizzle of rain audible. Wind through leaves at times. Voices barely audible at times. Insects audible. Thunder in distance not impacting on sound level. Wind reducing third measurement with lighter drizzle. Voices from passersby raising noise level 5th measurement.

6.8.13 Archaeological and Cultural Environment

The National Heritage Conservation Commission (NHCC) National Register indicates the existence of several protected archaeological sites in the wider environment of the project area, but not within the project area of influence. These sites range from Stone Age (Sangoan, sedimentary and open), Iron Age (settlements and smelting), Fortified villages, Rock art paintings (open sites).

One of the most important archaeological discoveries in the region was made in Kabwe (cradle of early hominids) relating to Zinc and Lead mining activities in 1921. This discovery was the skull of the Broken Hill man – Rhodesian or Kabwe man or the *Homo heldelberggenis* belonging to the Middle Stone Age and about 125 000 and 300 000 years old. Found at the site also, were numerous stone and bone artefacts associated with the hominid and may be the oldest evidence of bone tool working in the archaeological record.

The other important archaeological site is the Nsalu Rock Art National Monument located about 30 km north of Kanona. Archaeological investigation done by Clark in 1949 showed that the site was first inhabited by the Middle Stone Age folks perhaps as long as 20 000 years ago or more. Stone material evidence also shows that the site was occupied by the Late Stone Age people from around 12 000 years ago to about 1000 A.D., who were later replaced by the Iron Age farmers as evidenced from two skeletons found at the site. Most of the paintings in the rock cave are mainly schematic in nature and designs include grids parallel, ladders concentric circles, elongated loops, inverted semi-circular designs boat-shaped designs and radiating lines, etc. The schematic paintings are believed to be the works of the Iron Age peoples and date from within the last 2000 years.

The culture of the Kunda and Chewa people is matrilineal driven and therefore focuses on the "mbumba" female members of the community. Their entertainment is centred on dances such as chintali and chitele as the apex of their totality. Thus, landscape of Mkaika Royal Village and its immediate surrounding villages is the centre of Gule wa Mkulu. The Mkaika Royal Village that houses the "King's" Palace and that of the Queen Mother Nyangu as well as the Kulamba Cultural Arena the Gwalada-spiritual centre, the Dzimbabwe entertainment centre, where people converge to celebrate the good things relating to those that have transitioned, are some of the important aspects of the cultural landscape. Gule wa Mkulu is the emergence of the reincarnation in the form of spirits of the departed souls mimicking their deeds, lifestyles or achievements e.g. deceased was a farmer, a dancer etc. The emergence of Gule wa Mkulu is mainly associated with secrecy and in this case, they appear and disappear into thickets which are mainly associated with pristine forests and graveyards.

A total of 11 cultural heritage sites were found within the wider area along the TL Route Options (see Figure 22); however, none were located within the 55 m RoW (i.e. within 27.5 m from the TL centre line in both directions). The closest site found was MP7 (inactive graveyard), which is located approximately 40 m from the TL centre line. The sites are described in Table 29.

More details on the archaeological and cultural environment are presented in the Heritage Impact Assessment report (see Annexure D).

Table 29: List of Cultural Heritage sites along TL Route Options

S/N	Location	Name	Heritage type	Status & distance from the proposed TL	Level of significance	Images
MP1	13°50'13.43"S 32° 3'8.57"E	Mtonya Village Graveyard	Cultural	Graveyard still active There are over 25 graves covering an area of about 30 x 30m^2 The Graveyard is approximately 850 m from the TL centre line	Local	
MP2	13°49'42.93"S 32° 2'19.07"E	Tiyankula Village Graveyard	Cultural	Graveyard still active. There are over 20 graves on site covering an area of about 30 x 40m^2 The graveyard is approximately 620 m away from the TL centre line	Local	

S/N	Location	Name	Heritage type	Status & distance from the proposed TL	Level of significance	Images
MP3	13°48'43.06"S 32° 0'39.50"E	Mukalema village graveyard	Cultural	Graveyard still active There are over 20 graves on site covering an area of about 50 x 40 m^2 The graveyard is approximately 1.4 km away from the TL centre line	Local	
MP4	13°48'0.96"S 32° 0'32.91"E	Mangani village	Cultural	Graveyard still active There are over 20 graves on site covering an area of about 60 x 40 m^2 The graveyard is approximately 650 m away from the TL centre line	Local	

S/N	Location	Name	Heritage type	Status & distance from the proposed TL	Level of significance	Images
MP5	13°47'46.03"S 32° 0'51.10"E	Kwayenda village Graveyard	Cultural	Graveyard still active There are over 6 graves on site covering an area of about 20 x 40 m^2 The graveyard is approximately 82 m away from the TL centre line	Local	
MP6	13°47'4.86"S 31°59'46.97"E	Kantu Nikako and surrounding areas Graveyard	Cultural.	Graveyard still active There are over 50 graves on site covering an area of about 100 x 500 m^2 The graveyard is approximately 400 m away from the TL centre line The surrounding areas that use this graveyard include Gwalaya farms, Chizula, Mikusu, Chikondi, Chimwemwe and Mukuza	Local	

S/N	Location	Name	Heritage type	Status & distance from the proposed TL	Level of significance	Images
MP7	13°44'56.52"S 31°57'56.04"E	Wazaza Village Graveyard 1	Cultural	Graveyard is inactive There are over 10 graves on site covering an area of about 15 x 20 m^2 The graveyard is approximately 40 m away from the TL centre line. **This is closest graveyard to the proposed TL.**	Local	
MP8	13°45'3.42"S 31°57'46.23"E	Wazaza Village Graveyard 2	Cultural	Graveyard is active There are over 40 graves on site covering an area of about 40 x 30 m^2 The graveyard is approximately 400 m away from the TL centre line	Local	

S/N	Location	Name	Heritage type	Status & distance from the proposed TL	Level of significance	Images
MP9	13°45'6.99"S 31°57'23.11"E	Wazaza Village Graveyard 3	Cultural	Graveyard is active There are over 30 graves on site covering an area of about 50 x 30 m^2 The graveyard is approximately 1.1 km away from the TL centre line	Local	

S/N	Location	Name	Heritage type	Status & distance from the proposed TL	Level of significance	Images
MP10	13°44'23.82"S 31°57'44.83"E	Wazaza Village graveyard 4	Cultural	Graveyard is active There are over 15 graves on site covering an area of about 40 x 30 m^2 The graveyard is approximately 500 m away from the TL centre line	Local	

S/N	Location	Name	Heritage type	Status & distance from the proposed TL	Level of significance	Images
MP11	13°40'11.29"S 31°55'22.36"E	Chivyololo-Maule substation Graveyard	Cultural	Graveyard is active There are over 15 graves on site covering an area of about 40 x 30 m^2 The graveyard is approximately 1.6 km away from the TL centre line	Local	

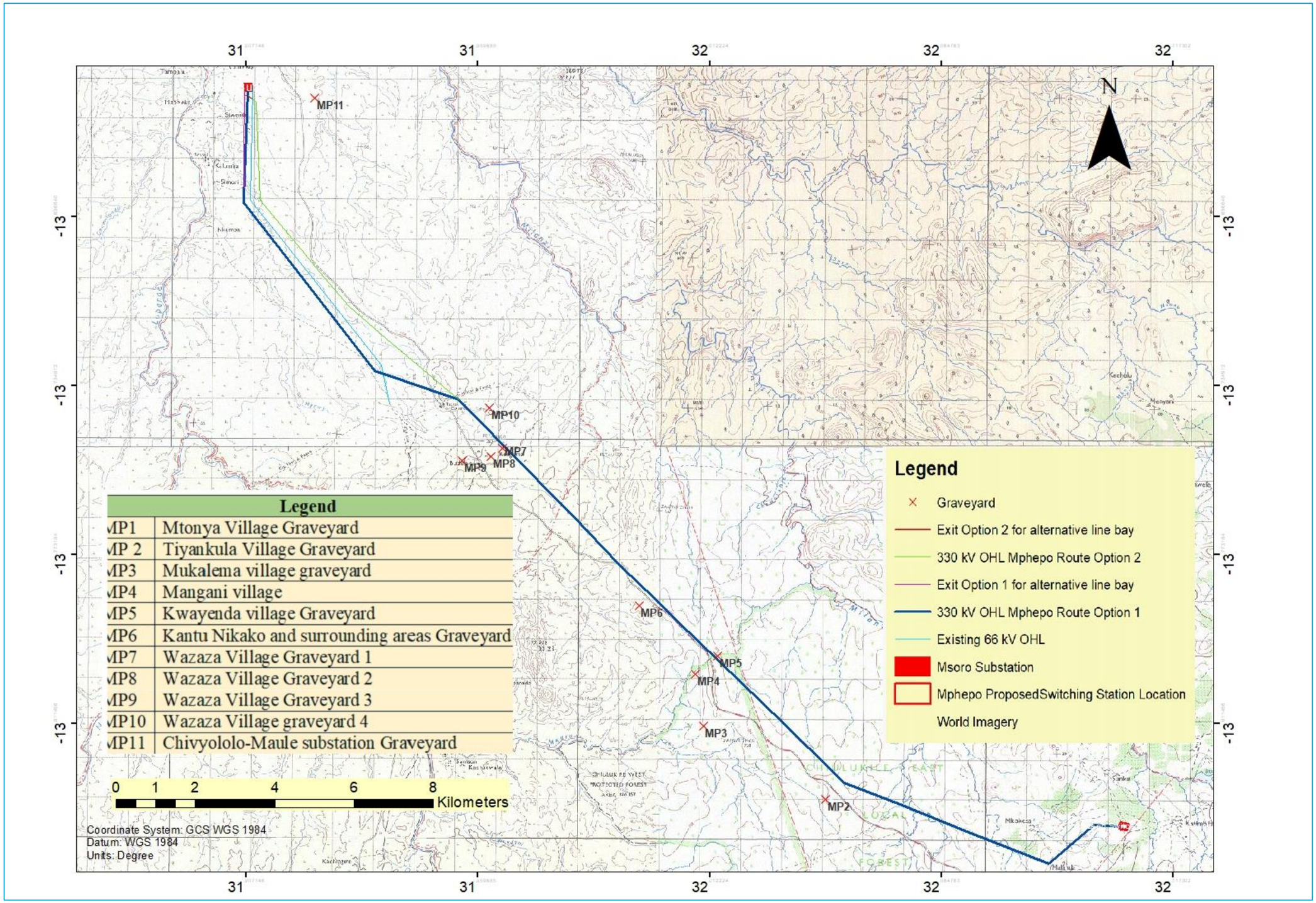


Figure 22: TL Route Options and Cultural Heritage sites identified

7. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Due to the fact that the two TL route options follow the same route for the first 21 km (see Figure 3), and that the environmental impacts associated with TL Route Option 01 and Route Options 02 are almost identical and have therefore not been assessed separately.

7.1 BIOPHYSICAL AND ECOLOGICAL IMPACTS

7.1.1 Landscape and Topography

Background and Baseline Conditions

In general, as described in Chapter 6, the study area is comprised of a landscape of tall forested hills, elevated ridges and low-undulating hills, with broad, flat valleys extending between the hills. The valleys in-turn supports a number of ephemeral streams and well as seasonally flooded wetlands. There are existing power transmission lines within the Project Site, particularly around the northern sections of the proposed TL route, near the existing Msoro substation.

Impact Assessment

No impacts on topography are expected. During the construction phase, the Wayleave for the TL will need to be cleared of vegetation (trees, bushes, etc.). The Project Site has a fairly dense cover of vegetation along the proposed route, and the elevated ridges and low undulating hills would act as a visual screen. Post mitigation, the impact of construction of the TL on the landscape is expected to be of low intensity, local extent and short duration with a probable likelihood, resulting in a ***very low*** overall significance.

The operational phase impacts are expected to be similar to the construction phase impacts as the Wayleave for the TL would need to be maintained in order to avoid any high growing vegetation (e.g. trees) that might interfere with the conductors, and to mitigate against fire risk in the event of the conductors breaking. The impacts on the landscape during the operational phase is considered to be ***very low.***

Table 30: Impact Assessment: Landscape and Topography

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Medium	Low	Low	Very Low
Geographic Extent	Localised	Localised	Localised	Localised
Duration	Short-Term	Short-Term	Long-Term	Long-Term
Probability	Definite	Probable	Definite	Probable
Consequence	Very Low	Very Low	Low	Very Low
Significance	Very Low	Very Low	Low	Very Low

Recommendations and Mitigation Measures

Construction phase mitigation:

- Minimise clearance of vegetation outside of the Wayleave to minimum necessary for access roads and laydown / construction areas;
- Avoid creating and leaving piles of excavated soil and ensure any such piles are levelled / contoured to natural landform post construction;
- Maintain vegetation on the sides of the Wayleave to act as a screen;

- Minimise establishment of new access roads and design for minimum road width necessary for future maintenance;
- Minimise need to remove fruit trees / crops and obtain permission from local communities prior to any necessary clearing;
- Avoid use of fire to clear Wayleave.

Operation phase mitigation:

- Avoid use of fire to maintain Wayleave;
- Minimise extent of removal of natural vegetation in Wayleave to minimum necessary for safety requirements.
- Avoid complete clearance of Wayleave but retain low grass / shrub layer (at least 4-6 cm above ground) to minimise soil erosion;
- Remove all alien invasive vegetation by uprooting or use of approved herbicides.

7.1.2 Terrestrial Ecology

Background and Baseline Conditions

The area along the TL Route Options (including a 55 m wayleave corridor) consists of degraded miombo woodland, agricultural areas, freshwater areas and degraded forest. Much of the natural habitats are degraded as a result of land use activities of local communities, including clearing (for settlements, roads and other infrastructure), livestock grazing, timber harvesting (for charcoal production), erosion and alien invasive vegetation. Approximately 8 km of the TL route passes through two Forest Reserves (5km through Chivuna Hills and 3 km through Chiulukire West), but both these Forest Reserves are generally degraded with a large portion actively farmed or cleared for wood and assessed as Modified Habitat). The majority (approximately 90%) of the TL Routes consist of Degraded Miombo woodland and agricultural lands.

No faunal Species of Conservation Concern (SCC) were observed during field surveys. However, three bat species and one otter species (all listed as Near Threated by the IUCN) have a relatively high probability of occurring within and around the Freshwater Habitats, which provide suitable foraging, roosting and refuge areas, as well as areas movement corridors.

Impact Assessment

Transmission line construction would entail land clearance and site preparation for access roads and for pylon footings. Between 58 and 74 ha of land would need to be cleared within the TL Wayleave, depending on the final TL route (see Table 13), much of which is assessed as Modified Habitats comprising mostly degraded woodland and agricultural land of negligible biodiversity importance. Given the Local extent of the impact (30km); the Medium-term duration of habitat loss (assuming much of the access roads for construction will recover) and Low intensity nature of the loss (given the low sensitivity of the affected habitats), the overall consequence is considered ***low***. Given that the likelihood of this impact is **Definite** the pre-mitigation impact significance is ***low*****.** With construction mitigation (indicated below) the impact significance is assessed as ***very low***.

Once the transmission line access roads and pylons have been cleared during construction, the only expected additional impact on terrestrial habitats during operation is the risk of alien invasive plant spread, especially if new material is imported from infested areas. However, given the highly disturbed habitats of the transmission line route this additional risk is minimal and the impact is likely to be of Local extent; long-term and of low intensity with overall ***very low*** consequence. Given that the probability is possible, the significance is ***very low***. With implementation of the operational phase mitigation measures (indicated below), the impact significance is reduced to ***insignificant***.

Table 31: Impact Assessment: Terrestrial Ecology

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Medium	Low	Low	Very Low
Geographic Extent	Local	Local	Local	Local
Duration	Medium Term	Medium Term	Long Term	Long Term
Probability	Definite	Definite	Possible	Possible
Consequence	Low	Very Low	Low	Very Low
Significance	Low	Very Low	Very Low	Insignificant

Recommendations and Mitigation Measures

In addition to the measures specified in Section 7.1.1, the following mitigation is required:

Construction phase mitigation:

- Minimise construction footprints by demarcating the works areas and vehicle access routes and clearing the minimum required servitude width.
- Avoid use of fire and herbicides to clear Wayleave.
- Implement alien invasive plant control through:
    - Sourcing of fill material: any requirement for fill material to create a level platform for site development should be sourced from weed free areas to minimise the risk of spreading alien invasive species and to reduce the ongoing maintenance requirements;
    - Equipment decontamination: Wash down bulldozers / earthmoving equipment prior to site entry;
    - On-site alien invasive plant monitoring and control (removal and disposal);
- Restoration / rehabilitation: All construction disturbed areas not required for infrastructure, including access tracks that are not required for maintenance, should be graded to near natural contours, scarified to decompact soils and allowed to recover naturally.

Operation phase mitigation:

- Allow natural regrowth of vegetation within safety requirements (e.g. < 4m height).
- Inspect the transmission line Wayleave to monitor for alien invasive plant species. Ensure all alien invasive plant species are managed, controlled and removed (see construction phase mitigation above).

7.1.3 Aquatic Ecology

Background and Baseline Conditions

The Freshwater Habitats across much of the project area have been notably impacted upon by vegetation clearance for agriculture and grazing. The dambos and streams convey large amounts of water, however vegetation removal has resulted in increased peak water flows and erosion within the dambos and along stream banks.

Due to the nature of the terrain, the majority of riverine systems that were assessed in the field were closer to road access and human settlement, and have been subject to altered sediment and flow regimes mostly originating from adjacent fields. The more remote and inaccessible reaches of the various rivers are in a largely natural condition, with degradation due to upstream water quality impacts from discharge or runoff of domestic effluent.

As with all watercourses along the TL routes, the primary modifiers of the dambo systems are related to subsistence agriculture which are preferred due to the relatively flat terrain and moist soil conditions. Overall, the dambos range between largely natural to modified ecological condition, and reinstatement to a more natural state could occur with little to no human intervention.

Approximately 6% (Option 01) to 10% (Option 2) of the TL Route Options consist of Freshwater Habitats, mainly small stream/rivers, dambos and floodplain wetlands.

Impact Assessment

During the construction phase the clearing of natural vegetation and the stripping of topsoil and possible erosion will likely result in further increased runoff of sediment from construction areas into wetlands, streams, rivers and dambos. In addition, pollution of soils and water may arise from accidental release of hydrocarbons (fuel and oil from vehicles or equipment) or cement/concrete waste. In addition, solid waste such as litter may be spread by construction staff.

Post-construction, impacts on freshwater systems are limited to alien invasive plant spread (especially if new construction material was imported from infested areas or on vehicles) and from accidental spills of hydrocarbons during maintenance/repair activities.

During the construction phase and after mitigation the predicted impacts on aquatic ecology for the TL Route Options are of local extent, short-term duration, low intensity with overall ***very low*** consequence, which together with its ***probable*** likelihood results in an overall impact significance of ***very low.***

During the operational phase and after mitigation the predicted impacts on aquatic ecology for the TL Route Options are of local extent, long-term duration, very low intensity with overall ***very low*** consequence, which together with its ***possible*** likelihood results in an overall impact significance of ***insignificant.***

Table 32: Impact Assessment: Aquatic Ecology

Type of Impact	Negative			
Project Phase	Construction		Operations	
Impact Criteria	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Medium	Low	Low	Very Low
Geographic Extent	Local	Local	Local	Local
Duration	Short-term	Short-term	Long-term	Long-term
Probability	Probable	Probable	Possible	Possible
Consequence	Low	Very Low	Low	Very Low
Significance	Low	Very Low	Very Low	Insignificant

Recommendations and Mitigation Measures

Construction phase mitigation:

- Implement the vegetation clearing related mitigation measures for Terrestrial Ecology above.
- Ensure pylons/poles are located outside streams/rivers and wetlands as far as practical (and outside 1:100-year flood zones).
- Ensure access roads avoid wetlands, streams, rivers or dambos as far as practical, maintaining at least a 30 m buffer (for pylons) distance from the perimeter of freshwater resources.
- Infrastructure, especially the underground connector transmission lines and roads/tracks, must be routed and designed in such a way as to not impede the flow of rivers/streams or subsurface flow through dambos, or to cause erosion. Existing bridges/culverts should be used as far as practical.

- Where vehicle access and construction work within a wetland or creek is unavoidable demarcate the access route using temporary markers. Limit disturbance along edges, monitor road and construction site edges for any emerging alien invasive species and ensure that these are rapidly removed.
- Herbicides shall not be used within 50 m of wetlands, streams, rivers and dambos (i.e. only manual clearing is allowed). The use of herbicides for plant maintenance should be avoided but if essential only environmentally approved brands that comply with local legal requirements and relevant international conventions should be used. Persistent Organic Pollutants (POPs) and Pesticides as listed by UNEP will not be allowed.
- If required (i.e. where natural revegetation with indigenous plants is unlikely to occur naturally), disturbed wetland areas must be revegetated with locally indigenous vegetation wherever possible.
- Cement and concrete should be mixed within a demarcated and bermed area or in large mixing tray and/or ready mix should be utilised. Cement should not be mixed within 50 m of the perimeter of wetlands, dambos, streams and rivers.
- Provision must be made for adequate sanitation facilities located at least 150 m away from the wetlands, streams, rivers and dambos. Such facilities shall be regularly maintained and not allowed to spill and shall be secured to prevent falling over.
- Ensure chemical storage and use complies with standard good practice. All chemicals and other hazardous materials shall be stored in an enclosed restricted access area (to prevent human re-use) and containers or waste chemicals disposed of at an approved waste facility or by approved waste service providers. Hazardous chemicals, including fuels, should be stored in a bunded and fenced area located at least 150 m from wetlands, dambos, streams, and rivers.
- Major repairs to vehicles and diesel powered equipment will be conducted off-site (or at a dedicated and suitably designed maintenance workshop on-site). No washing or vehicle maintenance is permitted in or within 50 m of wetlands or rivers
- Ensure the necessary spill kits are available on site. All hydrocarbons spills on bare ground will be cleared immediately. This will include the lifting of the contaminated soil for bio-remediation or disposal to a hazardous waste facility.
- No abstraction of water from rivers or wetlands in the project area is permitted for any purpose. Water for dust suppression must be obtained from an approved and permitted water source.
- No washing of construction tools or equipment is allowed in any wetlands or stream.
- Any erosion damage caused by construction activities must be repaired as soon as possible, particularly before heavy rains may exacerbate erosion.

Operation phase mitigation:

- Monitor and control alien invasive plants and erosion.
- Any requirement for use of herbicides shall ensure only environmentally friendly herbicides are applied.

7.1.4 Avifauna/Birds

Background and Baseline Conditions

Transmission lines pose collision and electrocution risks to birds, particularly larger birds with a long wing span (such as cranes) which are less manoeuvrable and cannot change direction quickly or birds which may perch or nest on the transmission line cross bars (typically raptors).

A total of seven priority species were identified. This includes the Steppe Buzzard, Augur Buzzard, Brown Snake-Eagle, Black-chested (breasted) Snake-Eagle, Wahlberg's Eagle, African Harrier-Hawk and Martial Eagle. All these species present a medium risk of transmission line collision. None of these species, except the Martial Eagle, holds any particular conservation concern, being classified as Least Concern Globally and not listed in Zambia. The Martial Eagle is not Red Listed in Zambia, but it is Globally listed as Endangered. No signs of any Martial Eagle roosts/nests were identified, and it was recorded only twice in autumn. This species is considered to be at low risk of transmission line collision, although the consequence of any fatalities on this species is high.

Impact Assessment

Due to the highly disturbed habitats within the transmission line corridor, impacts on birds from loss of habitat during transmission line site clearance and construction will be ***insignificant*** and has not been further assessed**.**

Although all the raptors recorded flying on site could be at some risk of collision with overhead transmission lines during operation, raptors are not the group of species typically most at risk of this impact. Large terrestrial species such as cranes, bustards, storks, and waterfowl are most at risk. These species were not recorded to be in any abundance on site. The more open areas (either dambos or areas cleared for cultivation) do provide suitable habitat for some of these species which may visit occasionally.

The main (grid connection) Transmission Line will be 330kV. The relevant clearances on a power line of this voltage will be sufficiently large to be impossible for birds to bridge these. There is therefore a very low risk of electrocution on the 330 kV main (grid connection) Transmission Line. The on-site substation may pose an electrocution risk to birds but it is typically the more common and less sensitive bird species (such as crows) which enter a substation yard.

For collision with the overhead transmission lines the pre-mitigation operational impact on birds is likely to be of international extent (given the potential to impact globally threatened and migratory birds); long-term and of medium intensity with overall ***high*** consequence. Given that the likelihood is probable, the overall significance is rated ***high.*** With implementation of bird mitigation in transmission line design, the significance is reduced to ***medium*** (see Table 33).

For electrocution of birds from the 330 kV main overhead transmission line the pre-mitigation operational is likely to be of international extent; long-term and of medium intensity with overall ***high*** consequence. Given that the likelihood is possible, the overall significance is rated ***medium.*** With implementation of bird mitigation the significance is reduced to ***insignificant*** (see

Table 34).

Table 33: Collision of Birds with the 330kV Overhead Transmission Line

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	-	-	Medium	Low
Geographic Extent	-	-	International	International
Duration	-	-	Long-Term	Long-Term
Probability	-	-	Probable	Possible
Consequence	-	-	High	High
Significance	-	-	High	Medium

Table 34: Electrocution of Birds on the 330 kV Main Overhead Transmission Line

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	-	-	Medium	Very low
Geographic Extent	-	-	International	International
Duration	-	-	Long-Term	Long-Term
Probability	-	-	Possible	Improbable
Consequence	-	-	High	Very low
Significance	-	-	Medium	Insignificant

Recommendations and Mitigation Measures

Construction phase mitigation:

- Note: Bird protection measures and configuration of design is a relatively insignificant cost when installed during construction (rather than retrofitting) and is strongly recommended to minimise risks to birds.
- Transmission line configuration should be designed to minimise electrocution risks to birds perching on the pylon structures by implementing the following types of measures where practically possible:
    - Configure the insulators and conductors in such a way that birds landing, perching or taking off cannot connect them by keeping as many elements as possible under the cross-arm; and
    - Insulate all the live elements of the structure sufficiently to ensure that birds cannot connect exposed, live elements.
- The 330 kV main overhead transmission line should be fitted with suitable anti bird collision line marking device to make cables more visible to birds in flight and reduce the likelihood of collisions. The full length of the transmission line must be mitigated in this way. These devices are best installed on the earth/shield wires. They should be spaced 10 m apart and light and dark color devices should be alternated, so as to provide contrast against dark and light backgrounds, respectively.

Operation phase mitigation:

- Ensure that insulation of live elements and anti-bird collision line marking are maintained/repaired on a regular basis.
- A suitably qualified avifaunal specialist shall be consulted if roosts/nests are noted on poles/pylons.

7.2 SOCIO-ECONOMIC IMPACTS

7.2.1 Physical and Economic Displacement

Background and Baseline Conditions

The land required for the establishment of either of the two transmission line options (including the Feeder Bay and Exit Routes) falls under customary land and is mostly comprised of small-scale farmland held under exclusive rights by an individual. There are also numerous settlements found along the district roads. All land not under settlements or farmland is defined as communal land, which falls under the direct authority of the traditional authorities. No individual has exclusive rights to communal land, and all resources (including fruit trees, natural resources, waters, grazing land) are shared as a common resource.

The Project will need to secure all land required for the establishment of a 55.2-m Wayleave (including the Feeder Bay and Exit Routes). The total land requirements are estimated to be 173 hectares on both the route options, and in both TL options it comprises of communal land or land under small-scale agriculture.

Under the current design iteration all communities and isolated homesteads have been avoided. As such, it is very unlikely that the Project will lead to the physical displacement of any communities or individual households. However, the Project will definitely cause economic displacement primarily from loss of cultivated land and may restrict access to private and communal land (but not the loss of any homes) that supports the livelihoods of local communities and households.

The loss of small-scale farmland is owned by local households as well as communal land held by either the Chewa Royal Establishment or by the Chieftainess Msoro. Of the total land-take (173 hectares) an estimated 75% will be under small-scale farming (130 ha) while the remaining 45 hectares is likely comprised of open communal land. All land is communal, and no formal titled private land is expected to be affected.

Impact Assessment

The impact associated with physical and economic displacement will occur during the construction phase, extending into the operational phase. While the construction of the transmission lines will likely avoid physical displacement; economic displacement cannot be avoided given the extensive use of local land for small-scale farming on the land required for the project.

Without the adoption of effective mitigation measures (in the form of compensation and resettlement support) the negative impact of displacement would be permanent and of high significance and this would apply equally to both transmission line options. By adopting accepted national and international measures to address displacement (via a Resettlement Policy Framework) the impact is considered to be reduced to a ***low*** significance.

Table 35: Impact Assessment: Physical and Economic Displacement

Type of Impact	Direct Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	High	Low	-	-
Geographic Extent	Local	Local	-	-
Duration	Permanent	Permanent	-	-
Probability	Definite	Definite	-	-
Consequence	High	Low	-	-
Significance	High	Low	-	-

Recommendations and Mitigation Measures

Construction phase mitigation:

- The Project will ensure the placement of the transmission line avoids the need to relocate entire communities or households. The transmission line route option 2 results in the displacement of only one household, while route option 1 does not result in any known physical displacement. Given the small difference between the two options and extent of land parcels affected along the 30 km route, both TL options are viable from a social perspective, although route option 1 is favoured. Where physical displacement cannot be fully avoided, the affected households will be relocated consistent with the provision of the Resettlement Policy Framework.
- The establishment of the transmission lines will result in the loss of small-scale farmland and communal land located within the 55.2-m Wayleave. Temporary losses incurred during the

construction phase will be compensated consistent with the provision of the Resettlement Policy Framework.

- It is recommended that affected households are permitted to return to the Wayleave to continue crop farming during the operational life, with some restrictions in place on types of cropping permitted (potential safety risks must be communicated to the affected community members by the Project Company and community leaders). Where continued farming is not permitted, permanent land losses will be compensated consistent with the provision of the Resettlement Policy Framework.

7.2.2 Loss of Communal Land and Natural Resources

Background and Baseline Conditions

Natural resource harvesting is common for rural communities within the Project area, and there is a rich diversity or materials and habitats from which such materials are collected. Firewood, wood for charcoal production, hunting, collection of wild fruit, vegetables and mushrooms is common and is generally sourced from communal bush around local villages, as well as along the slopes of the local hills.

In addition, local rivers, streams and dambos are important sources of traditional building materials – including mud and clays for mudbricks, cut lumber and poles for the frames of traditional homes, as well as reeds and grasses for thatching. Again, such natural resources are sourced from communal areas.

The establishment of the transmission lines may require the clearing of communal land or habitats used for natural resource harvesting. However, the transmission lines will be restricted to only a 55.2-m Wayleave, which is unlikely to result in the complete destruction of entire habitats or significant loss of natural resources. Rather, the Project will require the clearing of linear strips of communal land / natural habitats, resulting in localised losses or degradation of communal land or natural habitats on which local communities rely.

Impact Assessment

Given the dispersed variety of habitats along the TL over a large area, the negative impact of habitat clearance on communal land and natural resources is expected to be of ***medium*** significance, assuming no mitigation measures are implemented. This impact will apply equally to both Route Option 1 and Option 2 given their relative proximity and common landscape. This is largely related to any indiscriminate clearing of communal land, notably sensitive habitats such as streams, rivers, dambos located within the transmission line 55.2-m Wayleave. However, such impacts can readily be mitigated, and the impact can be reduced to a ***low*** negative significance.

Table 36: Impact Assessment: Communal Land and Natural Resources

Type of Impact	Direct Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Medium	Low	Medium	Low
Geographic Extent	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Probability	Definite	Definite	Definite	Definite
Consequence	Medium	Low	Medium	Low
Significance	Medium	Low	Medium	Low

Recommendations and Mitigation Measures

Construction and Operation phase mitigation:

- Any recommendations made in the ecological specialist studies apply with respect to the conservation of sensitive habitats in the area. In addition, the Project will avoid the construction of any infrastructure within existing rivers, streams and dambos.
- Local small-scale farmland is considered to be more valuable, therefore project infrastructure (such as the towers) should be constructed on communal land as far as possible, but only where the local habitats are already degraded.
- Communities should be allowed to continue agricultural cropping within the Wayleave. The approved land use types and crops shall be confirmed and agreed with relevant communities.
- The Project will lease all land from the Chewa Royal Establishment and Chieftainess Msoro consistent with established lease agreements and the Resettlement Policy Framework. All funds provided as compensation for the use or lease of the land will be placed into a community trust for the exclusively use for the benefit of local communities as determined by the community leaders and chiefs/royal establishment/trusts.
- The Project will not make any payments of compensation for land, to any individual, body, or organisation as a private payment, or which is inconsistent with the provisions of the previous requirement.

7.2.3 Local Economic and Community Development

Background and Baseline Conditions

The Unika Wind Farm will be the first major industrial development in the study area and as well as within Katete and Mambwe Districts. The proposed overhead transmission lines are an associated facility and are essential to the successful implementation of the Unika Wind Farm. The transmission line, as an essential component of the Unika Wind Farm Project, has the potential to support local economic development via (i) local employment; (ii) local content (defined as use of local good and services), and (iii) via community development programmes.

The wider Wind Farm Project (which will include the transmission line) is expected to employ 700 persons during the construction phase, which is expected to extend over 18 months. The operational phase will require a relatively small workforce.

To ensure long-term economic development, the Project and the Chewa Royal Establishment have established a community development trust (the Chewa Development Trust). This is a legally constituted trust that will function as the primary development vehicle and will be funded by the Project via a share of dividends. All funds granted to the trust will be allocated to community development projects determined by the trustees of the Trust in collaboration with the SPV.

Impact Assessment

The Unika Wind Farm Project investment (which include the transmission lines) in employment and community development will be a primary project benefit to the local communities during both the construction and operational phases. However, local benefits may not be realised unless local procurement, local employment and local community development measures are established and implemented. Should such measures be adopted the benefit of the project may be increased from ***very low*** significance to ***medium*** *significance*.

Table 37: Impact Assessment: Local Economic and Community Development

Type of Impact	Positive Indirect Benefit			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Low	High	Very Low	Medium
Geographic Extent	Regional	Regional	Regional	Regional
Duration	Short-Term	Short-Term	Long-Term	Long-Term
Probability	Definite	Definite	Probable	Probable

Consequence	Very Low	Medium	Medium	Medium
Significance	Very Low Benefits	Medium Benefits	Very Low Benefits	Medium Benefits

Recommendations and Mitigation Measures

Construction phase mitigation:

- The Project Developer, contactors and third-party contractors will promote local recruitment under its human resources and recruitment systems. Preferential employment will be, where feasible, granted to residents of Katete and Mambwe Districts before recruiting Zambian nationals or expatriates.
- The Project Developer, contactors and third-party contractors will promote local content under its procurement systems. It should prioritise existing small, medium enterprises present in Katete and Mambwe District, notably in terms of accommodation, food, basis services etc.
- The Project Developer, contactors and third-party contractors will make provision of a pre-planned and practical demobilisation of the construction workforce via a Demobilisation Plan. The plan will make provision for reducing the adverse impacts of retrenchment on local workers.

Operation phase mitigation:

- The Project Developer will promote local recruitment of persons from villages within the Project area, along the transmission line, or nearby Katete Town during its operational life.
- The Project will support reasonable local content and procurement of goods (construction supplies, labour etc.) and services (accommodation, food) from villages within the Project area, along the transmission line, or Katete Town.

7.2.4 Impact of Access and Traffic Mobility

Background and Baseline Conditions

The roads in proximity to the transmission line route options are largely limited to four major types – gazetted trunk roads (T-roads), district roads (D-roads), rural roads (R-roads), and informal community tracks. The first three are state roads administrated by the Roads Authority or the District Authorities, while the informal community tracks have no formal designation and are owned by the local community and customary authorities.

It is the intent of the Proponent to utilise the existing local district roads (D-roads) to the maximum extent possible to support the construction of the overhead transmission line. However, the transmission lines will require an access road to be established within the 55.2-m Wayleave during the construction phase as well during the operational life (to allow for ongoing inspections and maintenance).

Impact Assessment

The construction of the overhead transmission line will not likely result in any substantial changes in access and mobility of local households using existing district and rural roads. There is the potential for traffic incidents and accidents where public and Project traffic share existing public roads, but this would be manageable through the adoption of standard traffic safety measures.

The Project will also establish an internal access road within the 55.2-m Wayleave during the construction phase. It is expected that the access road will not be restricted, and local communities will more than likely start to utilise them if it improves local access and mobility.

Local roads are unlikely to be affected while the internal access roads may improve local mobility but to a very limited extent. Both Route Option 1 and 2 are largely similar in that that will be low risk in terms of traffic risks and low benefits in terms of improved accessibility. Overall, both transmission line route options are deemed to be of ***low*** negative significance, without the adoption of mitigation measures.

However, the wider Wind Farm project investment in road upgrades, care and maintenance, proper traffic management measures as well as permitting public use of the transmission line access roads will likely

result in ***low positive*** benefits during both the construction and operational phases. Such benefits apply to both Route Option 1 and 2.

Table 38: Impact Assessment: Changes to Accessibility and Mobility

Type of Impact	Direct Positive and Negative Impacts			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Low	High	Low	Low
Geographic Extent	Local	Local	Local	Local
Duration	Short-Term	Short-Term	Long-Term	Long-Term
Probability	Definite	Definite	Possible	Possible
Consequence	Low	Low Positive	Low	Low Positive
Significance	Low	Low Positive	Low	Low Positive

Recommendations and Mitigation Measures

Construction phase mitigation:

- The Project Developer will upgrade and use existing public roads (including district and rural roads) where possible in preference to the construction of new roads. Any upgrades to district and rural roads will be authorised by the road and district authorities.
- No existing public roads or community tracks will be converted into private roads, nor will the Project Developer seek to restrict public use of existing roads or tracks.
- The Project Developer will ensure, to the maximum reasonable extent possible, that access roads will remain within the wayleave to the maximum extent possible.
- The Project Developer will ensure effective traffic management (via policies, plans, procedures, and occupational training) during the construction and operational phases.

Operation phase mitigation:

- No existing public roads or community tracks will be converted into private roads, nor will the Project Developer seek to restrict public use of existing roads or tracks.
- The public should, subject to authority approvals, be allowed to utilise the transmission line access road without any restrictions from the transmission line operators (ZESCO or Private Developer).
- The transmission line operators (ZESCO or Private Developer) will allocate an annual budget for the ongoing inspections and clearing of the wayleave as well as repairs and maintenance of the internal access roads during the operational life. Farming areas that do not pose a risk to the transmission line must not be cleared.

7.2.5 Labour, Working Conditions and Work-Seeker Influx

Background and Baseline Conditions

The transmission line is critical associated infrastructure linked to the Unika Wind Farm project. The Unika Wind Farm Project is expected to employ 700 persons during the construction phase, which will extend over 12-24 months. The operational phase of the wind farm will require a relatively small workforce of 10-15 skills persons that are expected to be resident in Katete Town or surrounding villages. Operational control of the transmission line will be given to ZESCO or a Private Developer who will likely use their existing staff.

Such employment opportunities will be a significant benefit given the very low level of formal employment in both the Katete and Mambwe Districts, as well as in communities immediately surrounding the Project Area and Transmission Line. However, given the very low employment rates the project will need to manage labour-related risks including:

1. Elevated and unreasonable community expectation on employment benefits,
2. Ensure fair and preferential recruitment practices in local communities,
3. Reducing the potential of work-seeker influx,
4. Ensuring safe and appropriate working conditions for the Project workforce; and
5. Managing economic *boom and bust* related to workforce demobilisation.

However, there will be limited direct employment related to the transmission line during construction and operation, therefore labour aspects and influx risks is considered to be negligible along the TL route. Given that operational life of the transmission line will be managed by ZESCO or Private Developer it is also expected that there will be negligible labour and influx risks during the operational phase.

Impact Assessment

The provision of employment will be of ***very low*** positive benefit for the short-term during the construction phase of the transmission line. The operational life of the transmission line will be managed by ZESCO or Private Developer, and it is unlikely that there will be a need for additional employees to maintain the new line. The job creation benefits for the transmission line is expected to remain at ***low positive*** benefit in the construction phase and ***negligible*** benefits in the operational phase.

Table 39: Impact Assessment: Labour, Working Conditions, and Work-Seeker Influx

Type of Impact	Direct Positive Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Low	Low	Zero	Zero
Geographic Extent	Local	Local	Local	Local
Duration	Short-Term	Long-Term	Short-Term	Long-Term
Probability	Probable	Probable	Probable	Probable
Consequence	Very Low	Very Low	Very Low	Very Low
Significance	Very Low Positive	Very Low Positive	Insignificant Positive	Insignificant Positive

Recommendations and Mitigation Measures

Construction and Operation phase mitigation:

- The Project Developer will establish appropriate Human Resources and Recruitment Procedures that establish rules for local recruitment and preferential employment consistent with national labour laws and relevant ILO conventions to which Zambia is a signatory. These procedures will be issued to the Construction Contractor for adoption with the own internal recruitment procedures during the construction phase.
- The Project Developer, and where relevant the appointed Construction Contractor, will provide fair and safe working conditions consistent with (i) Zambian national labour law, (ii) ILO conventions applicable to Zambia, and (iii3) labour standards established by financiers.
- The Project Developer, and where relevant the appointed Construction Contractor, will establish measures to reduce the potential for work-seeker influx during the construction phase. This will include:
    a. Establishment of a formal recruitment system and no “at-the-gate” casual employment will be permitted (including along the TL or at construction camps).
    b. Monitoring of settlement growth and the formation of informal housing or settlements around the Project.
    c. Investment in community facilities and self-employment programmes as part of their Community Development Plan.

- The Project Developer, as well as any third-party contractors, will ensure the occupational health and safety of all workers with (i) Zambian national health and safety laws, (ii) ILO conventions applicable to Zambia, and (iii) labour standards established by financiers.

7.2.6 Community Health and Safety

Background and Baseline Conditions

The communities that will be located in proximity to the Project infrastructure are largely rural and will have had minimal exposure to large-scale development and the associated health and safety risks. Interviews indicate that the current major community health and safety risks primarily relate to the following:

1. Household diseases, notably malaria, flu/influenza, and Cholera.
2. General poor nutrition, which is dominated by staple starches.
3. Poor water quality and poor sanitation practices, that results in elevated cases of Cholera.
4. Poor roads quality and traffic which results in accidents for pedestrians and commuter traffic.

In addition, there is limited public health infrastructure available within the study area. For emergencies, local households are required to travel a 50-km round trip to the St. Francis hospital in Katete Town.

The Project will pose some limited risks to community health and safety – including potential risks during the construction phase related to (i) construction traffic and movement of materials and equipment, (ii) transport of hazardous materials and waste, (iii) soil and water contamination, (iv) and security control at work-sites, and (v) incidents and emergency events.

The operational phase will present additional community health and safety risks – namely some (limited) operational traffic, trespassing (climbing) on towers, and grounding of live wires around communities which may pose an electrocution or fire risk.

Impact Assessment

The increased health and safety risks would most likely occur during the construction phase, primarily as a result of increased traffic. Such risks are however deemed to be manageable through implementation of Health and Safety systems/procedures, including traffic management. Without the adoption of such measures the negative impacts to local community health and safety would be deemed to be of ***moderate*** significance in the construction phase.

The operational phase health and safety impacts are considered to be of ***low*** significance with mitigation, and primarily concern potential electrocution from grounding of live wires around communities and potential (but unlikely) fire risks. Both risks can be managed through implementation of standard Health and Safety systems/procedures.

Table 40: Impact Assessment: Community Health, Safety and Security

Type of Impact	Direct Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	High	Medium	Medium	Low
Geographic Extent	Regional	Regional	Regional	Regional
Duration	Short-Term	Short-Term	Long-Term	Long-Term
Probability	Probable	Probable	Probable	Probable
Consequence	Medium	Low	Low	Low
Significance	Medium	Low	Medium	Low

Recommendations and Mitigation Measures

Construction phase mitigation:

- The Project Developer will establish suitable Emergency Response Plans that respond to both occupational incidents as well as incidents between the Project (including all third-party contactors) and local communities.
- The Project Developer must restrict access to all construction sites (including the transmission line wayleave) and ensure safety measures are in place to address:
    a. Accidental and active trespassing, theft, and vandalism at active work site,
    b. Safety of commuter and pedestrian traffic on public and project roads,
- Any upgrades to existing roads or new access roads will include standard traffic safety measures to ensure the safety of both pedestrian and vehicle traffic. This will include specific procedures to be adopted by the construction contractor, as well as long-term safety measures during the operational phase.
- Any upgrades to existing roads or new access roads (including any culverts, bridges, cuts, etc) will be undertaken in such a manner that it reduces soil and water contamination, notably to local farmland and surface water sources.
- The EPC contractor through the CLO should do awareness raising of traffic and equipment safety, and install safety signage on towers. Towers should be designed to prevent people climbing up on them.

Operation phase mitigation:

- The Project Developer (via the operational entity) will establish suitable Emergency Preparedness and Response Plans that respond to both occupational incidents as well as incidents between the Project Developer (including all contactors) and local communities.
- The Project Developer will collaborate with the Chewa Development Trust and Msoro Community Support Trust in support of their allocating community funds towards assisting in the management of malaria and other health impacts, community water development and improvements in agricultural production, as they deem fit.

7.2.7 Cultural Heritage

Background and Baseline Conditions

The cultural heritage survey of the proposed TL Route Options did not yield any palaeontological or archaeological sites or artefacts within the project area of influence (i.e within the 55 m RoW). The closest grave yard recorded was Wazaza Graveyard 1 recorded as MP7 which is approximately 40 m away from the TL centre line (but outside the 27.5 m RoW). The graveyard is no longer active and it only has about 6 unmarked graves. The second closest one to the proposed TL is Kwayenda Village graveyard recorded as MP5 and contains about 6 graves and is still active (approximately 80 m away for the TL centre line).

Despite not recording any archaeological site in the immediate project area the NHCC site Register shows strong evidence of long history of human occupation, it can be assumed that, if any archaeological and historical sites, features or artefacts did exist in proposed in the past, they could have been disturbed or destroyed by past and present agricultural activities.

No major cultural traditional ceremonies associated with the land space to be used for the T-Line apart from the Malaila and Kulamba Ceremony which is held annually in Mambwe and Katete at Chief Nsefu and Mkaika.

Impact Assessment

As noted above, none of palaeontological or archaeological sites or artefacts discovered are located within the TL RoW. However, during the construction phase unknown and undiscovered/unrecorded archaeological sites/artefacts and other cultural heritage resources may be encountered during vegetation clearance, access road establishments and excavations (mainly associated with the pylon footprints).

Any archaeological materials on the surface or buried may be impacted negatively due to compression as a result of the use of heavy earth moving equipment. Some artefacts may be mixed, crushed, their integrity compromised whilst compaction of soil may lead to changes in the moisture content of the soil or may affect the soil matrix, which may consequently affect the natural decay process of archaeological remains. In addition, exposure of archaeological may make them more susceptible to both chemical and biological degradation processes.

During the operation phase impacts are not expected as they would have had occurred in the construction phase. However, if sections of the TL collapse due to structural failure it may impact sites close to the TL (e.g. MP7). In addition, pylons may need to be shifted or new pylons may need to be added to the TL which could require additional excavations which could reveal unknown Archaeological Sites/Artefacts or Cultural Heritage Site. In addition, there is potential for maintenance workers (including line inspectors) to disturb known grave sites, especially those in close proximity to the TL (e.g. MP5 and MP7).

The potential impacts on cultural heritage can be largely divided into two categories:

- Disturbance or destruction of known grave sites; and
- Disturbance or destruction of unknown/discovered archaeological sites/artefacts or cultural heritage sites.

Disturbance or destruction of known grave sites during the construction phase and after mitigation the predicted impacts on cultural heritage for the TL Route Options are of local extent, medium-term duration, medium intensity with overall ***medium*** consequence, which together with its ***possible*** likelihood results in an overall impact significance of ***very low.***

Disturbance or destruction of known grave sites during the operational phase and after mitigation the predicted impacts on cultural heritage for the TL Route Options are of local extent, long-term duration, very low intensity with overall ***very low*** consequence, which together with its ***possible*** likelihood results in an overall impact significance of ***insignificant.***

Disturbance or destruction of unknown/discovered archaeological sites/artefacts or cultural heritage sites during the construction phase and after mitigation the predicted impacts on cultural heritage for the TL Route Options are of local extent, medium-term duration, medium intensity with overall ***medium*** consequence, which together with its ***possible*** likelihood results in an overall impact significance of ***very low.***

Disturbance or destruction of unknown/discovered archaeological sites/artefacts or cultural heritage sites during the operational phase and after mitigation the predicted impacts on cultural heritage for the TL Route Options are of local extent, long-term duration, very low intensity with overall ***very low*** consequence, which together with its ***possible*** likelihood results in an overall impact significance of ***insignificant.***

Table 41: Cultural Heritage - Disturbance or destruction of known grave sites

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	High	Medium	Medium	Very Low
Geographic Extent	Localised	Localised	Localised	Localised
Duration	Long Term	Medium Term	Long Term	Long Term
Probability	Probable	Possible	Possible	Possible
Consequence	High	Medium	Medium	Very Low
Significance	High	Very Low	Low	Insignificant

Table 42: Cultural Heritage - Disturbance or destruction of unknown/discovered Archaeological Sites/Artefacts or Cultural Heritage Sites

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	High	Medium	Medium	Very Low
Geographic Extent	Localised	Localised	Localised	Localised
Duration	Long Term	Medium Term	Long Term	Long Term
Probability	Probable	Possible	Possible	Possible
Consequence	High	Medium	Medium	Very Low
Significance	High	Very Low	Low	Insignificant

Recommendations and Mitigation Measures

Construction phase mitigation:

- The TL and RoW to avoid all cultural heritage sites identified, particularly grave sites MP5 and MP7 (which are the closest to the TL).
- A qualified archaeologist should be appointed to monitor excavation works and topsoil storage areas, and to provide support the Project ECO.
- Contractors must be provided with training on the importance of the burial and other cultural heritage sites and on the cultural traditions associated with them such as no trespassing, cutting of trees, dumping of waste, use of abusive language/insults or having sexual activities. All contractors shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or paleontological artefacts, as set out in the National Heritage Conservation Commission (Act No. 173 of 1989). This training should be done by an independent qualified archaeologist or, preferably, a qualified archaeologist from the National Heritage Conservation Commission (NHCC).
- Under no circumstances shall any artefacts be removed, destroyed or interfered with.
- A Chance Finds Procedure complying with international best practice will be implemented by the Project Developer and contractors to address any finds encountered during ground disturbing activities (see Appendix 5 of the Heritage Impact Assessment). In the event of unexpected discovery or accidental damage to cultural heritage resources a temporary exclusion zone should be established and works stopped temporarily. Work can only resume after mitigatory measures have been undertaken by an archaeologist (if required). A report must be made to NHCC (by the archaeologist).
- In the event of the unexpected discovery of buried human remains/graves the NHCC and Zambia Police Service shall be informed.
- The NHCC shall be allowed to examine, evaluate and store cultural chance finds if they request to do so.

Operation phase mitigation:

- The TL Operator and contractors must be provided with training on the importance of the burial and other cultural heritage sites and on the cultural traditions associated with them such as no trespassing, cutting of trees, dumping of waste, use of abusive language/insults or having sexual activities. All contractors shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or paleontological artefacts, as set out in the National

Heritage Conservation Commission (Act No. 173 of 1989). This training should be done by an independent qualified archaeologist or, preferably, a qualified archaeologist from the National Heritage Conservation Commission (NHCC).

- Under no circumstances shall any artefacts be removed, destroyed or interfered with.
- A Chance Finds Procedure complying with international best practice will be implemented by the Project Developer and contractors to address any finds encountered during ground disturbing activities (see Appendix 5 of the Heritage Impact Assessment). In the event of unexpected discovery or accidental damage to cultural heritage resources a temporary exclusion zone should be established and works stopped temporarily. Work can only resume after mitigatory measures have been undertaken by an archaeologist (if required). A report must be made to NHCC (by the archaeologist).
- In the event of the unexpected discovery of buried human remains/graves the NHCC and Zambia Police Service shall be informed.

7.2.8 Visual Amenity

Background and Baseline Conditions

The TL route is located on relatively level ground with some elevation change between the Unika I Wind Farm project site and the Msoro substation. The landscape along the TL route is largely comprised of transformed or cleared vegetation with extensive small-scale farming. In addition, there are existing transmission lines around the northern sections of the proposed TL route, near the existing Msoro substation. While the area has a moderate visibility due to the terrain and vegetation cover, the local landscape is considered to be moderately transformed.

The IFC Environmental Health and Safety Guidelines for Electric Power Transmission and Distribution (2007) specifically identifies the risks posed by power transmission and distribution projects to create visual impacts to residential communities. It recommends mitigation measures to be implemented to minimise visual impact, which includes the siting of powerlines with due consideration to landscape views and important environmental and community features. The TL route will be located along areas of low population density and no important community features or sensitivities have been identified along the route.

Impact Assessment

While the transmission line will be visible to residents in places it traverses an environment that has been transformed including small-scale farming and existing transmission lines. The transmission line will be visible to local residents along its route but to a limited extent due to the low-lying topography and vegetation cover (and the TL does not cross any ridgelines). The impact on visual amenity is considered to be of ***very low*** significance during construction and ***low*** significance during operation**.**

Table 43: Impact Assessment: Landscape and Visual Amenity

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Low	Low	Low	Low
Geographic Extent	Local	Local	Local	Local
Duration	Short Term	Short Term	Permanent	Permanent
Probability	Definite	Definite	Definite	Definite
Consequence	Very Low	Very Low	Low	Low
Significance	Very Low	Very Low	Low	Low

Recommendations and Mitigation Measures

Construction phase mitigation:

- Limit vegetation clearance to the TL Right of Way (Wayleave) only.
- Limit access roads to the TL Wayleave as much as possible.
- Rehabilitate disturbed areas.

Operation phase mitigation:

- No additional mitigation measures prescribed.

7.2.9 Air Emissions

Background and Baseline Conditions

There are currently no major sources of anthropogenic pollution such as industries in or near the TL route. Possible sources of impact on the local air quality include: (i) the T4 National Road (Great East Road), (ii) households within Katete Town, and (iii) fugitive dust along gravel access roads and from areas cleared of vegetation; and (iv) smoke from bush clearing and charcoal-making in the area. Local ambient air quality is considered degraded.

Impact Assessment

Air emissions related to the development of the TL is limited to fugitive dust and construction equipment emissions during the construction phase, especially during clearance of the Wayleave and movement of construction traffic along access roads. If the TL Wayleave and access roads are limited to a single track with vegetated verges, air emissions during the operational phase are predicted to be negligible.

The transmission line route is not located through any established settlements or villages. However, it is between 50 and 100 m from three small settlements/villages, and crosses over extensive areas with small-scale farm plots. Exposure to fugitive dust is therefore limited to: (i) farmers present in the area during the farming season, (ii) vehicle and pedestrian traffic utilising local access roads, and (iii) the construction work force.

The air emissions impacts will be of ***very low*** significance and limited during construction as well as during operation if no mitigation measures are established. If required, standard dust control measures as well as the adoption of mitigation measure noted below will reduce the overall significance of this impact to ***insignificant***.

Table 44: Impact Assessment: Air Emissions

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Medium	Low	Low	Very Low
Geographic Extent	Local	Local	Local	Local
Duration	Short-Term	Short-Term	Long-Term	Long-Term
Probability	Probable	Possible	Possible	Possible
Consequence	Very Low	Very Low	Low	Very Low
Significance	Very Low	Insignificant	Very Low	Insignificant

Recommendations and Mitigation Measures

Construction phase mitigation:

- Implement dust suppression during windy conditions, especially if complaints are raised by community members. This should be done using a water dowser truck.

- Apply the mitigation measures specified for Impact on Landscape and Topography in Section 7.1.1, notably maintaining vegetative ground cover and minimising extent of clearance and exposed soil dumps.

Operation phase mitigation:

- While minimal dust is expected during the operation phase, ensure construction cleared areas are restored or rehabilitated to establish sufficient ground cover to reduce dust, unless the land is allocated to local people to continue small-scale farming.

7.2.10 Noise & Vibrations

Background and Baseline Conditions

The study area is largely undeveloped with a rural character, though there are a significant number of communities dispersed in the area. Ambient sound levels are typical of a rural noise district. Anthropogenic noise sources along the proposed TL route include wood chopping, subsistence farming activities, social gatherings as well as motorcycles and vehicles moving along the roads.

Sensitive receptors, with respect to noise generated along the TL route, are largely limited to the six small communities located within 200 m of the proposed TL route. None of these communities and individual households are considered to be sensitive receptors for possible noise generation although will be affected by increased traffic noise and vibration during the construction phase.

Impact Assessment

The key temporary noise sources during the construction phase will be from the construction machinery, vehicles, workers and transmission line construction activities (including potential need for direct ramming). Construction activities is expected to be limited to normal day-time hours.

Very low noise levels are expected during the operational phase, and source will mainly be from the transmission line itself, substations/transformers and noises generated during maintenance activities (which are expected to be minimal).

After mitigation the predicted noise impacts during the construction phase are of local extent, short-term duration, low intensity with overall low consequence, which together with its possible likelihood results in an overall impact significance of ***very low***. The overall significance of noise impacts during the operational phase would be ***insignificant***.

Table 45: Impact Assessment: Noise and Vibrations

Type of Impact	Negative Impact			
Impact Criteria	Construction		Operations	
	Without Mitigation	With Mitigation	Without Mitigation	With Mitigation
Intensity/Severity	Medium	Low	Very Low	Very Low
Geographic Extent	Local	Local	Local	Local
Duration	Short Term	Short Term	Long Term	Long Term
Probability	Probable	Possible	Possible	Possible
Consequence	Low	Low	Very Low	Very Low
Significance	Low	Very Low	Insignificant	Insignificant

Recommendations and Mitigation Measures

Construction phase mitigation:

- Avoid or limit noisy construction activities outside of daytime hours. If night time work is required the CLO should inform nearby residents 24 hours in advance of undertaking the required noisy activities.

- Construction vehicles and plant will be serviced according to manufacturer's specifications, and maintenance records must be kept up to date and presented for inspection as required.

Operation phase mitigation:

- Avoid or limit noisy maintenance activities outside of daytime hours. If night time work is required the CLO should inform nearby residents 24 hours in advance of undertaking the required noisy activities.

7.3 DECOMMISSIONING PHASE IMPACTS

Once the TL reaches its end of life, there are two options. The first includes refurbishing or replacing the TL components to allow the project to continue transmitting electricity. The second option is to decommission the TL. The latter options will involve all components of the TL being removed and the Wayleave being rehabilitated. Where possible materials will be recycled, alternatively they will be disposed of according to both local and international waste management practices.

The impacts during the decommissioning phase for the TL are expected to be minor and of negligible significance. A detailed ESMP will be compiled for the decommissioning phase prior to decommissioning the TL, and more details are included in the ESMP (Appendix A). The framework for a decommissioning plan is outlined in Section 09.

7.4 CUMULATIVE IMPACTS

From a cumulative impact perspective, there is some uncertainty about specific future developments in and around the project site. Except for the proposed Unika I Wind Farm development the only other planned projects identified within Katete itself include a fruit processing plant and road upgrade projects along the T4 (Great East Road).

The TL Project Site is rural in nature and no other existing industries or developments were noted along the proposed TL route. No future industrial development is anticipated in the area around the TL. There is an existing 66kV transmission line along the last 2-3 km of the TL Route, and various other transmission lines northwards of the Msoro substation. It is unlikely that an additional transmission line along this area will result in significant additional negative cumulative impacts, especially if mitigation measures for habitat clearance and protection, and bird collision is implemented.

If not properly managed, alien invasive plant species will out-compete indigenous flora and reduce overall indigenous biodiversity in the area. Failure to control or preventing the worsening of alien invasive infestation will cause a decline in indigenous species. Altered population dynamics, such as displacement of natural indigenous species by alien invasive species, can impact on natural community structures, impacting further on ecological interactions, ecological services and natural food-chains.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

A detailed Environmental and Social Management Plan (ESMP) is included in Appendix A.

The ESMP provides a framework for the implementation of environmental and social management measures identified in the ESIA and is based on best practice principles which require that every reasonable effort is made to reduce and prevent negative impacts while enhancing the benefits.

The project will be implemented in line with the ESMP. The ESMP outlines the key steps to be taken by all project personnel and their contractors, to effectively manage the environmental and social impacts and risks associated with the construction and operation of the project. All personnel engaged on the project are required to fully comply with the requirements of the ESMP in order to limit the potential for unacceptable environmental and/or social impacts or regulatory non-compliance.

8.1 ENVIRONMENTAL AND SOCIAL MONITORING PLAN

Monitoring will be conducted during construction and operational activities to verify compliance and to evaluate the effectiveness of the mitigation measures. Monitoring requirements have been set out in the monitoring plans as contained in the ESMP.

9. DECOMMISSIONING AND REHABILITATION FRAMEWORK PLAN

The key objective of the Decommissioning and Closure Plan is to return the disturbed areas on the project site back to an acceptable state. In general, the TL route includes areas of disturbed agricultural land, one small area of Degraded Forest and crosses 22 Freshwater areas. The rehabilitation programme will attempt to restore these Degraded Forest and Freshwater areas to an acceptable standard, if they are impacted (i.e. complete vegetation clearance may not be required along the Wayleave, and pylons could be placed outside Freshwater areas).

The overall closure objectives are:

- Ensure that the area is safe for the intended end land use with the removal of the project infrastructure.
- Minimise the visual impact of the TL and Wayleave and rehabilitate areas by using indigenous vegetation from the area for rehabilitation.
- Ensure that the plant communities which establish within the rehabilitated areas comprise of indigenous vegetation only.
- Ensure that all areas are stable and rehabilitated to prevent erosion or dust creation.

At the end of the life of the transmission line, the following decommissioning and rehabilitation activities will take place:

- Disconnect the transmission line connection;
- Disconnect all services;
- Dismantle all transmission line components;
- Concreate foundations will be ripped;
- Rubble will be removed and disposed of at a suitably licensed facility;
- Removal of fencing;
- Compacted and disturbed areas on the project footprint will be ripped, sloped and shaped;
- Disturbed areas will be sloped to enhance natural run-off patterns;
- Seeding of the project footprint will be undertaken using indigenous seed mix (and/or by planting using indigenous plants);
- Monitoring and ongoing management of the vegetation establishment at site for a period of time to be determined after rehabilitation.

The need for a Decommissioning and Closure Plan is included in the ESMP.

10.SUMMARY AND CONCLUSION

The aim of the ESIA process is to provide sufficient information to allow the ZEMA to make an informed decision with regards to allowing the proposed Transmission Line to proceed. The ESIA provides this information and has been compiled in alignment with national legislation and the IFC Performance Standards.

The impacts of the construction and operation of the Transmission Line are summarised in Table 46.

In general, the TL route includes areas of disturbed agricultural land, one small area of Degraded Forest and crosses 22 small and localised freshwater areas (wetlands, dambos and streams). Complete vegetation clearance may not be required along the Wayleave, and the majority of the pylons could be placed outside the freshwater areas.

The Transmission Line route does not include any Critical Habitat as defined by the IFC. Most of the route traverses habitats with some degree of degradation, most assessed as Modified Habitat. All land located along the Transmission Line route fall under Customary Land.

The Transmission Line will not require physical displacement but might disrupt some active small-scale farming identified along the route. It is likely that the local communities will be able to be appropriately compensated through implementing mitigation measures aligned with IFC Performance Standard 5. A Resettlement/Livelihood Restoration Policy Framework has been developed. A Resettlement/Livelihood Restoration Action Plan will need to be developed and implemented prior to construction.

Occupational health and safety issues for the workforce during both the construction and operational phases of the project are of concern due to the potential unfamiliarity of the local workforce with international good practice procedures. However, this can easily be mitigated through appropriate training and implementation of a health and safety management system throughout the construction and operational phases of the project.

Construction and operation of the TL will provide minimal job creation opportunities. However, the TL is an essential component of the overall Unika Wind Farm Project which will provide additional jobs and procurement opportunities as well as community investment.

None of palaeontological or archaeological sites or artefacts discovered are located within the TL RoW. However, during the construction phase unknown and undiscovered/unrecorded archaeological sites/artefacts and other cultural heritage resources may be encountered during vegetation clearance, access road establishments and excavations (mainly associated with the pylon footprints). A chance find procedure has been developed.

The assessment of the construction and operation of the Transmission Line shows there are no impacts that are assessed to be of medium or high significance after mitigation. The majority of the impacts associated with the Project range from low to insignificant. The impacts of medium significance after mitigation include:

- Avifauna/Birds - Collision of birds with the 330 kV overhead transmission line

Impacts of **positive** benefits after mitigation include:

- Local Economic and Community Development;
- Impact of Access and Traffic Mobility; and
- Labour, Working Conditions and Worker-Seeker Influx.

It is concluded that, if mitigation and monitoring measures contained in the Environmental and Social Management Plan (ESMP) (Appendix A) are implemented and the developer commits to enhancing community benefits through creation of local jobs and use of local suppliers, the benefits of the Unika I

Wind Farm (which cannot proceed without the proposed Transmission Line) are predicted to outweigh the negative impacts.

Table 46: Summary of impacts

Environmental component	Impact during construction & operation phase of the **Solar PV plant**	**CONSTRUCTION PHASE** Significance without mitigation		**OPERATIONAL PHASE** Significance with mitigation	
		Without mitigation	With mitigation	Without mitigation	With mitigation
Biophysical and Ecological Impacts	Landscape and Topography	Very Low	**Very Low**	Low	**Very Low**
	Terrestrial Ecology	Low	**Very Low**	Very Low	**Insignificant**
	Aquatic Ecology	Low	**Very Low**	Very Low	**Insignificant**
	Avifauna/Birds - Collision of birds with the 330 kV overhead transmission line	-	-	High	**Medium**
	Avifauna/Birds - Electrocution of birds: 330 kV overhead transmission line	-	-	Medium	**Insignificant**
Socio-economic Impacts	Physical and Economic Displacement	High	**Low**	-	-
	Communal Land and Natural Resources	Medium	**Low**	Medium	**Low**
	Local Economic and Community Development	Very Low Benefits	**Medium Benefits**	Very Low Benefits	**Medium Benefits**
	Impact of Access and Traffic Mobility	Low	**Low Positive**	Low	**Low Positive**
	Labour, Working Conditions and Worker-Seeker Influx	Very Low Positive	**Very Low Positive**	Insignificant Positive	**Insignificant Positive**
	Community Health and Safety	Medium	**Low**	Medium	**Low**
	Cultural Heritage - Disturbance or destruction of known grave sites	High	**Very Low**	Low	**Insignificant**
	Cultural Heritage - Disturbance or destruction of unknown/discovered Archaeological Sites/Artefacts or Cultural Heritage Sites	High	**Very Low**	Low	**Insignificant**
	Visual Amenity	Very Low	**Very Low**	Low	**Low**
	Air Emissions	Very Low	**Insignificant**	Very Low	**Insignificant**
	Noise & Vibrations	Low	**Very Low**	Insignificant	**Insignificant**

11.BIBLIOGRAPHY

British Geological Survey, Groundwater Quality: Zambia, 2001.

Water Resources Management Authority, Hydrogeological Map of Zambia 1:150000, 2018.

Environmental and Social Impact Assessment: Unika I Wind Farm, Zambia, SLR, 2021

Bat Impact Assessment Report for the proposed Unika I Wind Power Project, Zambia, Arcus Consultancy Services South Africa (Pty) Limited, March 2021.

Avifaunal Impact Assessment - Unika1 Wind Farm, WildSkies Ecological Services (Pty) Ltd, May 2021.

Terrestrial, Aquatic and Wetland Ecological Studies to inform the Environmental and Social Impact assessment for the proposed Unika Wind Farm development in the Eastern Province of Zambia, Section A: Summary and Background Information, Scientific Terrestrial Services, June 2019.

Terrestrial, Aquatic and Wetland Ecological Studies to inform the Environmental and Social Impact assessment for the proposed Unika Wind Farm development in the Eastern Province of Zambia, Section B: Floral Assessment, Scientific Terrestrial Services, March 2021.

Terrestrial, Aquatic and Wetland Ecological Studies to inform the Environmental and Social Impact assessment for the proposed Unika Wind Farm development in the Eastern Province of Zambia, Section C: Faunal Assessment, Scientific Terrestrial Services, March 2021.

Terrestrial, Aquatic and Wetland Ecological Studies to inform the Environmental and Social Impact assessment for the proposed Unika Wind Farm development in the Eastern Province of Zambia, Section D: Freshwater Ecology, Goods and Services Assessments, Scientific Aquatic Services, March 2021.

Environmental Noise Impact Assessment for the for the proposed Mphepo Unika I Wind Farm and associated Infrastructure North of Katete, Zambia, Enviro-Acoustic Research, November 2020.

Mphepo Power Unika I Wind Farm – Social Impact Assessment, Nomad Socio Economic Management and Consultancy (Pty) Ltd, December 2020.

The Proposed Unika Wind Farm Project, Katete, Zambia - Landscape and Visual Impact Report, Visual Resource Management Africa cc, March 2021.

Unika Wind Farm, Zambia - Heritage Impact Assessment Report, Envirodynamics Consulting Limited, July 2019.

CNES/Airbus and Maxar (2020). Google Earth imagery. [Online] Available from: www.earth.google.com.

ESRI World Imagery (2020). Source: ESRI, Digital Globe, Geoeye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community.

IUCN, 2020. Protected Planet. [Online] Available From www.protectedplanet.net.

Zambian Wildlife Authority (2008). REMNPAS Information Portal: Description of the current National Protected Area System. [Online] Available From: http://zm.chm-cbd.net/remnpas/prot-areas-system/current-protected-area-system/description-current-national-protected-area.

CITES (2019). Consideration of Proposals for Ammendment of Appendices II. [Online] Available from: https://cites.org/sites/default/files/eng/cop/18/prop/020119_d/E-CoP18-Prop_draft-Pterocarpus-tinctorius.pdf.

Additional lists of bibliography are included in the various specialist reports.

12. DECLARATION OF AUTHENTICITY OF REPORT CONTENTS

I, __Stuart Heather-Clark___ (full name), in my capacity as__ Africa Power Sector Lead_ (position)

within __ SLR Consulting (Africa) Pty Ltd__ (company), declare that the contents of this report is

authentic.

Signature: (To be signed on Final report)

Date:

ANNEXURE A: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

ANNEXURE B: ZEMA LETTER OF APPROVAL FOR THE TERMS OF REFERENCE

ANNEXURE C: APPROVED TERMS OF REFERENCE

ANNEXURE D: SPECIALIST STUDIES

Annexure D 1: Social Impact Assessment

Annexure D 2: Ecology (Terrestrial and Aquatic) Baseline

Annexure D 3: Bird Impact Assessment

Annexure D 4: Heritage Impact Assessment

ANNEXURE E: CONSULTATION AND PUBLIC PARTICIPATION

Annexure E 1: Pre-Public Meeting Comments and Responses Report

Annexure E 2: 2021 Transmission Line scoping meetings summary report

ANNEXURE F: LANDOWNER AGREEMENTS

Annexure F 1: Deed of Agreement – Chewa Development Trust

Annexure F 2: Heads of Agreement – Chieftainess Msoro

ANNEXURE G: METHOD OF ASSESSING IMPACT SIGNIFICANCE

Conroy van der Riet (Report Author) To be signed on Final Report	**Conroy van der Riet** (Project Manager) To be signed on Final Report	**Stuart Heather-Clark** Reviewer) To be signed on Final Report

AFRICAN OFFICES

South Africa

CAPE TOWN
T: +27 21 461 1118

JOHANNESBURG
T: +27 11 467 0945

DURBAN
T: +27 11 467 0945

Ghana

ACCRA
T: +233 24 243 9716

Namibia

WINDHOEK
T: + 264 61 231 287